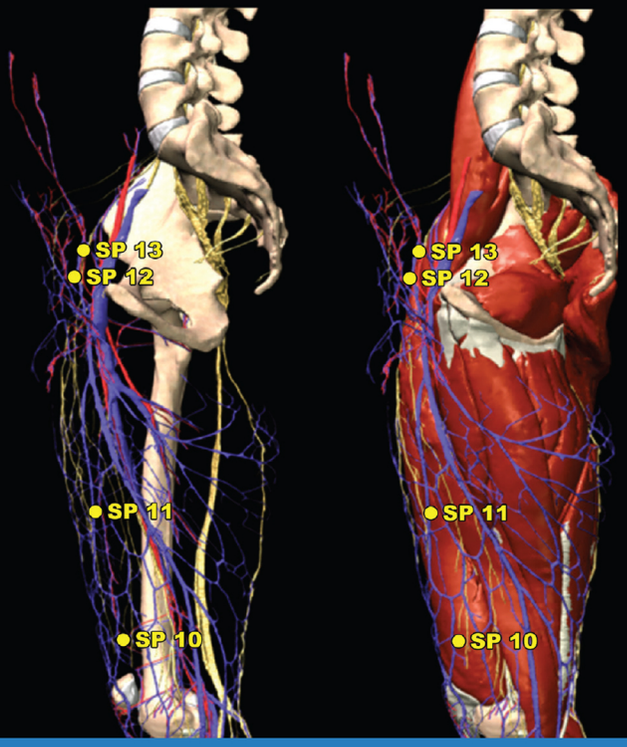
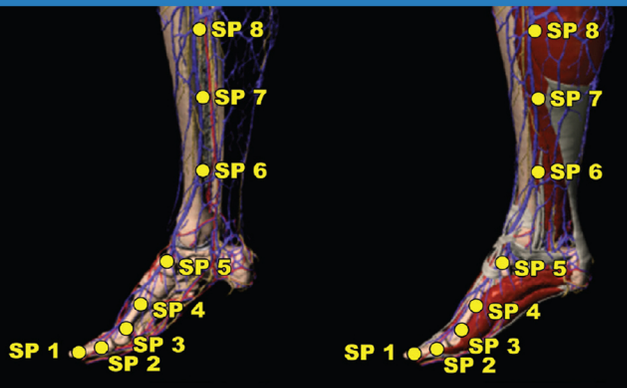
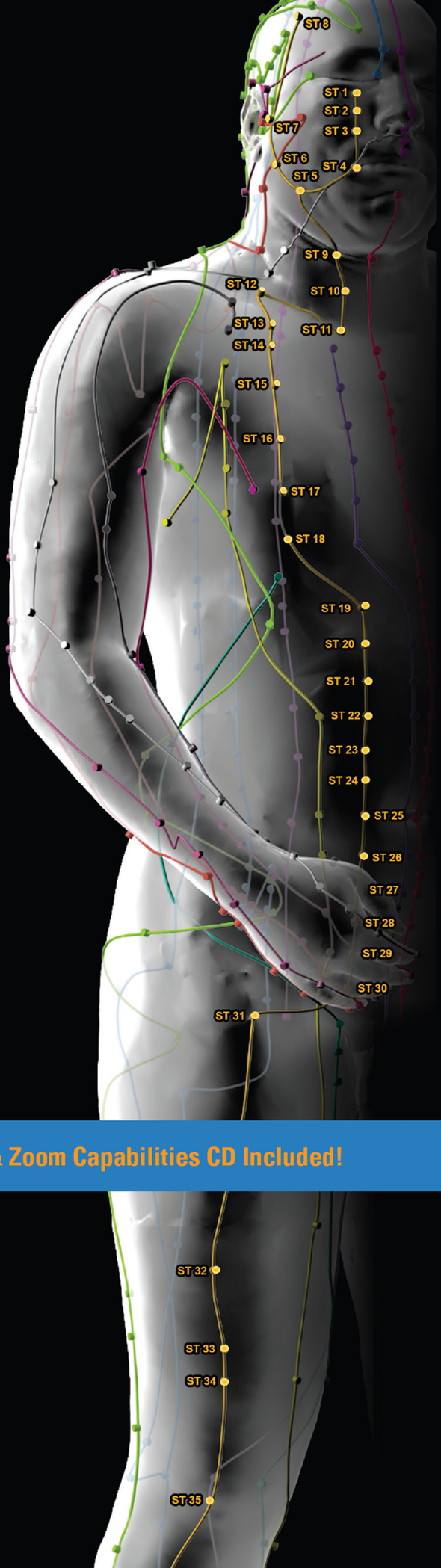
Interactive Medical Acupuncture Anatomy

Narda G. Robinson, DO, DVM, MS, FAAMA







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Preface

Awakening to acupuncture as neuromodulation permanently transformed my teaching and practice. In contrast to the early days of my acupuncture education, when I hungrily consumed and dutifully assimilated the belief systems required to adopt an energy-based viewpoint, I am no longer willing, nor ready, nor able to accept that acupuncture works through mystical, spiritual processes.

That is, I, like so many others, was taught that needling stirred an unseen electrical force ("Qi") along invisible lines called "meridians." When I learned, through mentors such as Deke Kendall, OMD, PhD, that the notion of acupuncture as "energy medicine" possessed neither a scientific nor historically accurate basis, I was shocked. How could this entire domain of acupuncture energetics result from a mistranslation of the Chinese word "Qi" in the early 20th century into "energy," "for lack of a better word"?

After reviewing the evidence for and against an energy-based mindset in acupuncture, I found no other rational explanation for its effects other than through, primarily, the nervous system. Intellectual honesty forced me to let go of belief systems entirely and instead teach only truth based on science and evidence. Intellectual curiosity led me to find far more beauty and wonder in the anatomy of acupuncture than even the most elaborate fairy tales ever could.

What I discovered inspires me endlessly. The modern science of acupuncture replaces the myths and metaphors of yesteryear with detectable mechanisms and measurable outcomes. The neurovascular channels beneath the skin allow us to both literally and figuratively "connect the dots," i.e., acupuncture points. The anatomical structures assembled at each site tell of their function and thus their effects.

Acupuncture then becomes more accessible, predictable, and sensible. Knowing which nerve pathways to target and why constitutes the cornerstone of noninvasive neuromodulation with acupuncture. Starting at the acupuncture point, one can follow a nerve's centripetal course to the spinal cord, autonomic centers, and the brain. The nervous system's responses to scientific medical acupuncture and related techniques thereby become clear, as fact replaces fiction.

Dedication

To my parents, Evelyn and Leonard, who brought me from formless to form, whose love and support gave me the strength and courage to find my own path.

To my brother, Larry, who inspired me to become not only a physician, but an osteopathic physician.

To the ancient Chinese, whose system of points and channels provides me endless amazement.

To Joseph M. Helms, MD, FAAMA, who flung the door to a life filled with discovery and meaning open wide.

To Deke Kendall, OMD, PhD, who caused me to question and rethink what I'd learned, allowing me to find deep fulfillment in a system of knowledge based on indisputable facts and realism.

To Joseph Wong, MD, whose clear message concerning the simple truths of neuroanatomical acupuncture stay with me to this day.

To Dave Mishlove, my life partner, who further cultivated in me a taste for authenticity, a penchant for integrity, and the strength to stand for truth amid staunch opposition.

To Nancy Howard, for her skills in editing and her commitment to high quality production.

Acknowledgments

This book and CD resulted from the extraordinary talents and commitment of several individuals, including:

The Visible Productions team, with special thanks to Stew Crawford who provided the computer programming for the CD and Amanda S. Almon, the medical illustrator and computer animator, who patiently worked with me to place the points and lines on the Visible Human anatomy images.

The folks at Teton NewMedia and Fiftysix Forty Design, including Sue Haun, creative director, whose expertise provided a book that is functionally and aesthetically pleasing, as well as Mike Albiniak, production manager, who worked with the project from start to finish to produce the internal layout. Special thanks as well to John Spahr, principal owner of Teton NewMedia, and Carroll Cann, the editor in chief, who saw value in the project and brought it to fruition.

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Section 1::

The Science of Acupuncture Neuromodulation


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Chapter 1:: From Metaphors to Modern Medicine

Chapter Highlights

To know acupuncture, know anatomy.
To know neuromodulation, know neuroanatomy.
Neuromodulation explains acupuncture.

Neither mysterious nor nebulous, the wisdom of acupuncture unfolds clearly and readily through the study of anatomy – specifically, neuroanatomy. Acupuncture anatomy eliminates the need to substitute science with myths and metaphors. Scientific investigations have identified and verified many of the mechanisms by which acupuncture and related techniques benefit the central, peripheral, and autonomic nervous systems. Needling results in neuromodulation. Neuromodulation interlocks the events that take place from neuron to brain and back again – no belief systems required.

What Is "Neuromodulation"?

Neuromodulation is a process of engagement with neural structures that helps to normalize nerve function. It reduces excessive firing of nociceptive pathways and improves the ability of endogenous analgesic mechanisms to counteract spinal cord windup and dampen the perception of pain. Effective neuromodulation begins with proper point selection. Neuroanatomically specific acupuncture protocols pinpoint a patient's presenting problem according to where and how it is altering function along the neuraxis and its peripheral as well as autonomic extensions.

By considering the myriad manners in which neural discord mediates and perpetuates aberrant signals, a scientifically based medical acupuncturist outlines neural avenues (i.e., acupuncture points and channels) as well as stimulation methods (e.g., needling alone or the introduction of electrical or laser stimulation) by means of which to restore harmony and homeostasis.[113,114,115,116,117,118,119] That is, neuromodulation impacts sensory, motor, and autonomic activity based on the nerves targeted. The modality and settings selected (e.g., intensity, frequency, and mode of stimulation) further color the patient's physiologic response. The input flows throughout the matrix of the nervous system, from peripheral to spinal nerves, and spinal cord to brain. Brain sites affected include, but are not limited to, the reticular activating system, central autonomic network, the limbic system, brainstem, and the diffuse noradrenergic projection system.[135,142,143]

Neuromodulation began long ago with acupuncture and electrotherapy;[120,121] modern medicine has created more direct interventions through implanted units. Whether they prove more effective, cost-saving, and safer than manual acupuncture (MA), electroacupuncture (EA), or laser acupuncture (LA) requires research comparing techniques head to head.

As with acupuncture, the aforementioned implanted stimulators have benefited patients with pain,[122] epilepsy, neurogenic bladder secondary to spinal cord injury, fecal incontinence, constipation, erectile dysfunction, interstitial cystitis, and lower urinary tract dysfunction (incontinence, overactive bladder, urinary retention).[123] Additional conditions include chronic, refractory angina pectoris,[136] migraine,[137,138] spinal cord injury,[139] and complex pain problems.[140]

Curiously, those who utilize implanted stimulators often insert them along similar nerve pathways as acupuncturists address. For example, implant-driven nerve stimulation for refractory overactive bladder focuses on the posterior tibial nerve.[124,144,145] Acupuncture treatments for urinary voiding dysfunction also focus on the tibial nerve with points such as KI 3, KI 4, KI 5, and SP 6.[125]

Vagal nerve stimulation (VNS) for seizure control offers another example.[126,127,128,129] Electrodes implanted in the cervical portion of the vagus nerve interrupt or abolish experimentally induced motor seizures.[130] Acupuncturists may also choose points on the face or head that speak to the vagus nerve through crosstalk with the trigeminal nerve. Auricular acupuncture opens another door to neuromodulating vagal function. Veterinarian acupuncturists treating epilepsy in dogs may select ear points such as Shen Men, a point shown to have value for seizures in rats as well.[131,132,133] Auricular Shen Men falls into the zone supplied by the auricular branch of the vagus nerve (cranial nerve X, or CN X).[134] Thus, whether through implanted electrodes or inserted acupuncture needles, VNS modifies brain activity and can reduce seizure activity in some cases.[146]

"What If I Prefer to Think of Acupuncture as Moving Energy Instead of Stimulating Nerves? Does It Matter?"

Yes, it matters. Shifting the dialogue from metaphors and metaphysics to meaningful mechanistic concepts requires a thoroughly different premise. That is, a science-based medical acupuncturist needs a modern medical education along with instruction in myofascial palpation and non-invasive neuromodulation skills. Traditional Chinese Medical (TCM) schools and energy-based physician acupuncture courses continue to teach that acupuncture moves energy they call "Qi." The latter approach demands little verification but much belief. Even today, after having sufficient opportunity to "get it right," Traditional Chinese Medicine (TCM), metaphor-based practitioners are still struggling to validate their TCM diagnostic approach. In other words, even experienced TCM acupuncturists cannot come to agreement in their metaphoric analyses of patients in studies after studies.[147,148,149]

Lacking tenable processes, a metaphor-based acupuncturist has limited rational rationales to rely on when deciding on which points to choose. Treating a headache of the "Liver Yang Rising" or "Qi Disturbance" variety affords mostly abstract analysis of the cause and effect. Although the liver often receives much of the blame in causing TCM headaches, the physical liver usually has little to do with producing head pain in most people. Other assessments involving disturbances in Qi, Yang, Yin, and Phlegm also miss the mark by resorting to stand-ins, i.e., metaphors, in place of the actual anatomic, physiologic, and pathologic problems. As such, TCM point selection usually resorts to metaphorical solutions rather than novel protocols based on the patient's actual pathology.[150] Point selection relies more heavily on rote memorization of empirical protocols that give the practitioner

minimal insight into why those protocols work from a biological perspective. To illustrate the difference between a metaphoric and scientific view of point effects, review the comparison in Table 1-1.

In contrast, a science-based medical acupuncturist treating head pain would, in practice, ordinarily strive to define the true cause, location, and myofascial relationships to the headache. Even if s/he defaults to a standard protocol for research or training purposes, the mechanisms by which acupuncture affects patients remain clear. To illustrate this, a group of Taiwanese researchers assembled a group of migraine sufferers in order to compare the value of acupuncture and a drug (topiramate) for prophylaxis of headache in chronic migraineurs.[151] Points selected for all sixty-six participants were the same: BL 2, GB 20, Taiyang, and Yintang. The rationale? "All of the selected acupoints were in the distribution of trigeminal and cervical dermatomes related to the trigeminal sensory pathway." Simple. Again, according to the authors, "It is assumed that a variable combination of peripheral effects, spinal and supraspinal mechanisms, and cortical, psychological or "placebo" mechanisms contribute to the clinical effects of acupuncture. Current theories suggest that migraine is a neurovascular disorder involving cortical spreading depression, neurogenic inflammation, and vasodilation. Sensitization and facilitation of pain transmission in central trigeminal sensory pathways may have a particularly important role in the development of CM (chronic migraine). A recent study suggests that acupuncture may have anti-inflammatory action via release of neuropeptides from nerve endings, including calcitonin gene-related peptide (CGRP), an important mediator of neurogenic inflammation and a potent dilator during migraine attack. We selected acupoints in the distribution of the trigeminal and cervical dermatomes because we postulated that an interaction between trigeminal and cervical nociceptive inputs to the trigeminocervical complex via acupuncture may inhibit trigeminal-vascular activation and thus may inhibit migraine attack….It is…important to understand what roles the peripheral as well as the central mechanisms have in CM patients after acupuncture treatment in future studies."

"Isn't Medical Acupuncture "Reinventing" Acupuncture Into Something It Never Was?"

Absolutely not. Admittedly, those already wedded to the metaphorical conceptualization brought to us by TCM may resist the need to learn the biological basis of disease, the anatomical basis of acupuncture, and the physiology of neuromodulation because they believe that a scientific approach to acupuncture is somehow new or foreign to China.[152] This is false. In fact, acupuncturists in China have been striving to practice scientifically for decades, with Zhu Lian making many important strides back in the 1950s.

That is, while the French were reworking acupuncture into an abstract system of "French Energetics" (see the section on George Soulié de Morant, below), Communist China created "The New Acupuncture" with the help of Zhu Lian, a physician trained in Western medicine who held several influential medical posts in China.[68] In keeping with the goal of the Communist Party leader Mao Tse Tung to integrate Chinese medicine with modern science, Zhu Lian, "strongly advocated the application of anatomy and western medicine in acupuncture." Zhu Lian pioneered the neuroanatomic basis of acupuncture well before Mao Tse Tung created Traditional Chinese Medicine (TCM) in the mid-twentieth century. In so doing, she unraveled many former mysteries through her extensive anatomical knowledge.[153] She saw acupuncture's influences as working to "stimulate and modulate the regulatory and control functions of nerve cells."[154]

Scientific research has only bolstered Zhu Lian's visions from the 1950s, as she hoped would happen. Even back then, however, she noted:

"The locations of the fourteen meridians roughly correspond to the anatomical distribution of excitors. Responses of the human body to acupuncture stimulation can basically be explained by neuroscience. Knowledge of higher nerves, however, was not available to ancient therapists, and hence discrepancies inevitably arose, because traditional acupuncturists, without a full understanding of neurology, simply formed associations between acupoints and internal organs."[155] That is, as aforementioned, non-scientific acupuncturists are frequently unaware of how their needling treatments actually work even today. Moreover, although Zhu Lian wanted acupuncture to survive and felt that exposing its factual, rational basis would allow it to do so, politics prevailed and TCM became increasingly engulfed by its murky metaphors.

When it moved west, TCM fell victim to even more myths; the American and European appetite for metaphysics unfortunately prevailed. The term "TCM" only adds to the confusion. That is, although the "T" stands for "Traditional," connoting a long-standing medical system, the Chinese Communist Party invented TCM only fifty years ago, during the years 1953-1956.[70,71] TCM is "a medical construct distinct to Communist China" and symbolizes "the standardized, government- created, institution-bound medicine that has existed in the PRC since 1956."[72] The first Outline of TCM became available in Communist China in 1958, published by the Beijing People's Health Publishers. It was designed to help fulfill the government's goal of having "doctors of Western medicine study Chinese medicine."[73]

In her book, *Chinese Medicine in Early Communist China 1945-1963,* Kim Taylor described the events surrounding the creation of TCM. "The formulation of a basic theory of Chinese medicine was an extraordinary feat, the ultimate in the manipulation of knowledge and its subsequent validation at the hand of politics."[74] She continued: "In general, the main aim of these "Basic Theories of TCM" was to simplify Chinese medicine and to reduce two thousand years of controversy and debate into one easy-access nutshell. This compromises every level of the physician's encounter with the patient, from examination to diagnosis through to prescription. Therefore this newly established theory of TCM simplifies the process of the identification of illness and the appropriate dispensation of drugs to a few basic steps. Such is the structured and measured packaging of a ready-to-use TCM designed for institutional consumption in twentieth- and twenty-first century Communist China."[75]

On the other hand, both in- and outside of China, science-based

acupuncturists continued to pursue acupuncture demystification. As one practitioner in the mid-1960s stated:

"If we wish to be taken seriously, and not to be confused with bone-setters or faith-healers, we must abandon the whole more or less Chinese mass of philosophy, cosmogony and mythology in which we have been entangled these forty years past. Let us clear the decks, and look at our problems without preconceived ideas. The study of the anatomy and physiology of the skin, and of the central and sympathetic nervous systems, the investigation of the physico-chemical and enzymic reactions in the body, all these should provide us with the means of solving the problem of what acupuncture really is and does."[1]

Scientific acupuncturists agree that acupuncture depends on nerve function. In 1972, the Peking Acupuncture Anesthesia Coordinating Group reported, "About half of the known acupuncture points are located right over various nerves and the rest are within half a centimeter of one or another nerve. From this, the conclusion was drawn that acupuncture acts in fact on the nervous system, and it is through a nerve that the stimulus produced by needling or applying a mild electric current is transmitted to a certain part of organ of the body where it effects a cure or brings about a state of analgesia."[21] The number of reports showing that acupuncture works via the nervous system began its rapid expansion in the mid-1970s and has continued ever since.[5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20]

Indeed, if acupuncture worked by moving energy, not nerves, then severing nerves should not abolish the body's reaction to needling. However, complete transection abolishes its effects and partial injuries minimize them.[2] This is not to say that acupuncture treatment should be avoided in cases of peripheral nerve, brain, or spinal cord injury, because needling therapy plays an important role (when given the opportunity) in helping patients recover from or contend with these conditions. Rather, it is intended to emphasize the central significance of the nervous system in medical acupuncture and related techniques.

In fact, by now, the neural basis of acupuncture has become so clear that certain authors are replacing the conventional alpha-numeric naming system of acupuncture points and channels with nerve names – not remote and possibly imaginary organs as is now the case with commonly accepted nomenclature.[3] This idea,of revising and updating the acupuncture lexicon has a precedent; i.e., over thirty years ago, Dr. Patrick Wall, the co-developer of the gate control theory, felt that a new classification system based on acupuncture points and nerves was overdue.[4]

"You Say "To-May-To" and I Say "To-Mah-To": Don't Scientists and Energy-Based Acupuncturists Arrive at the Same Points?"

No, not always. Acupuncturists from either perspective may or may not select similar points. As indicated earlier, a TCM trained practitioner may view headache as Liver Yang dysfunction and select LR 3, LI 4, and GV 20. While the TCM rationale may involve statements about balancing Yin and Yang, expelling evil influences from the liver, or eliminating wind,[156] a neuroanatomic acupuncturist sees the process much differently. Both LR 3 and LI 4 relate to double arterial arch systems in the foot and hand, respectively. These vascular circuits receive heavy investment of sympathetic fibers. Thus, needle stimulation in their vicinity modulates autonomic function throughout the body. GV 20 impacts vagal function through crosstalk along trigeminovagal and cervicovagal routes. It also lies along the sagittal cranial suture overlying the sagittal venous sinus, thereby further impacting autonomic function and cerebral venous drainage. GV 20 overlies the galea aponeurotica as well; needle stimulation at this site aids in reducing occipitofrontalis muscle restriction that produces a "tension headache" type of pain. For migraine headaches per se, a scientifically based medical acupuncturist might add points to address trigeminal nerve dysfunction, as illustrated above. The weight of evidence supporting a neuroanatomic approach emphasizes the importance of selecting points according to actual patient pathophysiology. To wit, chronic migraine sufferers who received acupuncture at points supplied by the trigeminal nerve experienced a significantly larger reduction in moderate/severe headache days than did those in the topiramate group with far fewer side effects.[157]

Even if a metaphoric practitioner chose the same points as the science-based practitioners did in the migraine study just described, an accurate understanding of the ways in which acupuncture works improves its legitimacy. Quoting Kendall: "Why does anyone care whether Chinese anatomy and physiology are explained as energy flowing through meridians, or by the circulation of blood, nutrients, other vital substances, and vital air (qi) through the vascular system? The answer to that lies in the moral obligation of every practitioner to provide each patient with the latest medical understanding available. The need to continually search for the truth is the most fundamental principle of science and medicine. If the functioning of the human body cannot be understood under normal physiological conditions, then there is little hope of knowing how to treat it when disease conditions exist. Research so far show that the true concepts of Chinese medicine operate under known physiological principles, involving the complex organization of the neural, vascular, endocrine, visceral, and somatic systems, sustained by the circulation of nutrients, vital substances, and oxygen from vital air."[22]

Why Researchers Need to Recognize the Scientific Basis of Acupuncture

Ongoing research in Asia and on other continents focuses on measurable, physiologic changes due to acupuncture, not the vague nuance and mysticism so commonly found in Western acupuncture literature. According to Kendall, the abstract, unscientific idea that acupuncture has an immaterial basis "has kept Chinese medicine on the fringes of conventional care since the 1930s and 1940s."[23] Countless research dollars and hours disappear in the misguided mission of searching for invisible, energy-conducting pathways, yielding little to benefit patients and further the understanding of acupuncture.[24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44] Moffet appears to concur, criticizing methodologic approaches that cling to "unsubstantiated traditional acupuncture theories."[158] He continues: "When comparing acupuncture interventions [e.g., verum and

sham approaches], investigators should offer a biologic rationale to support a hypothesis that the exposures are truly different. A clinical trial with indistinguishable exposures is a poor use of resources…If the acupuncture exposures are indistinguishable, then the investigators have failed to control for the placebo effect." Many examples of inadequate sham selection exist in the medical literature. Most commonly, researchers fail to consider the neuromodulatory overlap that happens when verum (real acupuncture) and sham (placebo acupuncture) excite similar nerve pathways.

Why Today's Clinicians Need to Espouse a Rational Premise for Acupuncture

The demystification of acupuncture in no way diminishes its brilliance. Rather, identifying the structure-function relationships between acupuncture point anatomy and clinical indications brings acupuncture closer to its ancient roots than do musings about energetic evolutions. Clinging to outdated jargon may, in fact, prevent patients from seeking appropriate medical attenti on.[45,46,47,48,49,50,51,52,53] For example, informing a patient complaining of chest pain and shortness of breath that they have "Qi and Yin Deficiency"[54] may have been adequate during the Han dynasty, but not today. Rather, prompt medical attention is in order. Similarly, "Liver Fire blazing with Phlegm-Heat" could indicate Graves' disease or even papillary thyroid cancer, and require treatments other than, or in addition to, acupuncture.[55] Patients with "Kidney Yang Deficiency"[56] may actually be experiencing adrenal insufficiency or crisis. One should neither delay nor preempt further diagnostic workup and appropriate medical intervention by seeking to balance an abstract Yin and Yang.[57,58,59,60]

Why, then, do schools and postgraduate courses promote acupuncture metaphysics? Perhaps too few instructors and students have learned about the actual origin of the energy-meridian misconception. Not thousands of years old, not even hundreds, the Qi-as-energy myth was born less than a century ago, a brainchild of a French citizen residing in China by the name of George Soulié de Morant.

George Soulié de Morant's Hope of Acupuncture Metaphysics

No convincing evidence exists that acupuncture works by pushing energy through invisible transmission lines.[61] As the inventor of the energy-meridian concept, George Soulié de Morant, stated, "Having observed the existence of "something" that passes through a meridian when a point is stimulated, the ancients gave this fluidity, this flux, the name qi, which we translate, for lack of a better word, "energy."[62] Because Soulié de Morant lacked medical training and in that he wanted to present Chinese medicine in ways he thought his French audience would understand, he introduced his own bias about how acupuncture worked, i.e., through unseen energies moving through intangible pathways.[63]

Living within the European cultural and philosophical context when he wrote his landmark text, *l'Acuponcture Chinoise (Chinese Acupuncture)*, Soulié de Morant relied on his readers believing his claim of a metaphysical basis for acupuncture. After all, the concept of "élan vital," or immaterial life force, had spread and grown popular throughout Europe. Élan vital was to have produced and shaped all life; notions about this vivifying impulse permeated the philosophy of that era.[64] Yet, not all were convinced; the British biologist Julian Huxley once commented that élan vital offers no better an explanation of life than élan locomotif accounts for the motion of a train.[65]

Nor was Soulié de Morant's book translator, Paul Zmiewski, convinced of the author's claims. Zmiewski noted in his introduction, "While ideas found in modern English texts are often expressed in English words derived from *l'Acuponcture Chinoise,* these words do not always mean what was meant in the classic works upon which *l'Acuponcture Chinoise* is based."[66] About Soulié de Morant's selecting the term "energy" for "Qi," Zmiewski wrote, "At the beginning of the twentieth century concepts like "human energy" were referenced in dictionaries and were considered valid matters for scientific inquiry. Many nineteenth century ideas of nature were still broadly regarded as truths. Today, however, the scientific era that had just begun when Soulié de Morant chose to use the term "energy," has left that word with new and different associations in both popular and scientific writing." As such, even Soulié de Morant's own idea behind the Qi translation has undergone an evolution, independent of its original meaning in ancient China.

Reinventing acupuncture into an "energy medicine" required that Soulié de Morant downplay the importance of anatomy and physiology in Chinese medicine.[76,77] He did not include *The Yellow Emperor's Classic of Internal Medicine* among his translations. Had he done so, as Kendall indicated, he would have found that the early Chinese physicians living between 600 and 300 BCE had compiled "surprisingly accurate and detailed information on the human body, with some of the ideas clearly equivalent to those of modern Western physiology."[78] Unfortunately, this disregard of acupuncture anatomy and physiology promulgated by Soulié de Morant led to an ensuing disinterest by future acupuncturists in the material foundation of acupuncture.

Some even assert, although incorrectly, that ancient Chinese investigators never performed anatomical investigations.[79] Kendall offers two possible reasons for this misconception.[80] First, historians may have assumed that since Confucian teachings proscribed postmortem dissections, they were not performed. Alternatively, some believe that since ancestor worship pervaded the culture especially strongly many centuries ago, those dissecting the body after death would have likely incurred a great degree of ancestral displeasure. Nevertheless, postmortem autopsy likely occurred long before Confucius existed (551-479 BCE), and still took place during his lifetime. Furthermore, the prohibition on autopsies that occurred in some dynasties happened several hundreds of years after the studies mentioned in the Nei Jing were already documented. Information encountered in the Nei Jing attests to the fact that anatomical dissections took place, producing insights into the size, weight, and capacity of all internal organs.[81]

Even the acupuncture channels (jingluo), which many now

Table 1-1

Metaphorical "Actions" of LI 4 stimulation, according to Chinese Medicine[85]	Effects of LI 4 stimulation, according to Scientific Studies*
Autonomic Influences	
"Regulates the defensive qi and adjusts sweating"	Both high and low frequency electroacupuncture (EA) stimulation of LI 4 (with SI 3) produced short-term cooling.[86] Manual and EA stimulation of LI 4 produced long-lasting warming (indicating a sympatholytic effect) after the transient, segmental increase in sympathetic activity that caused a localized, short-term cooling.[87] Acupuncture at LI 4 caused an increase in palm temperature, probably due to cutaneous vessel dilation.[88] EA at LI 4 selectively activated the sympathetic, but not parasympathetic, nervous system. In so doing, the rhythmic micturition contraction cycle lengthened and urine excretion increased, as did renal sympathetic nerve activity and blood pressure. These results indicated that EA at LI 4 may benefit patients with hyperactive bladder problems.[110] EA at LI 4 and LI 11 increased both pain thresholds and muscle sympathetic nerve activity.[111]
Analgesia	
"Expels wind and releases the exterior"; "Regulates the face, eyes, nose, mouth and ears"; "Activates the channel and alleviates pain"	EA diminished dental pain perception; high intensity EA was most effective.[89] Naloxone failed to reverse elevated pain thresholds induced by EA, indicating that non-opioid transmitters are involved in dental analgesia.[90] Nitrous oxide blocked the effects of electrical stimulation at LI 4.[91] Needle manipulation at LI 4 significantly increased pain pressure thresholds.[92] Unilateral EA at LI 4 (and LI 11) transiently inhibited the motoneuron pool in the extensor digitorum communis muscle of the contralateral arm, suggesting that EA operates by central effects, instead of or in addition to peripheral influences.[93] Transcutaneous electrical nerve stimulation (TENS) at LI 4 reduced the sensation of pain but not vibration.[94]
Effects on the Central Nervous System	
"Restores the yang" (i.e., "for the treatment of collapse of yang characterised by loss of consciousness, aversion to cold, cold counterflow of the limbs, purple lips, etc.")	Manual and EA stimulation of LI 4 produce differential brain activation. Manual needle manipulation caused prominent functional magnetic resonance imaging (fMRI) signal decreases in the posterior cingulate and superior temporal gyrus as well as the putamen/insula. EA caused signal increases in the precentral gyrus, the postcentral gyrus/inferior parietal lobule, and the putamen/insula.[100] Somatosensory evoked potentials obtained after EA at LI 4 (which activates radial nerve fibers) differ markedly from those obtained after EA at the median nerve.[101] Needle manipulation at LI 4 modulated activity in limbic and subcortical gray structures of the brain, as shown by fMRI.[102] Brain magnetic fields measured by SQUID (Superconductive Quantum Interference Device) after acupuncture at LI 4 revealed changes in the biomagnetic fields relating to the projection areas of the face and jaw.[103] LI 4 stimulation caused a significant increase in the latency and decrease in the amplitude of peaks reflecting primary cortical afferent activities.[104] Needle manipulation of LI 4 activated the hypothalamus, supporting the notion that this classical analgesic point works at least in part to reduce pain through hypothalamic activation.[105,106] Manual acupuncture to LI 4 activated both somatosensory cortical areas and the periaqueductal gray.[107] High-frequency EA at LI 4 induced specific electroencephalographic (EEG) modulation of Theta activity in the midline frontal region. This may reflect reduced activity in the anterior cingulate cortex, resulting in antinociception.[108] Needle manipulation at LI 4 activated structures in the descending antinociceptive pathway (i.e., the hypothalamus and nucleus accumbens) and

	deactivated multiple areas in the limbic system associated with pain (rostral part of the anterior cingulate cortex, amygdala formation, and hippocampal complex), indicating ways in which endogenous pain modulation circuits in the brain may function.[109] EA at LI 4 and LI 11 caused a positive spread of activation across the spinal cord segments C5 to T1, with peak activity taking place at C7. Activation occurred at both the dorsal and ventral parts of the cord, indicating that LI 4 and LI 11 can indeed modulate specific spinal cord regions. This study suggests that individuals with sensorimotor deficits arising from these spinal segments may benefit from acupuncture at these points.[112] Magnetic stimulation of LI 4 affected specific brain areas, such as the anterior cingulate cortex, that differed from those influenced by a "mock" point, also on the hand.[159]
Obstetrical Influences	
"Induces labour"	Acupuncture at LI 4 suppressed uterine contractions induced by oxytocin in pregnant rats.[95] Acupuncture at LI 4 inhibited the expression of the cyclooxygenase-2 (COX-2) enzyme and reduced uterine motility significantly.[96] Acupuncture at LI 4 (and SP 6) helped ripen the cervix at term and shortened the time interval between estimated date of confinement (EDC) and delivery.[97] Ice massage on LI 4 reduced labor pain during contractions.[98] Acupressure at LI 4 and BL 67 reduced labor pain during the active phase of the first stage of labor, but did not significantly affect uterine contractions.[99]

call "meridians," originally pertained to actual blood vessels and their accompanying nerves. This makes sense given that acupuncture started as bloodletting. In his essay, "Bloodletting in early Chinese medicine and its relation to the origin of acupuncture," Epler wrote, "The vessels are organic structures, not functional pathways as they were later to become, blood is a fluid, and pneuma is, certainly in part, a material substance, not the "energy" it was later to become."[82] In his *Dao of Chinese Medicine,* Kendall noted, "Replacing the blood vascular system with nonexistent meridians is the single greatest translation error to befall Chinese medicine."[83]

In the context of his nonmedical background and the times in which he lived, Soulié de Morant's mistranslation of "Qi" as "energy" seems forgivable. What is less "okay" is the perpetuation of this mistranslation by educators today, instead of acknowledging the truth, i.e., that in the acupuncture matrix originally referred to the vascular network with its circulating gases, cells, and nutrients. Forcing acupuncture to stay stuck inside a mystique and superstition it long outgrew binds its natural development like foot-binding did to maturing anatomy, unable to reach its full expression.[67] In both the metaphor-based acupuncture model and the torturous practice of foot-binding, the ideal represented a culturally repressed esthetic as opposed to reality, a system of sustained immaturity weakened by those who curtail proper expansion and innate capacity.

How do acupuncture researchers, educators, and clinicians undo the damage done by this prodigious misstep in acupuncture's history? Like most recovery programs would insist, those addicted to the energy-meridian paradigm need to begin by telling the truth. The time is now to set the record straight and acknowledge the rational, anatomic, and scientific basis of acupuncture.

Summary

The specificity and multiplicity of verifiable and reliable outcomes obtained by scientifically studying a point such as LI 4, as outlined in Table 1-1, illustrate the advantages of allowing acupuncture to mature into a modern medical treatment based on neuromodulatory actions. The steps toward manifesting this transformation first require a comprehensive grasp of neuroanatomy as it relates to acupuncture points, thus the purpose of the book.

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Chapter 2:: Function Follows Form

Key Points

The science of neuromodulation endows acupuncture with a factual, rational basis and a neuroanatomic framework. Together, the science of neurophysiology and the instructional attributes of anatomy inspire cogent and sophisticated protocols for scientific, medical acupuncture and related techniques (SMARTs).

The outcome of a neuromodulation treatment depends on the regions, types, and number of nerves activated, as well as the method of stimulation selected.

Acupuncture stimulation most immediately affects one or more of the three types of peripheral nerves:

- **Motor**
- **Sensory**
- **Autonomic**

Stimulation methods involved in medical acupuncture include but are not limited to:

- **Dry needling, otherwise known as manual acupuncture (MA)**
- **Electroacupuncture (EA)**
- **Laser acupuncture (LA)**
- **Acupressure**

Comprehensive treatment entails three steps:

- **Determine the problem; understand its nature, location, and origin**
- **Identify neural avenues that produced and perpetuate the problem; consider how neuromodulation can affect these or other nerves to undo the damage and promote recovery**
- **Influence nerves from the peripheral, central, and autonomic nervous systems**

Understand the Function of Acupuncture Points through their Anatomy (Form)

For ages, philosophers and physicians have recognized the inseparable partnership of anatomy and physiology.[282,283] Investigating ways in which form meets function in acupuncture illuminates the wealth of wisdom layered into each needling site. Systematic analysis of the local anatomy uncovers the effects of stimulating a point with delightful directness. Metaphorical medicine then dissipates and dissolves like fog in the morning after a night of rain; science, like the sun, burns away clouds of uncertainty with beams shining light on the ways in which acupuncture actually works.

Not merely an intellectual exercise, the anatomy of acupuncture impels clinicians to ask more precise questions about their patients and informs their thinking fingers during myofascial assessment of them.

In the examination process, one asks, "Is this where it hurts?" as the examiner's hands seek to find tension and tenderness. Three-dimensional anatomy reveals underlying reasons for numbness and weakness by disclosing regions where muscles course over and around nerves. Structure and function show why tension and pain result and where they require intervention. In other words, myofascial impediments may impair nerve communication. Nerve entrapment due to myofascial restriction, fascial bands, or scar tissue may block a signal from reaching its destination or alter its message. Thorough, informed palpation frequently allows the medical acupuncturist to detect sites of nerve compression through findings of tissue tension and tenderness.

Nerves that have suffered from excessive or prolonged pressure, overstretching, or starvation from insufficient oxygenation and nutrients through poor circulation can become neuropathic. Neuropathic nerves transmit erroneous information. Like trying to carry on a conversation along a poor cell phone connection, injured nerves relay distorted or interrupted messages. Depending on the nerve's job in life and specialization, the patient may experience alterations in sensory, motor, and/or autonomic message delivery. As a result, instead of accurately reporting information about position sense, pain, touch, and so on, neuropathic nerves may cause the patient to feel pain instead of touch or pressure (allodynia) or find a mildly uncomfortable stimulus to cause unbearable pain (hyperalgesia).

Dysfunctional muscle tissue and related neural networks produce myofascial trigger points. Myofascial trigger points, a nearly ubiquitous phenomenon, can cause peripheral nerves to become neuropathic and inflamed due to their chronic nature and tendency to worsen and multiply if left untreated. Attending to trigger point dysfunction with neuromodulation through needling and related techniques is a major process by which acupuncturists benefit their patients.

Where do trigger points occur? One finds most myofascial trigger points in the middle of the muscle belly where the majority of muscle spindles and motor endplates lie as well as in the myotendinous junctions, occupied by Golgi tendon organs. Due to their profound roles in producing and perpetuating pain and dysfunction, these sites of highly specialized nerve endings in muscles and tendons become critical targets for acupuncturists. For example, an acupuncturist may select Gallbladder 20 and 21 (GB 20, GB 21) for myofascial pain in the shoulder-neck region. GB 20 is located at the myotendinous attachment of the upper portion of the trapezius, and GB 21 lives in the middle of its muscle belly.

On a broader scale, truncal anatomy (as shown in the layered as well as cross-sectional anatomy in the upcoming chapters) bespeaks how form and function affect both soma and viscera. How do the nerves occupying BL 23 on the body wall affect the kidney? The answer becomes clear when considering the spinal segmental nerve supply that both sites share. Interneurons in the spinal cord yoke neural traffic from the small of the back with signals stemming from the depths of the abdomen and pelvis. Palpation of the paraspinal muscles along the entire back reveal results of aberrant neural traffic from facilitated spinal segments in the form of tissue tenderness, tension, and restriction. These findings of myofascial dysfunction along certain spinal segments serve to raise our awareness of potential somatic and/or visceral disturbances in the body realms subserved by this spinal cord "real estate." This then informs both our diagnosis and treatment of the patient.

Layered and cross-sectional anatomy images also uncover structures beyond our fingers' reach. The bony calvarium keeps us from touching the brain and its vessels. Through the translucent skull in the Visible Human images in this book, connections between channels and vessels such as the Governor Vessel (GV) and the superior sagittal venous sinus remind us of the original, vascular basis of acupuncture as a whole and the eight singular vessels in particular. The Governor Vessel's counterpart, Conception Vessel (CV), represents the vena cava, whose relationship to the overlying central CV on the surface of the anterior (ventral) trunk now makes sense. Clinically, one may detect expansions of the often forgotten collateral venous drainage pathways when the vena cava obstructs, making the connection between deep, interior processes and the body surface, visually striking. In this way, channels' interconnections from deep to superficial and from one to another bring to life the meaning behind the metaphor in ancient writings on acupuncture. Today, scientific pursuits elaborate on these early insights and draw detailed descriptions of how acupuncture and related techniques influence form and function. Let us begin at the point-stimulus juncture.

The Needle-Tissue Interface

In acupuncture, the "rubber meets the road" at the needle-tissue interface. Like tires on pavement, the acupuncture needle must engage with its surroundings in order to gain traction and cause change. When rotated, the acupuncture needle attracts and pulls on collagen and possibly muscle fibers, causing them to grab its shaft. This bond between metal and fibers forces the tissue to respond and initiates a conversation with neighboring nerves, fascia, and fibroblasts.

The message spreads to nearby cells, culminating in a wave of tissue deformation and neural discourse that travels beyond the immediate vicinity. If the needle has reached muscle, the impact of treatment intensifies.[284] Nerves ferry information about the event in both an orthodromic (toward the spinal cord) and antidromic (toward the nerve's terminals) direction along a channel.

The Peripheral Nervous System's Subspecialists: Nerve Endings

In addition to proprioceptors such as muscle spindles that respond to changes in length and Golgi tendon organs that assess tension, a number of other receptors in tissue act as an interface between the external environment and the nervous system. This allows the acupuncturist to employ treatments that adjust or alter sensory input with the aim of supporting the healing process. Knowing the types of nerve endings typically found at acupuncture sites gives the medical acupuncturist a better understanding of the likely outcome of stimulating those points. For instance, if the acupuncture point overlies a blood vessel, a needle tugging on fascia nearby may stimulate its nervi vasorum (vascular nerves). These adrenergic fibers control vessel wall tone. As such, the effects of needling this site could involve neuromodulation of circulation and blood pressure regulation. An example of this type of point is Lung 9 (LU 9).

Acupuncture Points as 3-D Structures

Acupuncture points are three-dimensional events, not static dots on the skin surface. This fact converts the rather simple activity of inserting a needle into a multilayered excursion into a patient's bodily habitus. The dialogue between form and function deepens as the needle traverses skin, then fat, then fascia, muscle, and maybe periosteum. At each level, tissue resistance to the needle tip's travel tells of the tension and tone it encounters. Too much or too little of either tension or tone can signify dysfunction and/or disease.

When the treatment involves trigger point deactivation, attention to tissue texture and tension changes becomes paramount. Isolating a patient's source of pain precedes its elimination. When patients exclaim, "That's it! That's where the problem is!" it confirms palpatory findings. Re-examination through palpation and patient feedback after dry needling verifies or denies that the trigger point has responded. Trigger point deactivation serves as a profound example of the dynamism between form and function that takes place through the needle conduit.

Nerve Chat

Nerves serve as the body's social medium. Not shy, they publicize their messages broadly, speaking to everyone who will listen, whether organs, glands, vessels, muscles, fascia, and other nerves. The messages they send may be momentary, such the faint brush of a breeze going by, or lifelong, as in the case of childhood onset Crohn's disease. Similarly, their emotional and somatic sequelae may place a temporary or permanent imprint, depending on how many signals they send each time they complain, and how long their upset lasts. The "complaint department," i.e., the central nervous system (CNS), responds to neural reports of pain and distress with attempts to alleviate them. If unsuccessful, neural plasticity makes the CNS a codependent partner by prolonging the problem, leading to hyperalgesia, allodynia, inflammation, sympathetic hyperactivity, muscle tension, and long-term stress.[285]

By the time a patient presents for treatment, pain and dysfunction have usually existed long enough to cause a collection of problems. This behooves the medical acupuncturist to develop a neuromodulatory intervention that addresses several levels. It is therefore not enough to ask how the chief complaint started and where it hurts, but also why it is continuing and how it expresses itself in the structure (myofascia, posture, joint mobility), viscera (organ, metabolic, and glandular activity), and emotions (anxiety, depression, withdrawal, confusion). Has the problem not only influenced function, but is it also now altering form?

Acupuncture neuromodulation should, to the degree possible, address each aspect of a patient's discord; i.e., its central, peripheral, and autonomic components. This likely will require several treatments.

Acupuncture Neuromodulation

Neuromodulation is a naturally occurring phenomenon, allowing the body to respond and adapt to endogenous and exogenous stimuli. It provides for the protection, homeostasis, and repair of

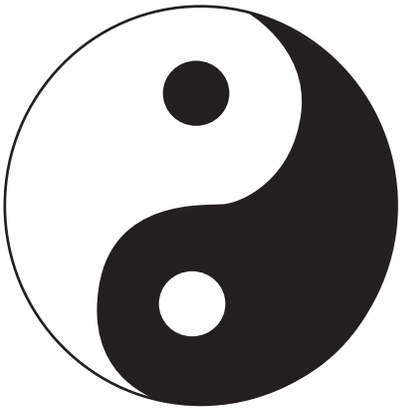
the organism.[2,3,4,5,6] Sometimes, though, autoregulatory processes either falter or fail. Acupuncture is simply a somatosensory input that assists the body in making the neuromodulatory changes necessary to regain health and homeostasis.[7]

Acupuncture neuromodulation signals initiated near needling sites propagate along nerves toward the CNS.[1] Connections at the spinal cord can course in several directions. The cord may 1) send efferent signals back out to the periphery (leading to antidromic activation of free nerve endings at the site of needling), 2) loop into related visceral neural networks and alter internal organ function in a spinal segmental manner, 3) foster endogenous opioid release in the dorsal horn of the spinal cord to reduce spinal facilitation, or "wind-up," and block pain, and/or 4) proceed to higher centers in the brain, altering neural and hormonal functions. When these impulses arrive at the brain, they influence activity there as well, usually in a beneficial manner.

Exactly how the body responds and which parts of the body react depend on the nerves stimulated.[8] However, the body's pre-needling state may also influence outcomes.[9,10] For example, the point ST 36 treats both diarrhea and constipation, depending on pre-treatment gastrointestinal motility status.[11,12] In this way, the same point can either "quiets things down" in cases of hyperfunction, or "fire them up" in hypofunction.

Yin and Yang in the Modern Era

TCM terms such as "Yang Excess" and "Yin Deficiency" can now be viewed as sympathetic hyperfunction or parasympathetic hypofunction.[13,14] Disease states that illustrate Yang Excess include hyperthyroidism and acute fever. "Deficient Yin" describes parasympathetic hypofunction, most dramatically depicted by toxic exposure to anticholinergics, or parasympathetic antagonists. In this case, the victim turns "red as a beet, blind as a bat, dry as a bone, mad as a hatter, and hot as hell."[15]



The Tai Ji symbol illustrates the balanced, intertwining, and evolving relationship between Yin (black) and Yang (white), with elements of the complementary partner held by each component (represented by the small circles).

Conversely, "Excess Yin" connotes just the opposite, i.e., parasympathetic hyperfunction and/or sympathetic hypofunction. One might even see a concatenation of autonomic disruption, as in cluster headaches. These patients exhibit both sympathetic hypofunction, manifesting as miosis and ptosis, along with parasympathetic hyperfunction, with rhinorrhea and lacrimation.

Table 2-1 Sympathetic and Parasympathetic Functions[18,19]

Organ	Effects of Sympathetic System (Yang)	Effects of Parasympathetic System (Yin)
Adipocyte metabolism	Causes lipolysis	---
Adipocyte, brown	Causes heat production	---
Adrenal medulla	Causes adrenaline/epinephrine (80%) and noradrenaline/norepinephrine (20%) secretion	---
Arteries in cranium	Vasoconstricts	May vasodilate
Arteries in erectile tissue (helical arteries and sinusoids in penis and clitoris)	Vasoconstricts	Vasodilates
Arteries in heart[20] (coronary arteries)	Transient vasoconstriction, followed by vasodilation	Some vasodilation
Arteries in skeletal muscle	Vasoconstricts (via adrenergic fibers) under resting tone and vasodilates large arteries (via cholinergic fibers) during exercise	---
Arteries in skin and mucosa of face	Vasoconstricts	Vasodilates
Arteries in skin of trunk and limbs	Vasoconstricts	----
Arteries in viscera	Vasoconstricts	----
Esophagus	Motility decreases Sphincters contract	Motility increases Sphincters relax
Eye	Pupillary dilator muscle dilates pupil Contracts tarsal muscle (lifts lid) Ciliary muscle relaxes for far vision	Pupillary sphincter muscle contracts pupil Contracts ciliary muscle
Gallbladder and biliary ducts	Relaxes	Contracts

Table 2-1 Sympathetic and Parasympathetic Functions, Continued

Heart	Increases heart rate Increases atrial and ventricular contractility	Decreases heart rate Decreases atrial contractility
Intestines	Motility decreases Sphincters relax Secretion decreases	Motility increases Sphincters contract Secretion increases
Kidneys	Arterioles constrict	Arterioles dilate
Lacrimal gland	---	Secretes
Liver metabolism	Causes glycogenolysis, gluconeogenesis	---
Lungs	Relaxes tracheobronchial muscles	Contracts tracheobronchial muscles Increases mucous secretions from bronchial glands
Lymphoid tissue	Reduces activity (e.g., of natural killer cells)	---
Nasopharyngeal glands	---	Secretes
Pancreas[21]	Increases circulating glucose Inhibits insulin secretion from the islet beta cells Constricts pancreatic blood vessels	Increases insulin secretion Dilates pancreatic blood vessels
Piloerector muscles	Contracts	----
Pilomotor muscles of the skin	Causes contraction	---
Pineal gland	Increases synthesis of melatonin	---
Prostate, seminal vesicle	Contracts	---
Salivary glands	Weak serous secretion (submandibular salivary gland) Sparse, thick secretion	Profuse serous secretion
Splenic capsule	Contracts	---
Stomach	Motility decreases Sphincters contract Secretion is inhibited	Motility increases Sphincters relax Secretion increases
Sweat glands of the skin	Induces profuse secretion	---
Thyroid gland	Becomes stimulated	
Ureter	Decreases ureteric tone and motility	Increases ureteric tone and motility
Urinary bladder	Relaxes detrusor muscle (small amount) Increases internal sphincter tone and trigone	Contracts detrusor muscle Relaxes internal sphincter tone and trigone
Uterus	Contracts pregnant uterus Relaxes or contracts the non-pregnant uterus	---
Vas deferens	Contracts	---
Veins	Vasoconstricts	---

Instead of relying on abstract concepts of Yin and Yang, studying the autonomic nerve supply to organs and glands yields insights into ways in which illness manifests neurophysiologically. This then opens the door to acupuncture neuromodulation by outlining neuroanatomic expressways that revise neural traffic. Table 2-1 compares the complementary actions of the two limbs of the autonomic nervous system (ANS), designated by tissue or organ. Most viscera receive dual innervation from both sympathetic and parasympathetic limbs of the ANS.[17]

How Acupuncture Points Affect Internal Organs

While needling neuromodulates nerve activity in local structures through direct effects on tissue, its broader, homeostatic value results from reflexes in the spinal cord and brain.

The Spinal Cord Connects the Soma with Viscera

One of the most salient depictions of how the ancient Chinese linked anatomy (structure) with physiology (function) comes from the Back Shu and Front Mu points. These twelve pairs of points (one Back Shu and one Front Mu for each organ) act upon certain sections of the spinal cord. Their associated spinal cord levels house interneuronal connections connecting pathways that produce reflexes between acupuncture points on the body surface (soma) and internal organs (viscera).

The paraspinal Back Shu points run along the inner Bladder channel from the thorax to the sacrum. The Front Mu points occur on the lateral or anterior aspects of the trunk and generally receive nerve supply from spinal cord segments that overlap with those of the Back Shu points.[122] Back Shu points receive innervation from the dorsal (posterior) ramus of a spinal nerve, while the Front Mu points occur along dermatomes of the same, or neighboring, spinal nerve, supplied by either the lateral or ventral (anterior) ramus.

The internal organs' associated Back Shu and Front Mu points typically share overlapping or, at least nearby, spinal segmental connections. In the spinal cord, neurons in the deep layers of the dorsal horn receive convergent input from somatic structures and viscera.[124]

Unhappy nerves arise from unhappy organs and body wall structures such as tense or painful muscles and fascia. Nociceptive neurons, when activated, bombard the spinal cord with tales of woe.[123] They become more excitable and fire more readily in response to stimuli. This phenomenon of central nervous system excitation is known as "wind-up" or "facilitation."[125,126] Sensitized neurons will, in some cases, trigger impulses spontaneously, long after the initiating insult has ceased causing tissue damage or irritation. Cells receiving muscle input in the intermediolateral gray column of the spinal cord, where preganglionic autonomic cell bodies reside, become hyperactive as well, propelling a loop within the sympathetic system that participates in the process of referred hyperalgesia.[127]

Central sensitization amplifies output to both visceral and somatic structures. Sympathetic efferent neurons in the thoracic and lumbar spinal cord segments join in this dysfunctional dance. Muscles supplied by sensitized segments become tense due to increased output through somatic motor neurons, causing sustained muscle contraction. This engenders myofascial dysfunction and trigger points.[128] Heightened sympathetic tone drives vasoconstriction and edema; it also amplifies tissue tenderness and texture changes.[129,130,131,132,133]

Organs receiving neural input from "wound up" spinal segments experience decreased perfusion due to sympatho-excitation.[134,135] Conceivably, compromised blood flow in an organ could, over time, lead to insufficiency or, ultimately, failure in that structure. In the kidney, for example, activated renal sympathetic nerves reduce renal blood flow, increase renin secretion, and increase renal tubular sodium reabsorption.[136] Should counteracting autoregulatory controls falter or prove insufficient, hypertension may result.[137]

In practice, an acupuncturist palpates the entire group of Back

Table 2-2
Sympathetic Input to the Back Shu and Front Mu Points[157,158]

Organ	Sympathetic Preganglionic Levels[159,160,161,162]	Site of Synapse of Pre- and Post-Ganglionic Sympathetic Neurons[163]	Course of Nociceptive Afferent Pathways into the Central Nervous System*[164]	Associated Back Shu Point and Vertebral Level**	Associated Front Mu Point and Dermatome Level
Lungs (including the trachea and bronchi)	T2-T7, to upper thoracic sympathetic ganglia	T2-T6 sympathetic ganglia	Afferents travel with the sympathetics to the dorsal root ganglion neurons from T2-T7 and the vagus nerve to the nucleus tractus solitarius (NTS) in the medulla	**BL 13;** T3	**LU 1;** C4,T2
Pericardium	T1-T5, to upper thoracic and cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Afferents travel with the afferents in the middle and inferior cervical sympathetic cardiac nerves and the thoracic sympathetic cardiac nerves and enter the cord from T1-T5	**BL 14;** T4	**CV 17;** T4
Heart	T1-T5, to upper thoracic and cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Afferents travel with the afferents in the middle and inferior cervical sympathetic cardiac nerves and the thoracic sympathetic cardiac nerves and enter the cord from T1-T5	**BL 15;** T5	**CV 14;** T7
Liver	T5-T10, to superior thoracic (greater) splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T10	**BL 18;** T9	**LR 14;** T8, T9

Table 2-2 Sympathetic Input to the Back Shu and Front Mu Points, Continued

Gallbladder	T5-T10, to superior thoracic (greater) splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T10	**BL 19;** T10	**GB 24;** T9
Spleen (Pancreas)	T5-T11, to superior thoracic (greater) splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T11	**BL 20;** T11	**LR 13;** T10, T11
Stomach and Duodenum	T5-T11, to superior (greater) and middle (lesser) thoracic splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T11	**BL 21;** T12	**CV 12;** T7, T8
Triple Heater (adrenal)	T7-L2, to superior (greater), middle (lesser), and inferior (least) thoracic splanchnic nerves and the first +/- second lumbar splanchnic nerves	Chromaffin cells of adrenal medulla	None reported	**BL 22;** L1	**CV 5;** T11, T12
Kidney	T10-L2, to middle (lesser) and inferior (least) thoracic splanchnic nerves and the first +/- second lumbar splanchnic nerves → celiac and renal plexuses	Celiac and aorticorenal ganglia	Afferents travel with the sympathetics and enter the cord from T10 to L2	**BL 23;** L2	**GB 25;** T12
Large Intestine	• **Cecum and appendix:** T10-T12 (cecum, appendix) to the superior (greater) and middle (lesser) thoracic splanchnic nerves → celiac and superior mesenteric plexuses • **Colon to the splenic flexure:** T10-L1 to the middle (lesser) and inferior (least) thoracic and first lumbar splanchnic nerves • **Splenic flexure to the rectum:** L1-2 through to the S2-S4 sacral chain ganglia, to the lumbar and sacral splanchnic nerves → inferior mesenteric and inferior hypogastric pelvic plexuses.	Superior and inferior mesenteric ganglia and ganglia in superior and inferior hypogastric plexuses	• **Cecum and appendix:** Afferents travel with the sympathetics and enter the cord from T10 to T12 • **Colon to the splenic flexure:** Afferents travel with the sympathetics, course through the superior and inferior mesenteric plexuses and splanchnic nerves, and into the cord from T10 to L1 • **Splenic flexure to the rectum:** Travel with the parasympathetic nerves and the pudendal nerves, into the cord at S2-S4	**BL 25;** L4 (receives sympathetic supply from T10-L2)	**ST 25;** T10
Small Intestine	T8-12 right, T8-T11 left, to the superior (greater) and middle (lesser) thoracic splanchnic nerves to the celiac plexus	Celiac and superior mesenteric ganglia	Travel with the sympathetics through the celiac and inferior mesenteric plexuses, into the cord from T8-T11	**BL 27;** (receives sympathetic supply from T10-L2)	**CV 4;** T12
Bladder	T11-L2 to the middle (lesser) and inferior (least) thoracic splanchnic nerves	Inferior mesenteric ganglion and sacral paravertebral ganglia	Travel with the parasympathetic nerves and some sympathetic afferents, to enter the cord at S2-S4 and L1-L2	**BL 28;** S2 (receives sympathetic supply from T10-L2)	**CV 3;** L1

*The afferent pathways listed in this table only pertain to the nociceptive avenues. Afferent fibers carrying other sensory information exist but have not been included here.
**Note: Sympathetic input to each spinal level is generally multi-segmental. That is, the tissues located in the vicinity of the Back Shu points along the inner line of the Bladder channel likely receive sympathetic supply from a spinal segment above and below that noted in the table.

Shu and Front Mu points in order to indirectly assess the function of the related organs. The point-organ relationships in the Shu-Mu system are arranged in a topographical fashion, with more cranial organs such as the lung and heart relating to more upper thoracic Shu-Mu point pairs, and more caudal organs such as the urinary bladder and large intestine showing up in the caudal point pairs. (See Table 2-2.)

Shu-Mu palpation should assess tension and tenderness in the muscles beneath the point, rather than merely the skin or subcutaneous tissue. Pain referred from an irritated viscus begins in deep somatic structures.[138] However, trophic changes in the skin follow visceral disturbances, as evidenced by thickened subcutaneous tissue and atrophic skeletal muscle.[139] When both members of the Shu-Mu pair demonstrate tenderness to palpation, assessment of that organ system would be prudent, since this may suggest visceral, rather than predominantly somatic dysfunction.[140,141,142,143,144]

Upon finding tender Shu-Mu points, an acupuncturist typically treats them, with the goal of reducing spinal cord windup and associated organ dysfunction. Mild, non-painful stimulation such as that provided by acupuncture may reduce pain and sympathetic hyperactivity in regions supplied by similar metameric/neuromeric/segmental fields.[145]

Table 2-2 also shows which spinal segments feed supply structures associated with the Back Shu and Front Mu points, the sites of synapse of pre- and post-ganglionic sympathetic neurons, and the course of nociceptive afferent pathways back to the CNS.

Table 2-3 provides the associated anatomy of organs outside of the Back Shu-Front Mu system. Relevant acupuncture points that could influence these organs can be determined on the basis of the neural structures linking the body surface (i.e., the soma) to these viscera.

Areas of referred tenderness precipitated by ongoing visceral nociceptive input land in metamerically connected cutaneous, subcutaneous, and muscular tissues. Metameric regions arise from similar segments of the developing embryo; referred pain and tenderness ordinarily occur ipsilateral to the disturbed structure.[146]

In the early stages of visceral disease, referred pain often has a deep, vague, and poorly localized quality. Pain at this phase (minutes to hours after the initial insult) feels like a dull discomfort, nearly always along the midline of the thorax or abdomen.[147] Autonomic concomitants such as sweating, nausea, vomiting, pallor, and a sense of impending death, may accompany true visceral pain in its early stages.[148]

If nociceptive signals continue from an irritated viscus, pain migrates to the body wall in the thorax or abdomen, usually located within similar or nearby spinal segments.[149] The referred pain begins to resemble somatic pain in that it becomes sharper, better defined, and well localized. Receptive fields expand in size in proportion to the number of painful episodes.[150] Over time, central sensitization as well as concurrent problems in other organs may cause pain to refer to adjacent myotomes, at which point neighboring Shu and Mu points could become tender.[151,152]

This is why, although the Back Shu and Front Mu pairs conventionally associate with only one organ, in reality, widespread multisegmental communication occurs. This limits the specificity of organs and acupuncture point relationships. Each paravertebral sympathetic ganglion may supply as many as six ipsilateral dermatomal levels.[153] Less predictable myotomal and scleromal innervation patterns further complicate interpretations of internal organ distress derived by myofascial palpation.[154]

While the nerve supply of the Back Shu-Front Mu points is elaborate and extensive, the general cranial to caudal layout of the Back Shu-Front Mu points exhibits a similar trend across species, even if specific vertebral levels differ. An alternative and probably more realistic arrangement would consist of overlapping zones assigned to various organs instead of discrete points, as suggested for the horse.[155] Initially, this variance from the human norm arose to address difference in vertebral formulae between humans and other animals. As humans have twelve thoracic and five lumbar vertebrae and horses have eighteen thoracic and commonly six lumbar vertebrae, difficulties arise if one attempts to transpose the Back Shu points directly from the human to the horse.[156] Instead, Panzer proposes multi-level "association segments" rather than discrete association points.

Extrasegmental Acupuncture Points and Autonomic Function

Acupuncture points outside of the Back Shu-Front Mu system also modulate autonomic function, but do so through a variety of connections. Table 2-4 lists the associations between sympathetic structures and acupuncture points on the neck and trunk. Table 2-5 links points on the head and trunk with parasympathetic projections. Bear in mind that these are only partial lists, designed to denote the more common pathways utilized in a diverse and busy acupuncture practice.

The Brainstem's "Grand Central Stations" for Autonomic Reflexes in Neuromodulation: The Nucleus Tractus Solitarius and Rostral Ventral Lateral Medulla

Scientific research over the past decade has answered the question about how a point on the leg, ST 36, can treat both diarrhea and constipation. Instead of influencing autonomic activity in a unilateral direction, appropriately selected and stimulated acupuncture points modulate, or coax, bodily processes toward a homeostatic function.

Neuroscience has thus removed the need to rely on abstract "Yin-Yang balance" conceptualization by substituting metaphors with precise neurophysiologic descriptions that outline the trajectory from point to brain and spinal cord, and then on to the organ.

For example, two points on the limbs, ST 36 and PC 6, affect

Table 2-3
Anatomic Relationships of Organs Outside of the Shu Mu System[165]

Organ	Sympathetic Preganglionic Levels[166,167,168,169]	Site of Synapse of Pre- and Post-Ganglionic Sympathetic Neurons[170]	Course of Nociceptive Afferent Pathways into the Central Nervous System*[171]
Meninges and arteries of the brain	T1-T3 to and through the cervical sympathetic ganglia	T2-T6 sympathetic ganglia	Cranial nerves V, IX, and X enter the spinal trigeminal nucleus; afferents traveling through C1-C3 spinal nerves enter at the C1-C3 spinal cord segments
Eyes	T1-T4, to and through the cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Ophthalmic branch of CN V enters the spinal trigeminal nucleus
Lacrimal gland	T1, T2, to and through the cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Lacrimal nerve to the ophthalmic branch of CN V, to the spinal trigeminal nucleus
Parotid	T1, T2, to and through the cervical sympathetic ganglia	Celiac ganglion	Parotid nerve to the auriculotemporal nerve of CN V_3, to the spinal trigeminal nucleus
Submandibular, and sublingual glands	T1, T2, to and through the cervical sympathetic ganglia	Celiac ganglion	Submandibular branch of the lingual nerve to CN V_3, to the spinal trigeminal nucleus
Thyroid gland	T1, T2, to and through the cervical sympathetic ganglia	Celiac ganglion	Travel with sympathetic nerves to T1-2 spinal cord segments
Blood vessels of the skin and somatic structures of the head and neck	T1-T4, to and through the cervical sympathetic ganglia	Celiac ganglion	Some travel with sympathetic nerves to the T1-T4 spinal cord segments; others accompany CN V, CN IX, and CN X to the spinal trigeminal nucleus
Larynx	T1, T2, to and through the cervical sympathetic ganglia	Chromaffin cells of adrenal medulla	Superior laryngeal nerve to the spinal trigeminal nucleus
Esophagus	• **Cervical:** T2-T4, to and through the upper thoracic sympathetic paravertebral ganglia • **Thoracic:** T3-T6, to and through the upper thoracic sympathetic paravertebral ganglia • **Abdominal:** T5-T8, to the thoracic sympathetic paravertebral ganglia and superior thoracic splanchnic nerve	Celiac and aorticorenal ganglia	• **Cervical:** Some travel with the vagus to the NTS, others travel with the sympathetics to spinal cord segments T2-T4 • **Thoracic:** Some travel with the vagus to the NTS, others travel with the sympathetics to spinal cord segments T3-T6 • **Abdominal:** Some travel with the vagus to the NTS, others travel with the sympathetics to spinal cord segments T5-T8
Thoracic Aorta	T1-T5, to the thoracic sympathetic paravertebral ganglia	Superior and inferior mesenteric ganglia and ganglia in superior and inferior hypogastric plexuses	Travel with the sympathetic afferent pathways to the spinal cord levels T1-T6
Abdominal Aorta	T5-L2, through splanchnic nerves and direct branches	Celiac and superior mesenteric ganglia	Travel with the sympathetic afferent pathways to the spinal cord levels T5-L2
Ureters	• **Upper 2/3:** T10-L2, to the middle and inferior splanchnic and upper two lumbar splanchnic nerves • **Lower 1/3:** T11-L2, to the S2-S4 sacral ganglia	Inferior mesenteric ganglion and sacral paravertebral ganglia	• **Upper 2/3:** Travel with sympathetics to the spinal cord levels T10-L2 • **Lower 1/3:** Travel with sympathetic and parasympathetic nerves to enter the cord between T10 and T12
Uterus	T6-L2, to the splanchnic nerves to aortic and ovarian plexuses and superior and inferior hypogastric plexuses		Travel with the sympathetic afferent pathways to the spinal cord levels T11-L2
Testes, ductus deferens, epididymis, seminal vesicles, and prostate	T10-L1 through thoracic and upper lumbar splanchnic nerves, the celiac, aortic (intermesenteric), and superior hypogastric plexus, and hypogastric nerves to the inferior hypogastric (i.e., pelvic) plexus	Prevertebral ganglia and inferior mesenteric ganglion	Afferents through the testes (or ovaries) travel to T10. Parasympathetic afferents from these structures enter the S2-S4 portion of the spinal cord

*The afferent pathways listed in this table only pertain to the nociceptive avenues. Afferent fibers carrying other sensory information exist but have not been included here.

Table 2-4
Linkage of Autonomic Structures and Acupuncture Points -- Sympathetics[175,176]

Associated Spinal cord segments (C8-L3)	Structures Near Acupuncture Points and their Function	Acupuncture Points
C8-T5	**Superior cervical ganglion:** Supplies the head, neck, and heart; postganglionic axons "hitchhike" on the carotid arteries and branches to reach their destinations, which include the blood vessels supplying the lacrimal, salivary, and nasopharyngeal glands, the eye and dilator pupillae muscle, and remaining tissues.	SI 17
T1-T6	**Middle cervical ganglion:** Supplies the neck and heart (via the cardiac pulmonary plexus)	ST 10 GV 14[177]
T1-T7	**Inferior cervical ganglion (may fuse with the T1 ganglion to form the stellate ganglion):** Supplies the heart, caudal neck, arm, and posterior region of the head	ST 11
T1-T12	**Thoracic sympathetic ganglia (paravertebral and prevertebral)** • T2-T5 supply the heart and lungs • T5-T9 supply the stomach and proximal gut (fibers synapse in the celiac ganglion) • T8 to L2 supply the adrenal gland • T7 to L1 supply the superior mesenteric ganglion • T9-T11 supply the superior mesenteric ganglion • T9-T10 supply the inferior mesenteric ganglion • T12 supplies the renal ganglion • T12 fibers may also synapse in the aorticorenal ganglion (the combined superior mesenteric, renal, and inferior mesenteric ganglia) which supplies the kidney	GV or BL points at related spinal levels[178]
L1-L5	**Lumbar Sympathetic Ganglia** Axons from all lumbar ganglia region spinal nerves supplying the abdominal wall and pelvic limbs. Axons from most lumbar ganglia also join the abdominal plexuses. Fibers from lower lumbar sympathetic nerves migrate along the iliac arteries and branches to innervate pelvic vessels.	
S1-S4	**Sacral Sympathetic Ganglia** The pelvic sympathetic chains fuse in the midline, anterior to the coccyx, to form the ganglion impar. Postganglionic branches supply the wall of the pelvis and the pelvic limbs. Branches destined for the distal colon or pelvic viscera form the superior and inferior hypogastric plexuses. The superior hypogastric plexus lies below the origin of the common iliac arteries. The inferior hypogastric plexus is also called the pelvic plexus, and is located deep within the pelvis, close to the pelvic nerves.	S1: BL 31; BL 27 S2: BL 32; BL 28 S3: BL 33; BL 29 S4: BL 34; BL 30

Table 2-5
Linkage of Autonomic Structures and Acupuncture Points -- Parasympathetics[179,180]

	Parasympathetic Structures Near Acupuncture Points and their Function	Points
Cranial Parasympathetic Nerves	**Ciliary ganglion, CN III** Pupillary constriction.	ST 1 for CN III
	Sphenopalatine/pterygopalatine ganglion, lacrimal gland, CN VII Sends secretomotor signals to the lacrimal gland to stimulate tear production. Innervates the mucosal glands of the nose and mouth.	TH 23; GB 1
	Submandibular ganglion, submandibular and sublingual glands, CN VII Causes the submandibular and sublingual salivary glands to secrete saliva.	ST 5 for submandibular ganglion
	Otic ganglion, parotid gland, CN IX Causes the parotid gland to secrete saliva.	ST 7 for otic ganglion
	Carotid sinus nerve, CN IX Supply the carotid sinus and body	CV 23 ST 9 for carotid sinus
	CN X Vagal input to the thoracic and abdominal viscera	TH 17; SI 16; ST 9 CV 22; ST 9 for recurrent laryngeal nerve
Sacral Parasympathetic Nerves	**Sacral Nerves (S2-S4)** Supply the lower gut and the pelvic viscera. Modulate smooth muscle activity and stimulate pelvic glands to secrete	S2: BL 28, BL 32 S3: BL 29, BL 33 S4: BL 30, BL 34

brainstem nuclei[172,173,174] that participate in long-loop reflexes between the acupuncture point and internal organs. These nuclei, most notably the nucleus tractus solitarius (NTS) and its partner, the dorsal motor nucleus of the vagus (DMNV) as well as the rostral ventral lateral medulla (rVLM), modulate autonomic tone based on somatoautonomic input converging on the NTS and rVLM.[24,25,26]

The Nucleus Tractus Solitarius

The NTS interconnects numerous central nervous system networks. It acts as an important relay center for sensory afferents from diverse sources. Afferent signals arising from peripheral chemoreceptors, baroreceptors, the gastrointestinal tract, cardiovascular system, lungs, and the airways terminate in the NTS.[27] Some of these afferents reach the NTS by hitchhiking on cranial nerves III, VII, IX, and X, i.e., the cranial nerves that carry parasympathetic fibers.[28]

The NTS also receives input from afferents innervating the skin, subcutaneous tissues, and muscle in an ongoing fashion. Adding somatic afferent stimulation through acupuncture augments or otherwise modifies this input.[286]

For example, acupuncture points on the face (supplied by the trigeminal nerve) and limbs (such as ST 36, supplied by the fibular (peroneal) nerve), influence gastrointestinal motility, blood pressure, cardiopulmonary function, and pain. In one study, researchers used the cellular marker of neural activity, c-fos, to identify activated neurons in the CNS after gastric distension and electroacupuncture. They stimulated points on the face (GB 14, ST 2, and ST 6). Their results showed that both noxious visceral information and non-noxious somatic afferent stimulation (i.e., acupuncture) converged in the NTS. This suggested that the NTS mediates EA analgesia through neuromodulation.[29,287]

Receptors from the cardiovascular and respiratory systems also send messages into the NTS. Baro- and chemoreceptors living in the bifurcation of the carotid artery help the body autoregulate blood pressure and blood chemistry.[30] Impulses from the carotid body and sinus artery travel to the NTS by way of the glossopharyngeal nerve (CN IX). There, they converge with input from the reticular formation and the hypothalamus as well. The NTS assembles this information and determines the appropriate reflex autonomic responses.[31]

Impaired sensing capability from dysfunctional baro- and chemoreceptors triggers sympathetic bias that could conceivably lead to myocardial infarction, heart failure, and stroke.[32] Carotid body and carotid sinus electromodulation may help prevent or treat cerebrovascular events by restoring autoregulation.[33] The idea of externally influencing the carotid sinus is not new; carotid sinus massage has been used to determine the cause of syncope and also to terminate supraventricular tachycardia through alterations in autonomic tone.[34,35] The acupuncture point ST 9 (located near the carotid body and sinus) has long received attention as a point that is valuable for treating "shortness of breath," "asthma," "sudden turmoil disorder," "pulseless syndrome," "hypertension," and "hypotension."[36] This indicates that the ancient Chinese

recognized the role of structures stimulated by needling ST 9 in cardiopulmonary problems, even though they were unaware of the actual neurophysiological mechanisms involved.

Far and away, the largest body of research exploring the impact of acupuncture on NTS has focused on its role in restoring normal gastrointestinal motility.[288] This results from communication with its neighbor, the dorsal motor nucleus of the vagus (DMNV). Together, the NTS (a site that receives afferent information) and the DMNV (an efferent structure) form the dorsal vagal complex, or DVC. The DVC thus comprises sensory and motor aspects, creating a conduit for somatovagal and vagovagal reflexes.[49] In this manner, the DVC is a parasympathetic preganglionic center that modifies visceral output based on convergent, somatoautonomic input.

The Rostral Ventral Lateral Medulla

The rostral ventral lateral medulla (rVLM), like the NTS, receives convergent input from both visceral and somatic sources. The rVLM also assists the NTS in the baroreceptor reflex.[37] The rVLM affords the main source of tonic excitatory input to cardiovascular sympathetic preganglionic neurons in the spinal cord.[38] It modulates cardiovascular responses according to the signals it receives from the gut and soma. The neurotransmitters nitric oxide, opioids, and nociceptin are a few examples of the chemicals involved in its activity.[39,40,41,42]

EA influences cardiovascular function at least in part by affecting rVLM activity.[43,44,45] Physiologic investigations demonstrate point- (i.e., nerve-) specific cardiovascular responses in the rVLM.[46] EA at points associated with deep nerves (such as the median (PC 5, PC 6) or deep radial (LI 10, LI 11)) produce stronger and longer-lasting modulation of visceral reflex pressor responses than does EA over superficial cutaneous nerves, such as at the terminal branches of the tibial nerve (KI 1, BL 67).[47] Cardiovascular responses to EA also demonstrate frequency specificity. Research shows that both EA at 2 Hz and MA (dry needling) inhibit reflexive excitatory cardiovascular responses caused by visceral afferent stimulation, but EA at 40 Hz or 100 Hz does not.[48]

The rVLM influences gastrointestinal motor function, too. Compared to somatic afferent stimulation at ST 36, which, after reaching the NTS, increases gastric contractions (a parasympathetic effect), stimulation at ST 25 predominantly influences the rVLM, resulting in gastric relaxation (a sympathetic effect).[289]

Somato-somatic Reflexes

Each acupuncture point delivers a panoply of effects. Some influence both somatic and autonomic function simultaneously. ST 36, for instance, treats not only constipation and diarrhea through the mechanisms just described, but also helps alleviate back pain and pelvic limb dysfunction.

MA at ST 36 activates afferent fibers belonging to groups I, II, III, and IV.[196] Group II and III afferents elicit acupuncture analgesia; afferents belonging to groups II, III, and IV also impact various autonomic processes,[197,198] while activation of Group I afferents more clearly influence motor neuron activity.[199]

All of these afferents connect to the fibular nerve, supplied by lumbosacral spinal cord segments. Patients with disk disease or back pain in the low back may derive relief from ST 36 stimulation at least in part because of the spinal segmental analgesia it provides. From a supraspinal perspective, EA at ST 36 regulates beta-endorphin and adrenocorticotropic hormone (ACTH) levels in the hypothalamus and pituitary, bestowing generalized analgesia and anti-inflammatory effects.[201,202,290]

EA at ST 36 also affects structures in the limbic system, i.e., brain structures involved in processing pain, memory of pain, and its emotional qualities.[291,292] Furthermore, ST 36 neuromodulation leads to changes in cerebral blood flow in the frontal lobes, brainstem, and thalami. These alterations occur as a consequence of acupuncture treatment and relate to pain-relief.[200] Thus, even considering this one point's effects, one sees how acupuncture alleviates pain through a multiplicity of mechanisms.[192,193,194]

While needling points such as ST 36 can help patients with conditions such as back pain through generalized analgesic mechanisms, direct treatment of painful regions is usually also necessary for successful treatment. Palpation and postural evaluation of the back, neurologic testing, and mobility assessments all lend vital information about the specific problems plaguing the patient. The medical acupuncturist then considers ways in which to stimulate sites related to the myofascial and neuroanatomic matrix in order to optimize relief, especially when medication has failed to do so.[208,209]

This is where somato-somatic reflexes through acupuncture neuromodulation perform vital roles in prompting recovery. In the case of back pain, for example, stimulation of paravertebral somatic afferent fibers at acupuncture points along the spine suppresses activity in spinal nociceptive neurons.[195] This alleviates muscle tension, fascial restriction, and local nerve irritation and inflammation, ultimately reducing spinal cord facilitation. Reduction in facilitation (wind-up) helps dampen pain transmission, efferent motor activity and sympathetic tone, leading to analgesia, muscle relaxation, and improved circulation. Obtaining a twitch in the muscle through electrical stimulation, similar in ways to the needling of trigger points, provides significantly greater immediate and sustained relief of myofascial low back pain than stimulating only the muscle or overlying skin.[215]

As an illustration of how somato-somatic reflexes connect acupuncture points to painful sites, Table 2-6 lists groups of acupuncture points often used for spinal pain, their location, and the nerves they most intimately impact. Not included are peripheral points such as BL 40, BL 60, ST 36, SI 3, and others that provide additional analgesia, depending on the patient's pain problem(s). In general, it is standard practice to focus not only on the specific spinal segment or vertebral level involved in the pain problem, but also on points associated with spinal segments above and below. This takes into account the multisegmental somatic nerve supply to spinal structures as well as the discrepancy that appears between the vertebral level and dermatomal nerve supply in the caudal spine. One should not neglect the sympathetic contribution to the pain problem. Therefore, one should consider selecting points along paraspinal locations that provide autonomic input to the region.[244,245]

Table 2-6 Acupuncture Points Commonly used for Spinal Pain

Acupuncture Points (Medial to Lateral)	Location	Related Nerves[246]
Governor Vessel (GV) points and additional interspinous points along the midline	Between spinous processes of adjacent vertebrae, on the dorsal midline	Medial branch of the dorsal (posterior) primary ramus
Huatojiaji points[247,248,249,250]	0.5 cun lateral to the midline, from C1 to L5	Medial branch of the dorsal primary ramus
Facet joint points	1.0 cun lateral to the midline, from C1 to L5	Medial branch of the dorsal primary ramus
Inner Bladder line	1.5 cun lateral to the midline	Lateral branch of the dorsal primary ramus
Outer Bladder line	3.0 cun lateral to the midline	Ventral branch of the dorsal primary ramus
Myofascial Trigger points	Variable	Variable
Front Mu points (for organ relationship)	Variable	Variable

Table 2-7 associates structures often implicated in spinal pain such as intervertebral disks, facet joints, and spinal muscles.[251] Inflammation, compression, developmental anomalies, or degeneration of these tissues can all lead to spinal pain. The table includes mention of particular acupuncture point groupings that may most directly influence pain transmission in the affected nerves.

Controlled trials and systematic reviews in human research provide increasingly strong supportive evidence indicating that acupuncture effectively treats chronic spinal pain.[222,223,224,225,226,227,228,229,230,231] Several uncontrolled studies have reported that acupuncture also reduces spinal pain in dogs and horses.[232,233,234,235,236,237,238] According to Adrian R. White, MD, the author of several systematic reviews on acupuncture, "Acupuncture treatment should be considered for anyone who has nonspecific mechanical back pain that has persisted for 6 weeks or more despite standard treatment."[239,240] In humans, ten sessions of acupuncture produced stable, long-term effects lasting at least six months according to a recently published prospective cohort study.[241] A 2005 paper systematically reviewing acupuncture for chronic low back pain echoed the findings of earlier work, concluding that adding acupuncture plus conventional treatment produced better analgesia and functional improvement than conventional treatments alone.[242,243] Acupuncture saves money; results from a 2011 study in Canada suggest that patients with low back pain were less likely to visit physicians if they had received acupuncture, thereby lowering costs spent on healthcare for these patients.[293]

Assembling Acupuncture Points to Impart a Meaningful Neuromodulatory Input

Whether treating back pain, irritable bowel syndrome, trigeminal neuralgia, or radiation-induced xerostomia, a medical acupuncturist can simplify the neural input protocol by asking three simple questions:

1. What is the problem and how is it expressing itself in the soma with myofascial dysfunction, pain, tenderness to palpation, etc.?
2. How does the problem affect neurophysiologic activities in the periphery, CNS, and ANS?
3. Which acupuncture points will influence these affected nerve pathways both specifically and comprehensively?

The physician acupuncturist will find the answers to question 1 when taking the patient's history, performing the physical examination, and pursuing an appropriately detailed workup. The answers to questions 2 and 3 require a solid foundation in neuroanatomy, neurophysiology, and scientifically based medical acupuncture. Acupuncture point anatomy, such as that presented in the chapters that follow, informs the physician about the local, regional, and system-wide impact of stimulating each site.

Summary

Whether a clinical problem involves pain, visceral disturbance, or a psychological or somatic dysfunction, numerous neural networks participate in the problem. This is due to the widespread interactions between the nociceptive and autonomic systems not only in the periphery, but also in the spinal cord, brainstem, and several sites in the cerebrum and cerebellum.[280] Fortunately, acupuncture can influence many of these loci, including, most notably, the medulla, pons, periaqueductal gray, hypothalamus, amygdala, insular cortex, and anterior cingulate gyrus. These sites serve to regulate autonomic outflow, balance endocrine function, and blunt pain.[281] The key is knowing which nerves and regions to target. Hence, the fundamental premise of this book.

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Table 2-7
Potential Sources of Back Pain, Their Innervations, and Related Acupuncture Points[252,253,254]

Structural Source of Back Pain	Related Neural Elements	Acupuncture Points Influencing Nerves Related to the Pain Source – Select Points at One to Three Spinal Segments Above and Below the Lesion, as Well as Those Located at the Pertinent Level From Which Sympathetic Contributions Arise
Intervertebral disc	The outer third of intervertebral disks contains nociceptors and mechanoreceptors. • The sinuvertebral nerve innervates the dorsal (posterior) aspect of lumbar intervertebral disks.[255] The sinuvertebral nerves consist of somatic and sympathetic fibers. When they return to the spine, they can ascend or descend for up to 5 segmental levels.[256,257] Sympathetic fibers supplying disc in the lumbar spine will arise from the thoracolumbar level. Low back pain caused by the sinuvertebral nerve is often diffuse because of its unique anatomic pathway and sympathetic components.[258] The dorsal portion of the lower lumbar disks receives innervation from sensory fibers arising from the T13 to L2 DRGs.[259] • Branches of the ventral rami and the gray rami communicantes supply the lateral aspects of the disks in the lumbar spine.[260,261] The lateral portion of the L5-L6 intervertebral disc (in rats) arise from both ipsilateral and contralateral dorsal root ganglion (DRG) neurons from the T13, L1, and L2 levels.[262] • The ventral (anterior) portion of the L5-L6 intervertebral disc (in rats) receives innervation from the L1 or L2 spinal nerves. This may explain why patients with lower lumbar disc problems may also experience pain in the inguinal region, which corresponds to the L1-L2 dermatome.[263,264,265] • "Paradiscal rami" from the rami communicantes cross intervertebral disks and course through the connective tissue of the disc deep to the origin of the psoas muscle. These rami also likely provide discal innervation.[266] • Severely degenerated lumbar intervertebral disks exhibit more extensive disc innervation than do normal disks.[267]	Huatojiaji points,[1] "facet joint points"[268]
Facet joint capsule	The joint capsule is richly innervated by proprioceptors and nociceptors. The synovial membrane of the lumbar facet joint (in rats) is supplied by sensory and sympathetic fibers.[269] The dorsal rami supply the lateral portions of the facet joints. The sinuvertebral nerves supply the medial portion of the facet joints. Facet joints in the low back receive both segmental and nonsegmental innervation, due to the innervation from sympathetic postganglionic neurons in the thoracolumbar region and the multisegmental nature of spinal innervation.[270] In rats, the L5/L6 facet joint receives multisegmental innervation from the L1 to L5 DRGs.[271]	Huatojiaji points, "facet joint points"[272]
Costovertebral joints (thoracic spine only)	Dorsal rami and sympathetic fibers supply the costovertebral joints.	Huatojiaji points, "facet joint points"
Dorsal root ganglion (DRG)	Mechanically sensitive nociceptors (i.e., mechanonociceptors) in the nervi nervorum of the epineuria surrounding the DRG may contribute to pain if compression or tension affects the DRG.	Points along the inner Bladder channel

Table 2-7 Potential Sources of Back Pain, Their Innervations, and Related Acupuncture Points, Continued

Spinal ligaments: **1) Longitudinal ligaments – dorsal/posterior and ventral/anterior** **2) Supraspinal ligaments** **3) Interspinous ligaments**	These ligaments contain free nerve endings that have been implicated as potential contributors to back pain. • The sinuvertebral nerve supplies the dorsal (or posterior) longitudinal ligament. • Recurrent branches of the rami communicantes innervate the ventral (or anterior) longitudinal ligament.[273] • The grey rami communicantes supply the anterior (ventral) longitudinal ligament. • Medial branches of the lumbar dorsal rami supply the interspinous ligaments	Points along the Governor Vessel channel
Vertebral periosteum	The periosteum contains an extensive plexus of nerve fibers that exhibits the lowest pain threshold of any of the deep tissues.	Huatojiaji points or points along the Governor Vessel channel
Meninges	The dura is sensitive to mechanical and noxious stimulation; meningeal irritation may contribute to back pain. The sinuvertebral nerve supplies the dura mater. The dura mater of the lower lumbar spine receives sensory fibers from the upper lumbar ganglia; these fibers may interact with sympathetic nerves and mediate pain in the low back.[274]	Points along the Bladder channel
Muscles attaching or referring to the back	Myofascial pain is characterized by palpable, taut bands occurring lengthwise along muscles that contain exquisitely tender regions. Lateral branches of the dorsal rami supply the iliocostalis lumborum muscle; intermediate branches of the lumbar dorsal rami supply the longissimus muscle. Medial branches of the lumbar dorsal rami supply the multifidus and the short intersegmental muscles (intertransversarii mediales and interspinales).	Local, direct needling into the taut band or trigger point[275]
Thoracolumbar fascia	Cutaneous branches from dorsal rami of lumbar spinal nerves innervate the thoracolumbar fascia. The thoracolumbar fascia may be involved in a neurosensory capacity in controlling the lumbar spine mechanism.[276] Nerves supplying the thoracolumbar fascia in humans with chronic mechanical back pain may undergo degeneration secondary to ischemia or inflammation.[277]	Points along the Governor Vessel, Bladder, or Gallbladder channels, depending on the area affected by pain, as determined by palpation
Sacroiliac joint	Sensory innervation to the sacroiliac joint arises from neurons in the DRGs ipsilateral to the joint from L1 to S2; sensory fibers from the L1 and L2 DRGs course through the paravertebral sympathetic trunk.[278]	
Dysfunctional viscera causing or resulting from central sensitization[279]	Address both the myofascial and visceral components.	Points along the Governor Vessel, Bladder, or Gallbladder channels, depending on the area affected by pain, as determined by palpation

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Section 2::

Acupuncture Points and Channels


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Chapter 3:: Introducing the Points and Channels

The point tables that follow group acupuncture points according to channel. Although the organ-based naming system for the channels no longer makes sense (if it indeed ever did), it has been retained in order to remain consistent with the World Health Organization (WHO) Standardization of Acupuncture Nomenclature. While retaining this common terminology facilitates communication between those in teaching, research, and clinical practice, it causes confusion because few, if any, points on a given channel have any association with their namesake organ.

Designations of the alphanumeric names of acupuncture points may not include a space between the two-letter channel designation and the point number or, instead, a dash. All are acceptable. For example, the fifth point on the Lung channel may appear as LU 5, LU5, or LU-5. The style selected to denote points in this book utilizes a space between the channel abbreviation and point number.

The indications listed for each point in the chapters of this book provide a glimpse of potential clinical applications and neuroanatomically justifiable or evidentially supported combinations. When available, published trials or experimental evidence pertaining to that point are included. However, medical judgment regarding the appropriate interventions for each patient may necessitate treatment other than acupuncture. For example, although a classical application of LU 4 is chest pain and shortness of breath, patients experiencing these symptoms should receive emergency evaluation and treatment without delay.

The evidential support selected for each point, when available, includes case reports, case series, and uncontrolled trials, along with randomized controlled trials when available. More research, with treatment controls based on a neuroanatomic understanding of acupuncture instead of an energy basis, is certainly needed. Otherwise, research methodology suffers and studies lead to conflicting or confusing results. For example, belief in the energy-meridian concept may prompt a metaphor-based researcher to select verum and sham points too close together. When two points share innervation, one can expect to find non-significant differences between the treatment and control groups, leading skeptics to claim that the effects of acupuncture are essentially those of placebo.

Each point will have listed the alphanumeric code for the channel and individual point number, the Pinyin name of the point, and the English translation of the Pinyin point name. Instead of referring to the San Jiao or Triple Energizer channel by its Chinese name or English name, the term "Triple Heater" was chosen.

The order of channel presentation along with their abbreviations appear below:

Lung (LU)
Large Intestine (LI)
Stomach (ST)
Spleen (SP)
Heart (HT)
Small Intestine (SI)
Bladder (BL)
Kidney (KI)
Pericardium (PC)
Triple Heater (TH)
Gallbladder (GB)
Liver (LR)
Governor Vessel (GV)
Conception Vessel (CV)

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Chapter 4:: Locating Points on the Body

Chapter Highlights

Safe acupuncture requires a solid grasp of anatomy.
Precision and consistency in point location is a precursor to clinically effective and predictable neuromodulation.
Inaccurate and variable point locations may produce unexpected results in clinical and research settings.[1,2]

As important as precise, neuroanatomically accurate point location is, the two traditional methods of point location, i.e., proportional and directional systems, do not always lead to the same locus.[3,4] Instead, the emerging recommendation encourages acupuncturists to employ these techniques as rough estimates but to finalize site selection through touch.

Remember, too, that the targets for neuromodulation are not dots imagined on skin but neurovascular passageways, muscle components, or fascial elements. With experience, the ability to visualize layered anatomy during palpation expands as reliance on standard dictated measurements recedes.

One of the main problems pertains to the fact that acupuncture point location relies on a system of anthropometry designed for a monoethnic population from a distant era.[5] Even in Asia, the length and girth of today's patients' limbs and torsos reflect idiosyncrasies of life style, nutrition, adiposity, and genetics. Anthropometric assessments from millennia ago did not foresee or predict today's diverse populations. The mismatch becomes more extreme when one extrapolates the human points and channels onto other species.[6]

Both the proportional and directional methods of locating points utilize the Chinese anatomical inch called a "cun" (pronounced "tsun"); the plural form is also "cun."

Finding a point begins by defining the length of an anatomical segment as a certain number of cun.[7] Cun are relative to a patient's size, allowing for flexibility across individuals and throughout growth stages. For example, the cun count on the forearm remains twelve regardless of its actual length; from infancy to young adulthood and old age, the forearm remains 12 cun long. See Table 4-1 for a complete list of cun distances.

Proportional Method of Point Location

The proportional approach estimates point locations by dividing the distance between two reference points or topographical landmarks into equal-sized components based on conventionally accepted predetermined anthropometric values. For example, in order to locate TH 5, which can be found at roughly 2 cun proximal to the wrist on the dorsal surface, the proportional method would begin by subdividing the 12-cun antebrachium into six segments, each 2 cun long. The proportional method tells us that TH 5 lands between the distal two sixths, as illustrated in Figure 1.

Table 4-1 Cun distances employed for finding points according to the proportional method.[9]

Region	Cun Measurement Between the Following Landmarks	Cun count	Figure
Head/Neck	Right and left ST 8	9	5
	Middle of the eyebrow to the anterior hairline	3	6
	Anterior to posterior hairlines	12	6
	Posterior hairline to the inferior border of C7 spinous process (GV 14)	3	6
	Right and left mastoid processes	9	7
Trunk	Right and left ST 17 (at the nipple)	8	8
	Suprasternal notch (CV 22) to the xiphisternal synchondrosis (or xiphisternal joint) (CV 16)	9	9
	Xiphisternal synchondrosis (joint) (CV 16) to the umbilicus (CV 8)	8	10
	Umbilicus (CV 8) to the superior border of symphysis pubis (CV 2)	5	10
	Center of axilla (HT 1) to the tip of the 11th rib (LR 13)	12	11
	Medial border of the scapula to the posterior midline	3	12
	Inferior border of spinous process of T1 (GV 13) to the tip of the coccyx	30	13
Arm	Superior end of the anterior axillary crease to the cubital crease	9	14
	Cubital crease to the distal wrist crease	12	15
Leg	Superior border of symphysis pubis (CV 2) to the superior tip of the patella	18	16
	Lateral prominence of the greater trochanter to the popliteal crease	19	16
	Popliteal crease to the lateral malleolus	16	17
	Medial tibial condyle to the medial malleolus	13	17
	Gluteal fold (BL 36) to the middle of the popliteal crease (BL 40)	14	18

Directional Method of Point Location

The directional method employs a side-by-side line-up of cun, meted out as thumb widths that each measure out 1 cun. Other digit-based measurements can provide "shorthand" cun counts, as shown below. This approach requires calibration of the practitioner's hands against the patient's; it is the patient's hand size that determines the cun width, but the acupuncturist's hand finds the points. Therefore, before beginning a treatment, it is common for the practitioner to match her or his hand size against the patient's. If the two measure about the same, then no adjustments are required. On the other hand, if the practitioner's hand dimensions differ from the patient's, one needs a "fudge factor" when measuring cun. Patient adiposity can also complicate cun measurement with the direct method.[8]

Cun "Shorthand"

- 1 cun = the width of the thumb at the interphalangeal joint (Figure 2) or the distance between the proximal and distal interphalangeal joints of the middle finger (Figure 3).
- 1 cun = the width of the apposed index and middle finger measured at the level of the interphalangeal joint of the index finger (Figure 4).
- 3 cun = the width of all four fingers measured at the level of the proximal interphalangeal joint of the index finger (Figure 4).

Summary

As they say in the real estate business, "Location, location, location." For acupuncture, we might add, "Anatomy, anatomy, anatomy."

Figure 1. The **proportional method** approximates cun distances by divvying up parts of the body into separate sections and then specifying the relative position of a point in terms of those sections. For example, TH 5, shown in this image, lands 2 cun proximal to the dorsal wrist crease. The cun measurement for the antebrachium equals 12. Therefore, TH 5 falls between the last two sixths, 10 cun distal to the elbow or 2 cun proximal to the wrist. In practice, in order to determine the length of each of the six segments, one first divides the antebrachium into halves and then subdivides each half into thirds, yielding six equal portions. Contrast this method with the **directional approach**, which utilizes the distance of two of the patient's thumb widths from the dorsal wrist crease. The examiner should arrive at roughly the same region with both methods. However, final point selection should result from palpation for a depression, a report of tenderness from the patient, and/or specification of the exact site for stimulation. In the case of TH 5, this may include the extensor digitorum or extensor digiti minimi tendon, the extensor indicis or extensor pollicis longus muscle, the posterior interosseous nerve, or one of the other structures in the vicinity.

Figure 2. The width of the thumb at the inter-phalangeal joint equals 1 cun.

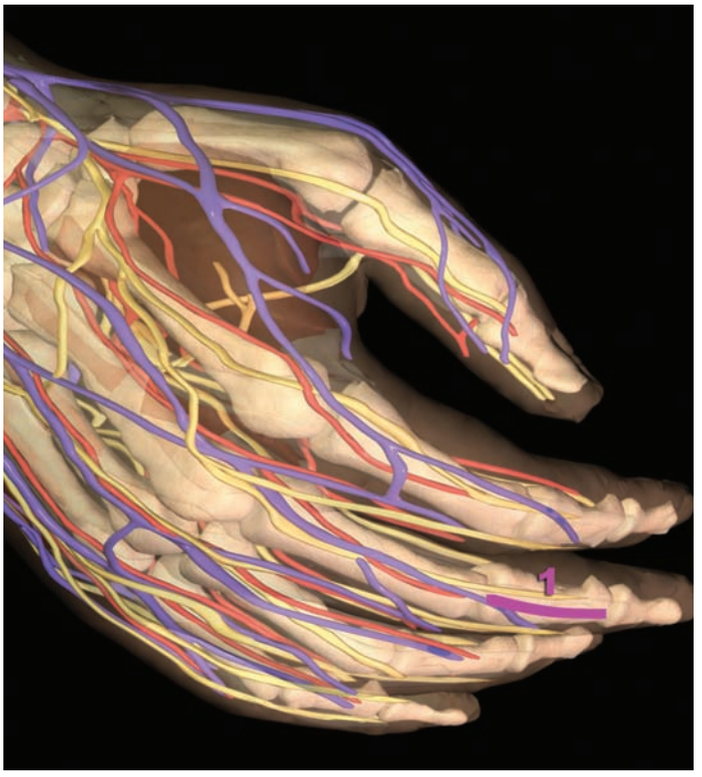

Figure 3. In addition to the thumb width, one can utilize the length of the middle phalanx on the third finger to measure a cun.

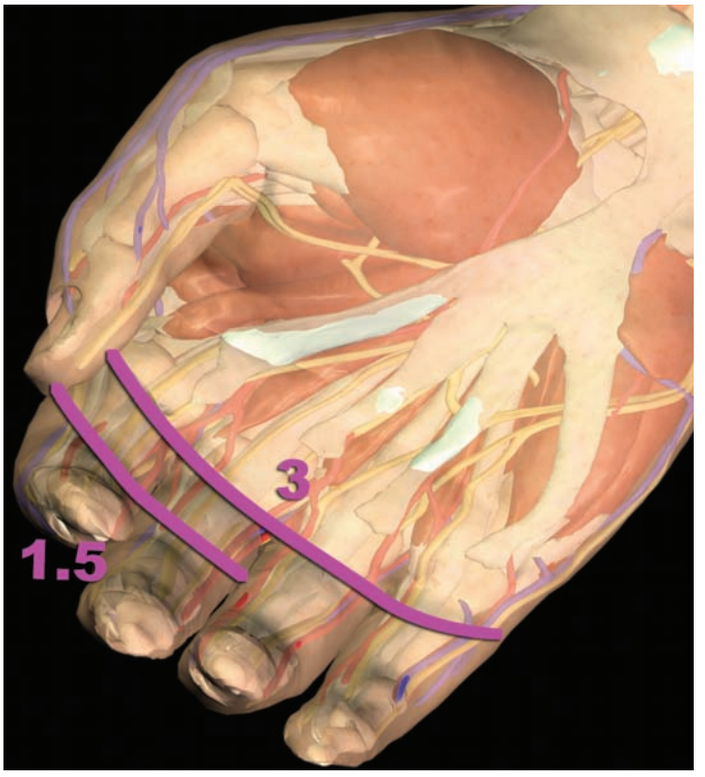

Figure 4. The patient's index and middle fingers held closely together measure 1.5 cun. The width of all four fingers held together counts as 3 cun at the level of the proximal interphalangeal joints.

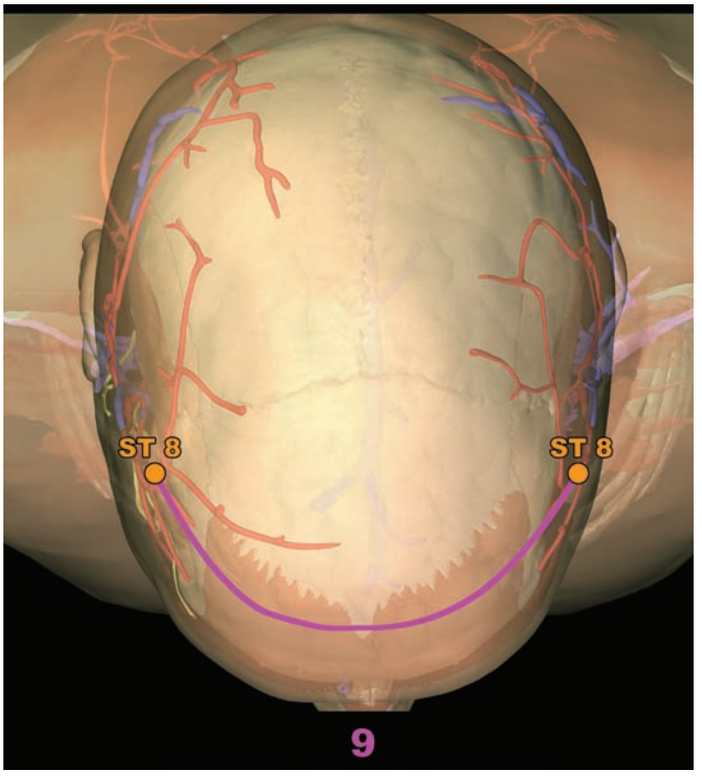

Figure 5. The distance from the right ST 8 to the left equals 9 cun.

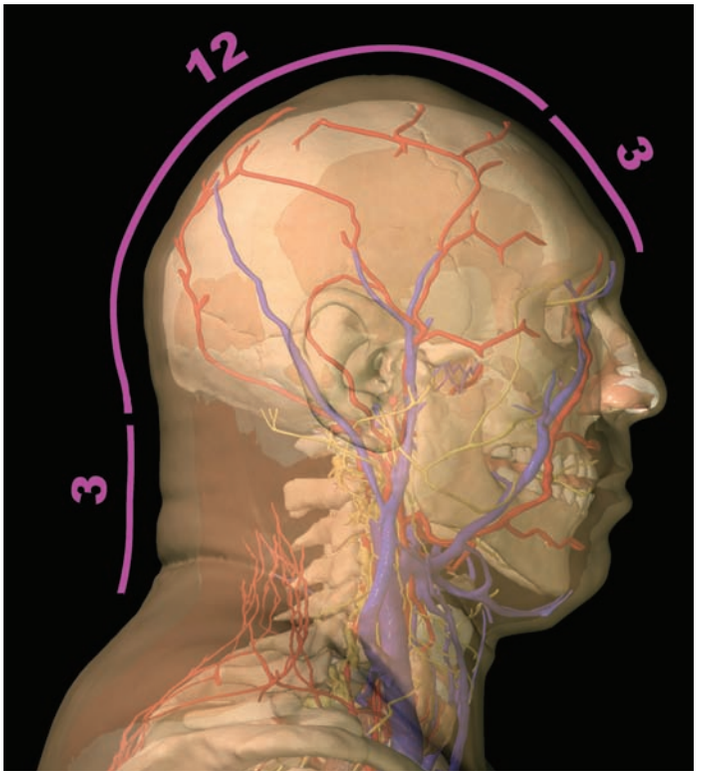

Figure 6. Along the sagittal plane, the distance from glabella to the anterior hairline measures 3 cun. There are 12 cun between the anterior and posterior hairlines and 3 cun from the posterior hairline to the inferior border of C7.

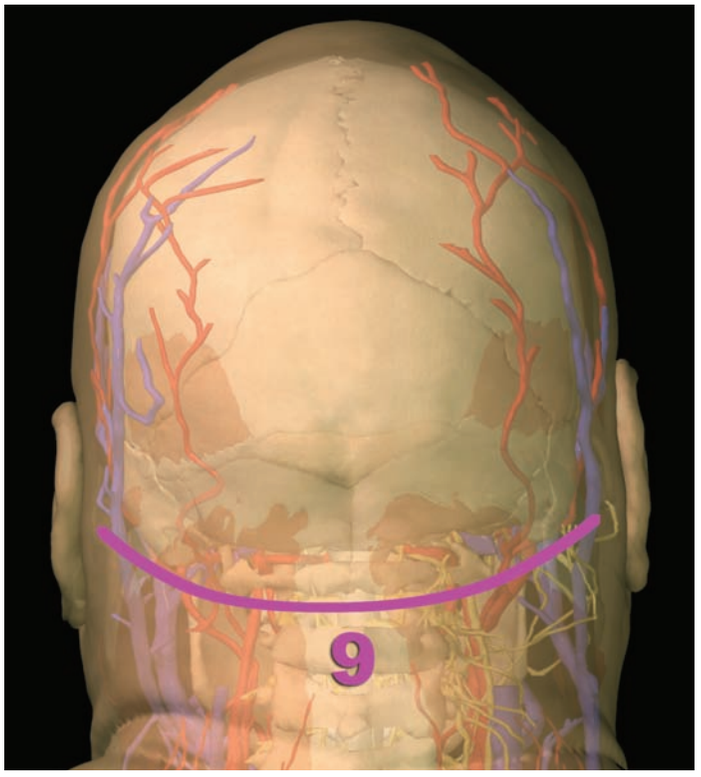

Figure 7. The distance between the right and left mastoid processes approximates 9 cun.

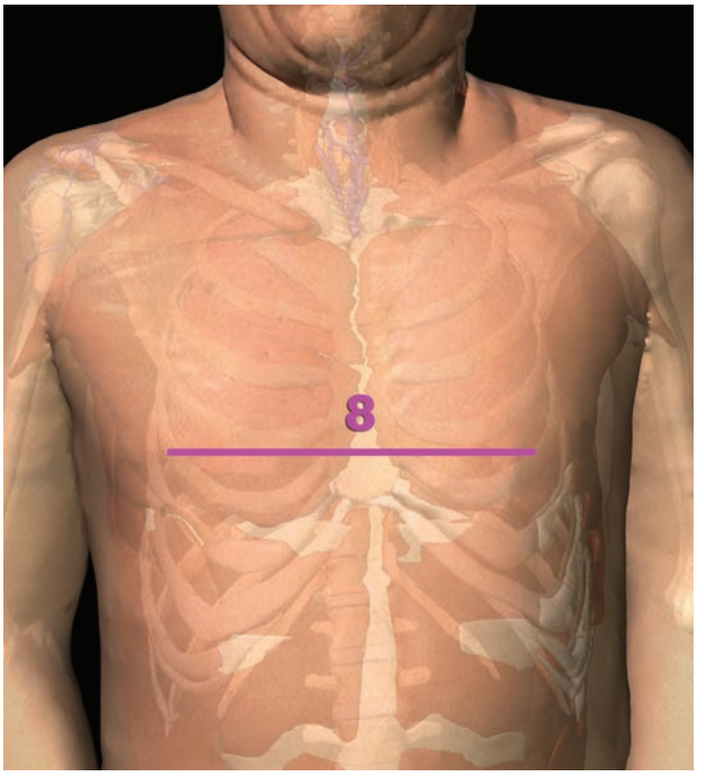

Figure 8. The distance between the two nipples equals 8 cun.

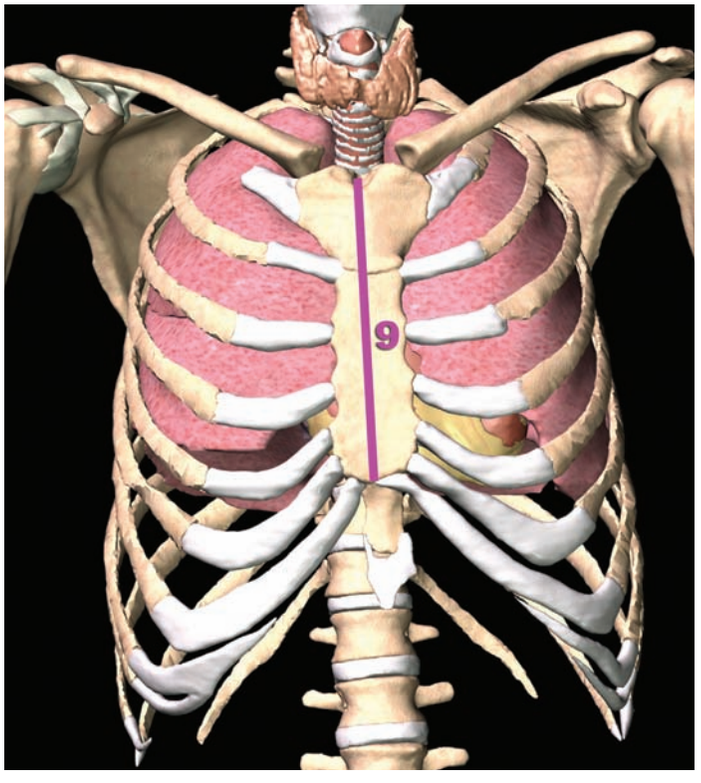

Figure 9. The suprasternal notch to the xiphisternal synchondrosis measures 9 cun.

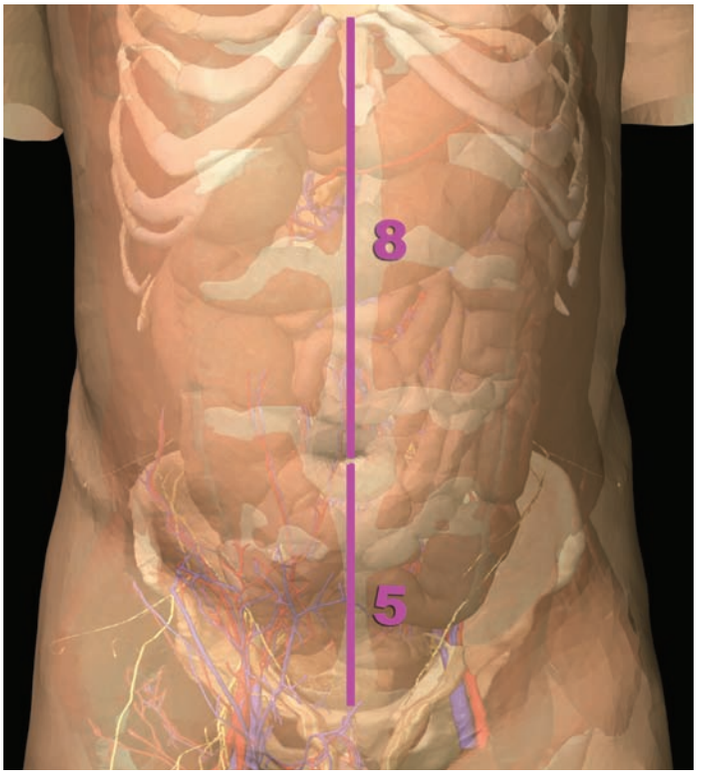

Figure 10. The absence of bony landmarks over the abdomen encourages more reliance on the proportional method of point location when demarcating the location of points on the anterior torso. The distance from the xiphisternal synchondrosis to the umbilicus is 8 cun, but it is only 5 cun from umbilicus to the superior border of the symphysis pubis.

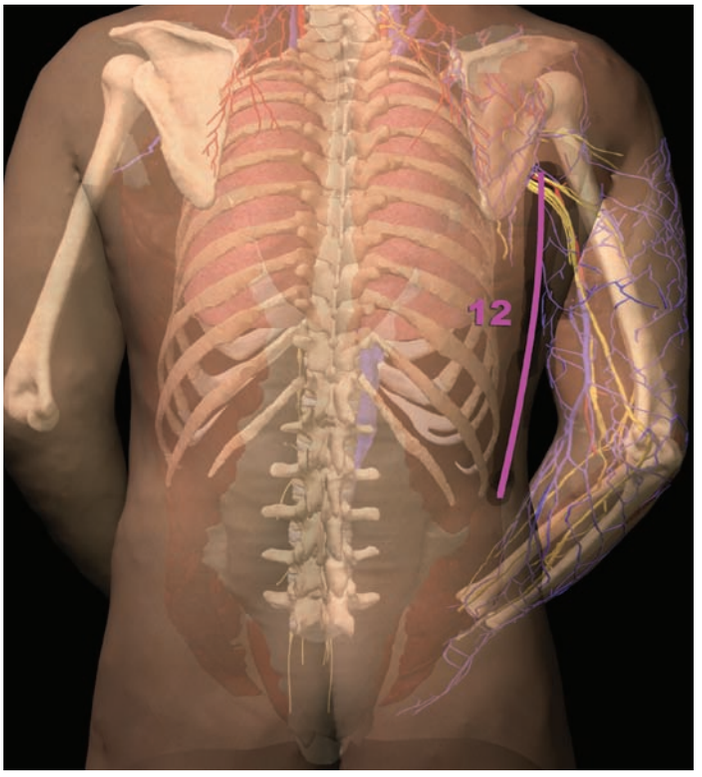

Figure 11. 12 cun cover the distance between the center of the axilla and the tip of the 11th rib.

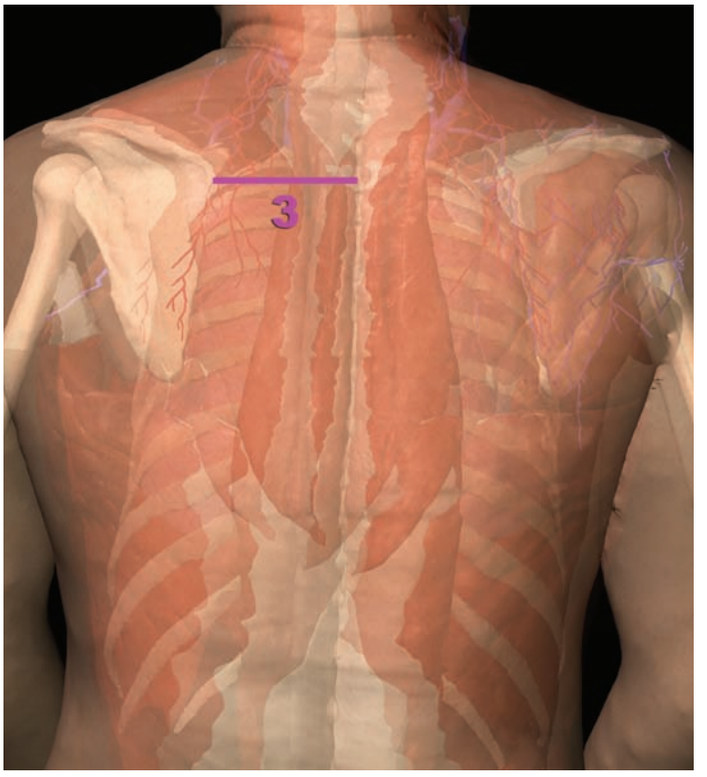

Figure 12. The distance between the medial border of the scapula and the midline is often given as 3 cun. However, the spatial relationship of the scapula and the spine depends on the position of the scapula.

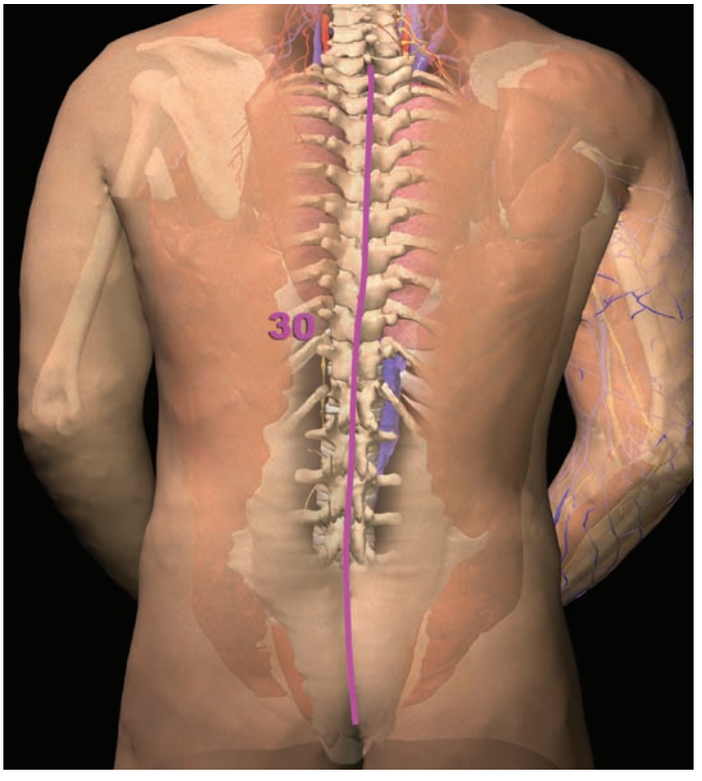

Figure 13. The length of the spine from T1 to the tip of the coccyx equals 30 cun. Note that this individual is missing the 1st rib on the right.

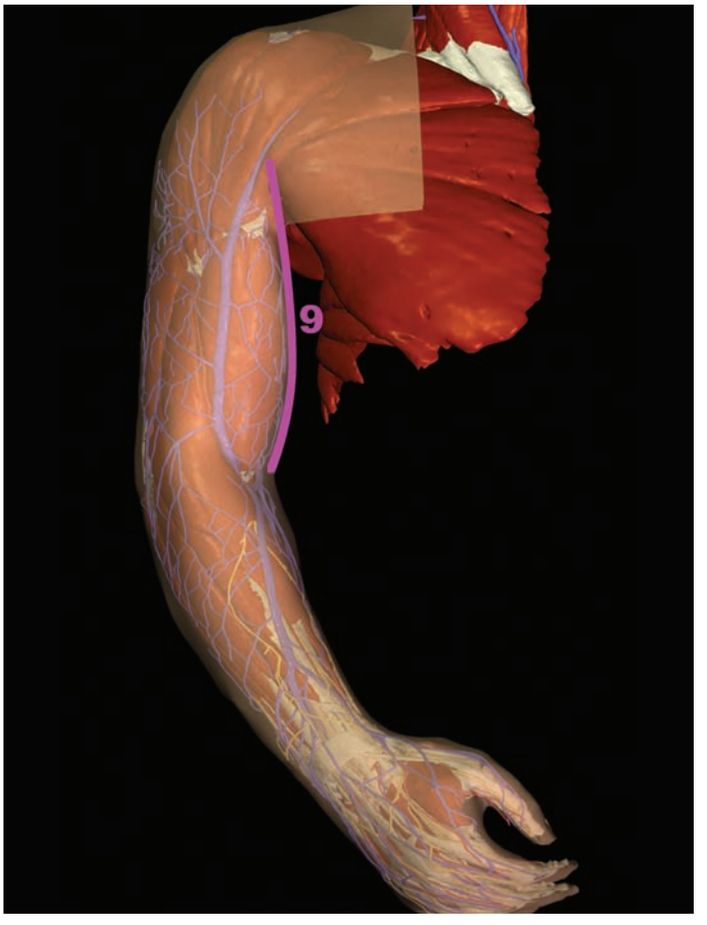

Figure 14. The brachium measures 9 cun from the superior limit of the anterior axillary crease to the elbow.

Figure 15. The cun count on the antebrachium is 12. Given the density of acupuncture points located on the antebrachium, this number frequently comes in handy.

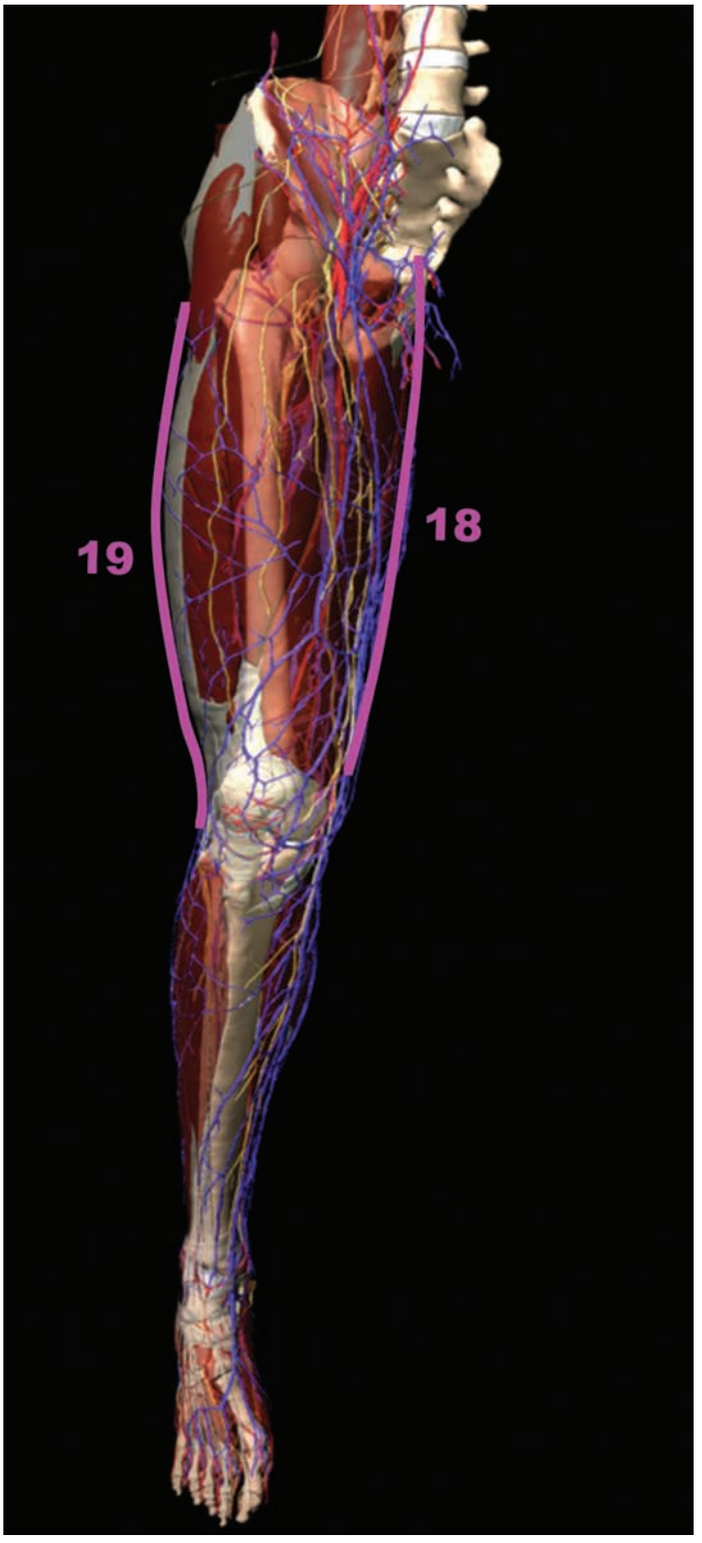

Figure 16. Pelvic limb cun measurements differ on the medial and lateral aspects of the limb, as indicated here for the thigh as well as in the following figure for the crus. This variance arises because the landmarks used in their calculation fall at different heights. On the thigh, the distance between the superior border of the pubic symphysis and the superior tip of the patella measures 18 cun. In contrast, the length of a line drawn from the lateral prominence of the greater trochanter to the popliteal crease equals 19 cun.

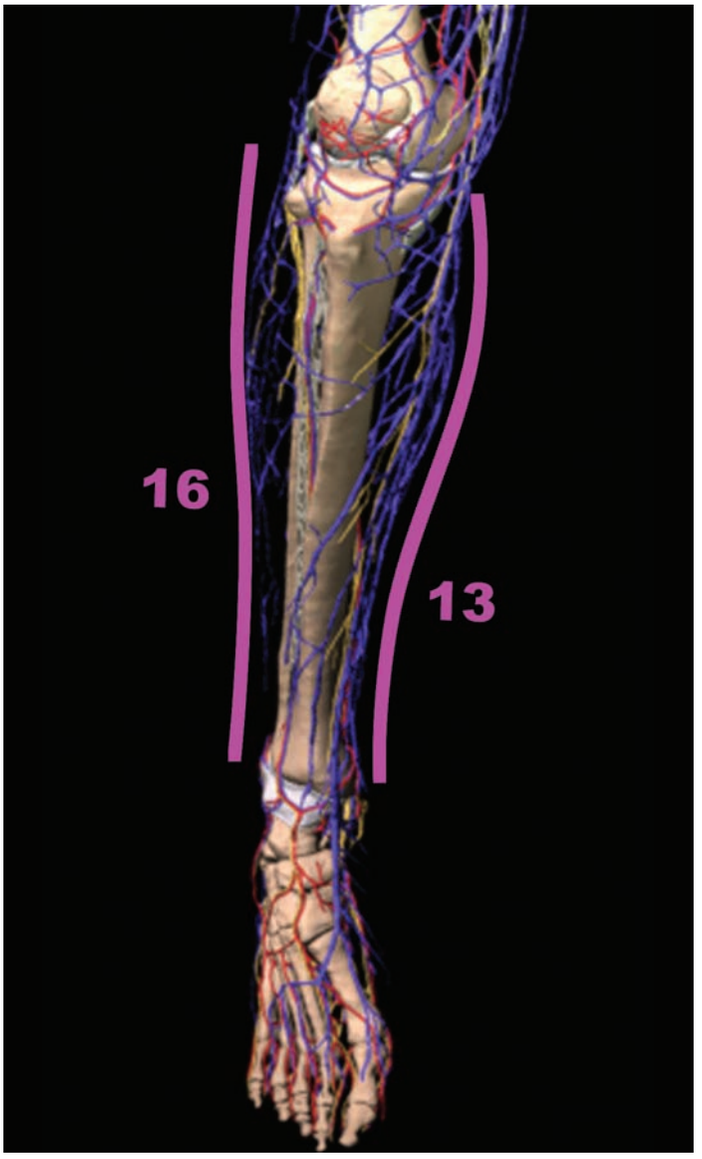

Figure 17. As with the thigh, the cun count on the crus depends on whether one is looking for points on the medial or lateral aspect of the limb. That is, the distance between the popliteal crease and the lateral malleolus is 16 cun while it is only 13 cun from the medial tibial condyle to the medial malleolus.

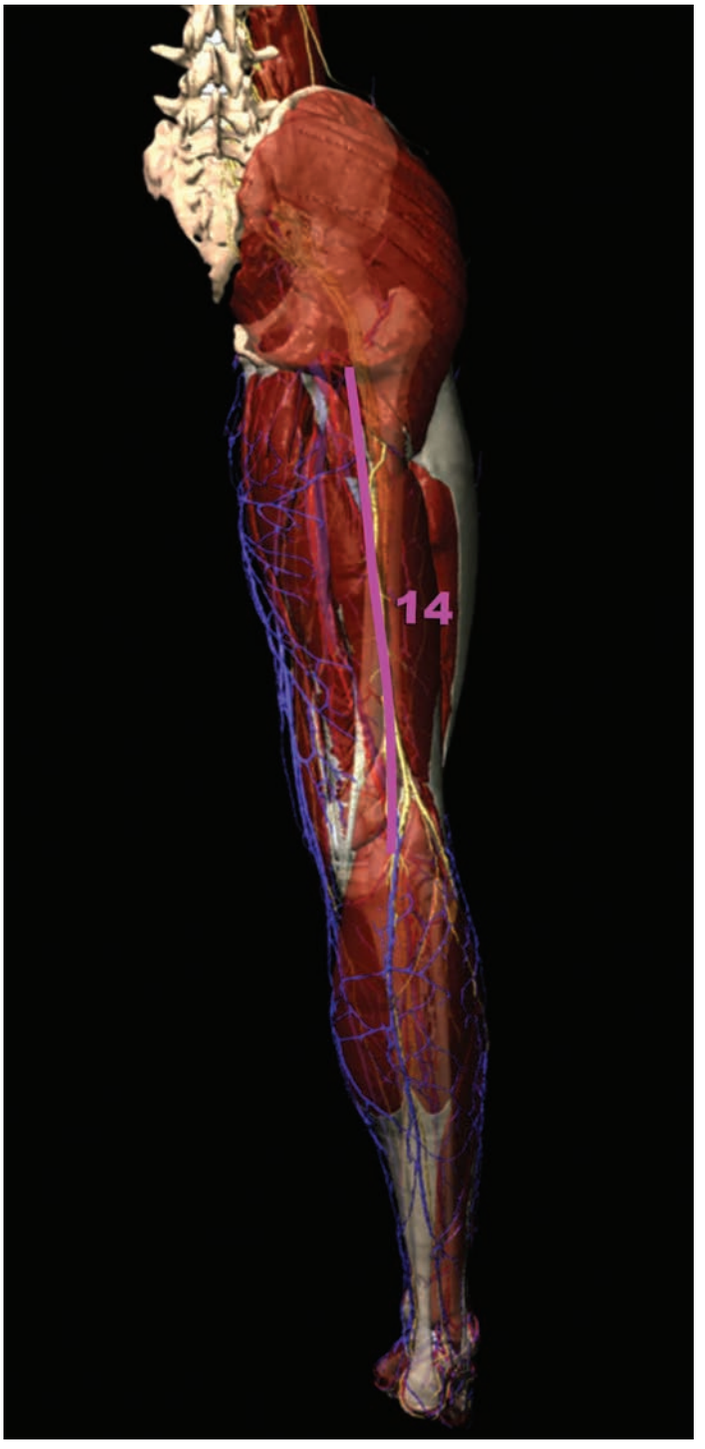

Figure 18. The cun count from gluteal fold to popliteal crease amounts to 14 cun.

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Chapter 5:: Acupuncture Safety

Chapter Highlights

Compared to other medical treatments, acupuncture has a strong safety record.
Knowledge of anatomy is paramount in order to avoid injury.
Familiarity with the mechanisms of action of each modality included in a medical acupuncture treatment reduces the likelihood of adverse outcomes.

The link between safety and education in acupuncture is well known. As noted by various authors:

"Accidents arrive most often with those who are not fully trained."[1]

"The distinction between [acupuncture] malpractice and normal practice is an important one because it is malpractice that is the cause of the most serious events including all fatalities."[2,3]

"Adverse events due to errors of omission include failure to identify serious underlying pathology such as cancer, autoimmune disease, or subtle systemic pathology. Not only does this lead to failure to appropriately refer for a medical opinion and/or further investigations, but it allows the disease process to progress...The risks after failure to refer might be more significant than the other risks associated with acupuncture treatment…Acupuncturists, like conventional doctors, need to recognize both their own limits as well as those of the therapy, so as to minimize the risks of adverse events caused by failure to refer."[4]

On the other hand, certain authors appear to over-emphasize the dangers, as noted in the following critique of a paper by Ernst et al[32] in which the authors were thought to have overstressed the risks of acupuncture by citing case reports:

"For safety, it is important to know the risks in the context of also knowing the frequency…Any medical intervention or any contact with an incompetent health care provider has the potential to cause damage…In Germany, acupuncture is mainly provided by physicians, and…[large] scale surveys have been conducted. One survey of 9429 German physicians performing more than 760,000 acupuncture treatments reported 2 instances of pneumothorax, one exacerbation of depression, an acute hypertensive crisis, a vasovagal reaction, and an asthma attack with hypertension and angina….To conclude, major adverse effects of acupuncture appear to be rare, and acupuncture is safe in competent hands."[33]

Acupuncture does indeed rank high in safety compared to most medical treatments though, admittedly, underreporting of adverse events likely skews the results.[5,6,7] Studies show that between 6% and 15% of patients experience minor side effects such as pain or bruising at the needling site, tiredness, and transitory exacerbation of their problem.[8,9] These events usually do not prevent patients from seeking further sessions.[10]

Case reports of serious adverse reactions or fatalities following acupuncture, while rare, prove that acupuncture can indeed injure patients.[11] Inadvertent organ puncture occurs when practitioners insert needles too deeply or at incorrect angles. Infections arise when needles penetrating unclean skin surfaces seed bacteria into the underlying tissues of immunocompromised patients. Aquapuncture, or point injection, may cause infection as well, especially when involving non-sterile herbs, extracts, or human placenta.[12,13,14] Needles that break or are embedded intentionally may migrate into organs or the nervous system and cause severe injuries.[15] Acupuncturists who needle pregnant patients must proceed cautiously; the exact rate of injury or miscarriage in this population following acupuncture remains unknown.[16,34] Risks include unintended changes in uterine contractility[17,18] and altered hormonal or prostaglandin levels.

Acupuncturists should know which conditions contraindicate treatment and refer patients elsewhere or consider utilizing a different modality. If acupuncture is indicated but risk factors exist, practitioners should take extra care to ensure safe treatment. (See Table 5-1.) Severely immune deficient patients may be unable to, as one author put it, "meet the challenge of the bacteremia that results when needles penetrate the skin."[19] Other patients with sensitive autonomic nervous systems may become syncopal from vasovagal responses.[20] When injury or exacerbations occur as a consequence of acupuncture treatment, practitioners must ensure that the patient receives appropriate medical follow-up and emergency treatment, if required.[21]

Table 5-1 Patient Risk Factors and Potential Adverse Events[22]

Risk factors	Potential Outcomes
• Hemophilia • Advanced liver disease, affecting clotting factor production • Patients taking anticoagulant medications or herbs • Deep needling over vessels[23]	Bleeding or bruising
• HIV • Diabetes • Patients receiving immunosuppressants, such as transplant patients • Skin infections	Infection
• Hypoglycemia • Debilitation • Fear or anxiety about needling • Advanced age	Vasovagal syncope, possibly even convulsive syncope[24]

Table 5-2 Patient Risk Factors and Potential Consequences[29]

Condition or Location	Needling precaution
Scalp	Avoid needling the scalp of infants with open fontanelles, or those with defects in the skull following injury or surgery
Orbit	Points such as ST 1, BL 1, and GB 1 lie close to the orbit and globe. Needling these points incorrectly could damage delicate tissues around or in the eye.
Trunk	Deep, perpendicular needling of points over the thoracic, abdominal, and pelvic regions could damage internal organs or major vessels.
Trapezius	Needling GB 21 deeply, especially in thin or poorly muscled individuals, may cause pneumothorax.
Sternum	Deep needling over the sternum, especially at the level of the 4th intercostal space at CV 17 may enter the pericardium or heart if a congenital sternal foramen exists.
Occipital region	Needling points at the base of the skull below the occiput may injure the brain stem, spinal cord, or vertebral artery if angled toward these structures and inserted deeply. Extra caution is advised when needling GV 16, GV 15, BL 10, and GB 20.[30] Ancient sources suggest that the safe needling direction for GB 20 is toward the contralateral globe; modern researchers suggest that needling should aim toward the apex of the nose. Needling direction for GV 15 and GV 16 has been recommended toward the mouth; see details concerning these points in the following chapters.[31]

Needling Depth and Direction

A medical acupuncturist should have strong familiarity with anatomy before treating patients. Ideally, one should be able to mentally visualize the structures encountered by the needle as the tip courses through skin, subcutaneous tissue and fat, muscle, vessels, organs, bones, etc. Doing so enables the practitioner to guide the angle and depth of needle insertion in a way that will avoid inadvertent puncture of organs, nerves, and major vessels.[25] The desired depth of needle placement depends on treatment targets as well as individual patient characteristics including adiposity, muscularity, and tissue fragility.[26,27,28] For example, the safe needling depth in a patient with a build like the individual represented in this book would differ dramatically from a frail eighty-six year old, ninety pound patient with cancer cachexia.

In any patient, deep, perpendicular needling over the neck, thorax, or abdomen could injure underlying structures. Vessels, nerves, eyes, spinal cord, and the foramen magnum are also vulnerable to injury by needle insertion. (See Table 5-2 for additional precautions.)

Summary

The safety measures recommended in this chapter narrowly focus on some of the more salient aspects of patient selection and needle insertion. To adequately grasp the breadth of safety concerns not only with MA, but also with EA, LA, and acupressure, an acupuncturist must attend a reputable program that enumerates all of the possible negative outcomes from treatment.

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Section 3::

Twelve Paired Channels


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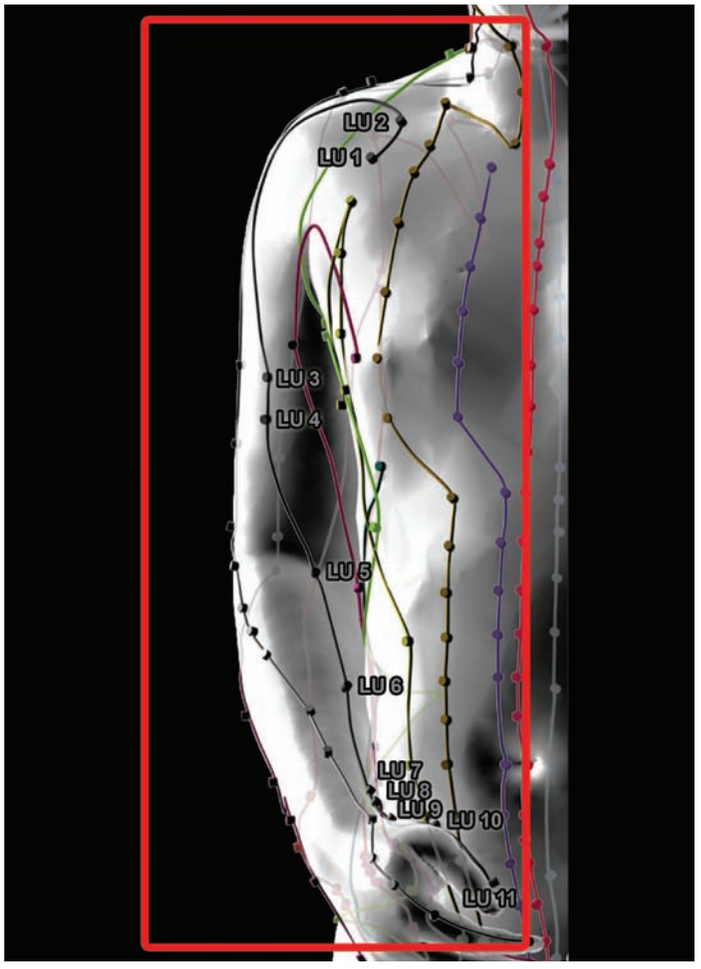
Channel 1:: The Lung Channel (LU)

The Lung channel begins at LU 1 in the first intercostal space, medial to the shoulder. It loops over the anterior shoulder and proceeds down the lateral aspect of the biceps brachii muscle to the elbow. Between the elbow and the wrist, the Lung channel hugs the radius. Distal to the wrist, the channel remains on the radial aspect of the hand and ends on the radial side of the thumbnail at LU 11.

The Lung channel describes the course of the cephalic vein and its tributaries.



LU 1

Zhong Fu "Central Treasury"

On the lateral pectoral region, approximately at the level of the first intercostal space. LU 1 is found 1 cun inferior and slightly lateral to LU 2.

CAUTION: Needle carefully to avoid pneumothorax.[1] Puncture obliquely in a lateral direction. Deep needling in a medial direction may injure the lung.

Muscles

• **Pectoralis major muscle:** Adducts and medially rotates the humerus. Draws the scapula anteriorly and inferiorly.

• **Pectoralis minor muscle:** Stabilizes the scapula by drawing it against the thoracic wall.

• **Coracobrachialis muscle:** Assists in arm flexion and adduction.

• **Biceps brachii muscle:** Supinates the forearm; flexes the supinated forearm.

Clinical Relevance: Restricted motion of the shoulder, as in adhesive capsulitis (frozen shoulder), soft tissue injury impeding movement, arthritis or other causes of restricted range of motion, rehabilitation following surgery.

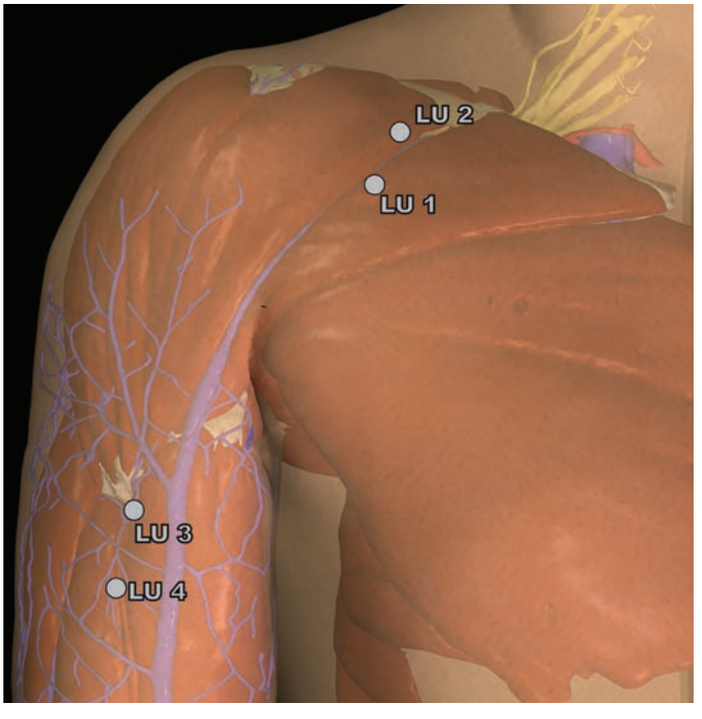


Figure 1-1. The Lung channel emerges from the chest at LU 1, near the entry of the cephalic vein into the deltopectoral groove, the deltopectoral triangle, and subsequently the axillary vein. The indications of LU 1 for lung problems likely relate to the fact that the point falls within the T1 dermatome; the lung receives sympathetic supply from several of the most cranial thoracic spinal cord segments. Also, freeing up the fascia in this region may promote air exchange by allowing fuller thoracic respiratory excursion. This then aids recovery from medical conditions related to or worsened by decreased chest wall mobility such as asthma and chronic obstructive pulmonary disease (COPD). LU 1 and LU 2 coincide with pectoralis major and minor trigger points.

Nerves

• **Supraclavicular nerves (C3, C4):** Supply the skin of the neck and part of the shoulder.

• **1st intercostal nerve (T1):** Supplies sensation to the skin in the first intercostal space.

• **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle and contributes to pectoralis minor innervation via a loop connecting with the medial pectoral nerve.

• **Medial pectoral nerve (C8, T1):** Supplies the pectoralis minor muscle and a portion of the pectoralis major muscle.

• **Musculocutaneous nerve (C5-C7):** Innervates the muscles of the anterior compartment of the arm.

• **Axillary nerve (C5, C6):** Innervates the shoulder joint, skin overlying the inferior part of the deltoid muscle, and the teres minor and deltoid muscles.

Clinical Relevance: Loss of sensation in the anterior shoulder; impaired motor function of shoulder (adduction, internal rotation); instability of the scapula. Weakness or inability to flex and supinate the forearm (antebrachium).

Vessels

• **Cephalic vein:** Ascends from the radial portion of the dorsal venous network of the hand. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

• **Thoracoacromial artery:** A short arterial trunk that divides into four branches: the acromial, deltoid, pectoral, and clavicular arteries.

• **Axillary artery:** Supplies blood to the arm.

• **Axillary vein:** Lies medial to the axillary artery and arises from the union of the brachial veins.

Clinical Relevance: Impaired circulation to or from the thoracic limb; edema.

Lymphatics

• **Deltopectoral lymph nodes:** While most of the lymphatic vessels traveling alongside the cephalic vein enter the apical group of axillary lymph nodes, some enter the deltopectoral nodes.

Clinical Relevance: Deficient or faulty lymphatic drainage of thoracic limb; avoid needling enlarged lymph nodes.

Organ

• **Lung:** The lung lies medial to LU 1.

Clinical Relevance: Inadequate lung expansion or air expulsion as in asthmatic individuals. Caution required in all patients, especially those with local muscle atrophy or hyperexpansion of lungs ("barrel chest").

Indications and Potential Point Combinations

• **Respiratory disorders:** cough, dyspnea, bronchitis, pneumonia, tuberculosis, and asthma, chronic obstructive pulmonary disease:[2] LU 1, BL 13, BL 12, LU 7, LI 4.

• **Local pain or restricted motion of the shoulder, including the scapula:** LU 1, local trigger points depending on pain pattern, myofascial restrictions, and somatic dysfunctions in the spine.

Evidence-Based Applications

• Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[3]

References

1. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupuncture in Medicine*. 2004;22(1):40-43.
2. Bockenhauer SE, Chen H, Julliard KN, et al. Measuring thoracic excursion: reliability of the cloth tape measure technique. *J Am Osteopath Assoc*. 2007;107:191-196.
3. Nowicki NC and Averill A. Acupuncture for dysphagia following stroke. *Medical Acupuncture*. 14(3). Obtained at http://medicalacupuncture.org/aama_marf/journal/vol14_3/article3.html on 01-10-06.

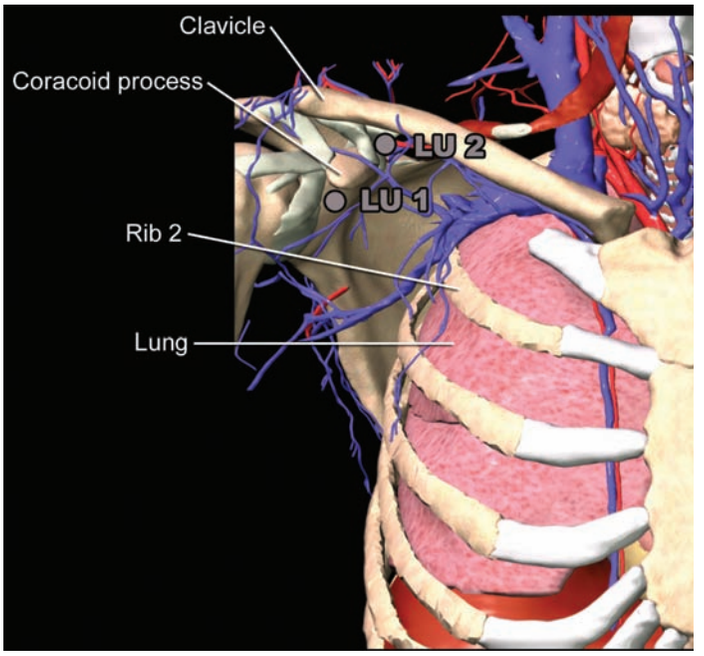


Figure 1-2. As the "Central Treasury," or "Central Residence," LU 1 metaphorically breathes life into the acupuncture network. Located near the lungs where inhaled air enters the bloodstream, the circulation of Qi (correctly translated as vital air) begins.

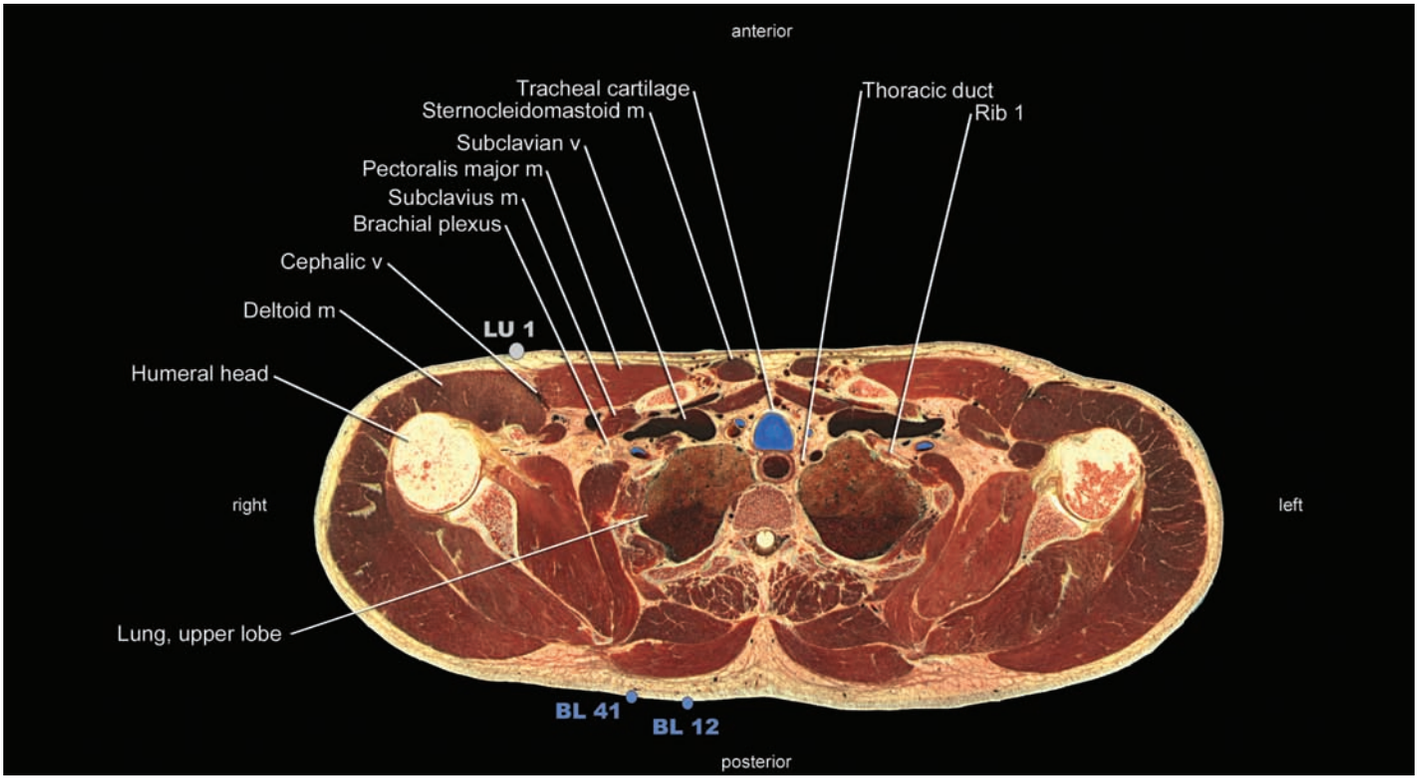


Figure 1-3. This cross section at the level of LU 1 examines the spatial relationships between LU 1, the cephalic vein, the brachial plexus, and the upper lobe of the lung.

LU 2
Yun Men "Cloud Gate"

In a depression below the lateral end of the clavicle, medial to the coracoid process and in the depression (or triangle) bordered by the deltoid muscle, pectoralis major muscle, and the clavicle.

CAUTION: Needle carefully to avoid pneumothorax.[1] Puncture obliquely in a lateral direction. Deep needling in a medial direction may injure the lung.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[2]

Fascia

• **Clavipectoral fascia:** Encloses the pectoralis minor and subclavius muscles. Envelops the muscles of the anterior thoracic wall.

Clinical Relevance: Fascial restriction impairing shoulder mobility, evidence of nerve entrapment or irritability due to compression.

Muscles

• **Deltoid muscle:** The anterior part flexes and medially rotates the arm.

• **Pectoralis major muscle:** Adducts and medially rotates the humerus. Draws the scapula anteriorly and inferiorly.

• **Pectoralis minor muscle:** Stabilizes the scapula by drawing it against the thoracic wall, inferiorly and anteriorly.

• **Subclavius muscle:** Anchors and depresses the clavicle.

• **Serratus anterior muscle:** Holds the scapula against the thoracic wall, rotates, and protracts it. This muscle is used when "boxing" or reaching in a forward direction.

Clinical Relevance: Pain or weakness when adducting or medially rotating shoulder. Shoulder injury affecting joint integrity and/or stability.

Nerves

• **Supraclavicular nerves (C3, C4):** Innervates the skin of the neck and part of the shoulder.

• **Nerve to the subclavius (C5, C6):** Supplies the subclavius muscle.

• **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle and contributes to pectoralis minor innervation via a loop connecting with the medial pectoral nerve.

• **Medial pectoral nerve (C8, T1):** Supplies the pectoralis minor muscle and a portion of the pectoralis major muscle.

• **Lateral cord of the brachial plexus (C5-C7):** Anterior divisions of the superior and middle trunks form the lateral cord of the brachial plexus.

• **Axillary nerve (C5, C6):** Innervates the shoulder joint, skin overlying the inferior part of the deltoid muscle, and the teres minor and deltoid muscles.

• **Long thoracic nerve (C5-C7):** Supplies the serratus anterior muscle.

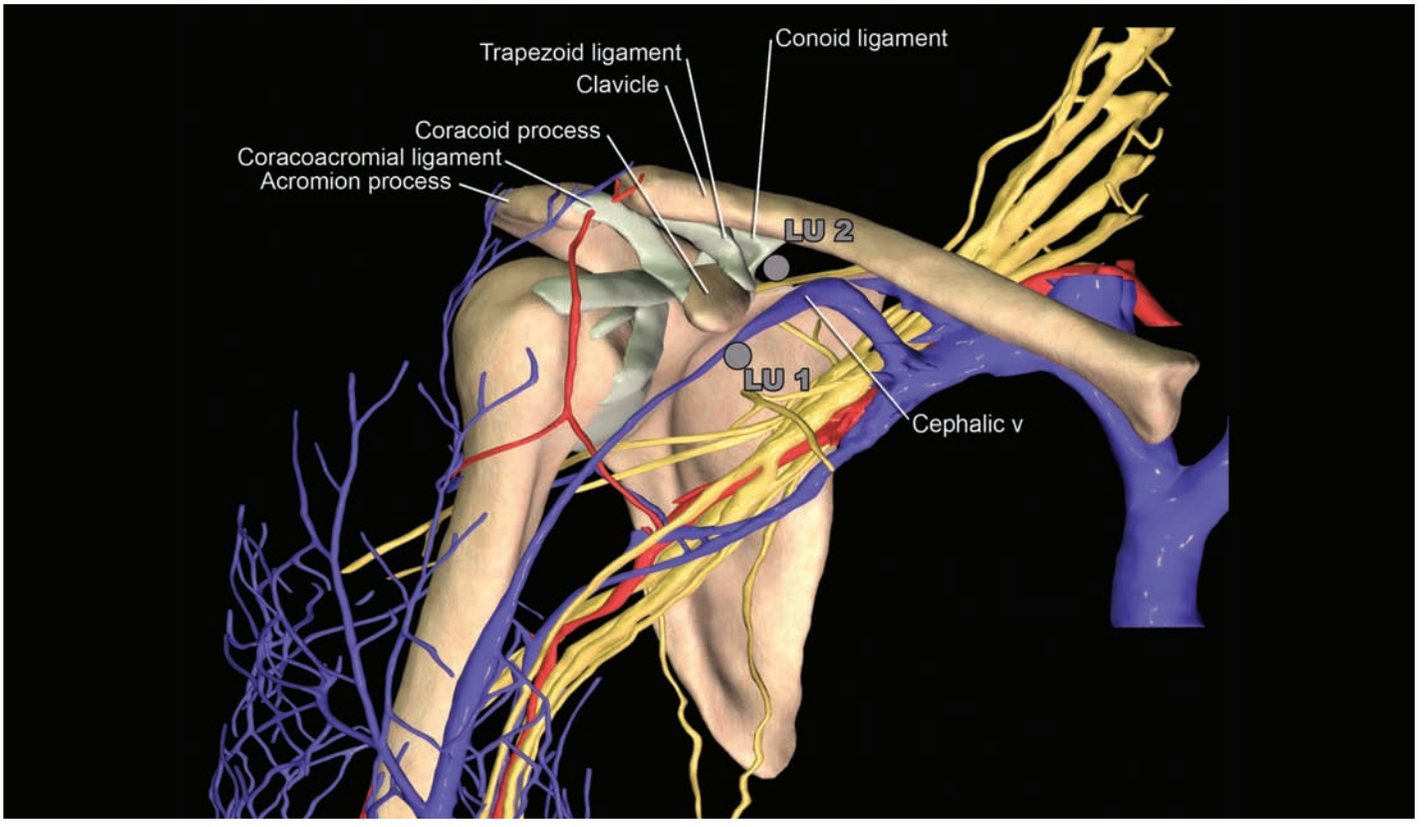


Figure 1-4. In keeping with the indications for LU 2 related to shoulder problems, this image illustrates the proximity of LU 2 to ligaments at the lateral end of the clavicle.

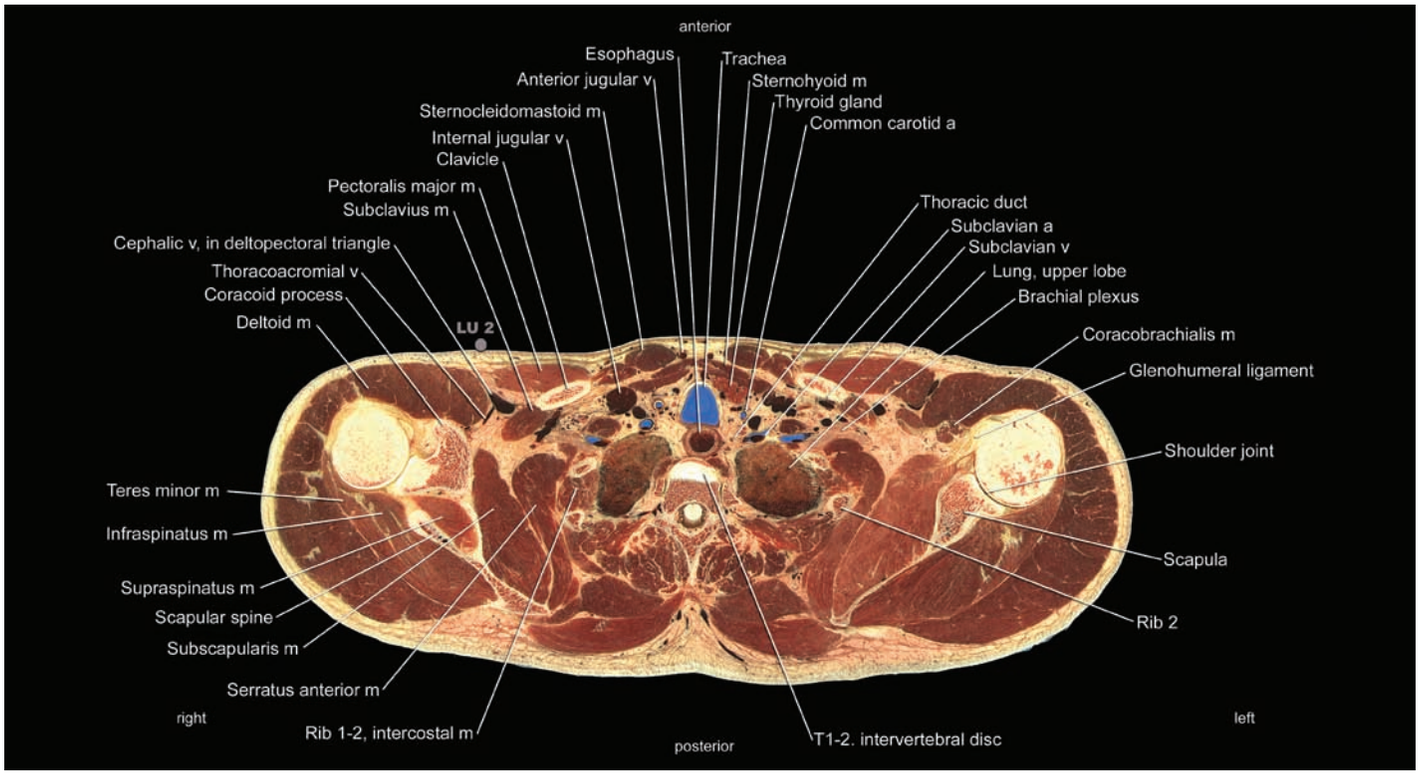


Figure 1-5. LU 2 as "Cloud Gate" alludes to the travel of the mists or clouds of Qi (as vital air and circulating nourishment) through the channels. LU 2 resides close to the lung and also over the cephalic vein, demonstrating the anatomic proximity of this point to both respiratory and vascular structures.

Clinical Relevance: Loss of sensation or motor function in the anterior shoulder vicinity.

Vessels

• **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

• **Thoracoacromial artery:** A short arterial trunk that divides into four branches: the acromial, deltoid, pectoral, and clavicular arteries.

Indications and Potential Point Combinations

• **Respiratory disorders:** cough, dyspnea, bronchitis, pneumonia, tuberculosis, and asthma: LU 2, LU 1, GV 14, BL 12, BL 13, LI 4.

• **Restricted motion of the shoulder, especially external rotation:** Needling LU 2 may affect restrictions in the axillary and clavipectoral fascia, thereby freeing structures contained within these planes and indirectly benefiting shoulder mobility and respiration. Consider additional points as indicated by the patient's restriction and palpation examination.

Evidence-Based Applications

• Patients who received EA (at LU 2, LU 7, and PC 6) prior to heart valve replacement surgery exhibited significantly lower serum troponin 1 release following aortic cross-clamp removal. This indicates potential benefit of EA in terms of reducing **reperfusion injury** from cardiac ischemia.[3]

References

1. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupuncture in Medicine.* 2004;22(1):40-43.
2. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
3. Yang L, Yang J, Wang Q, et al. Cardioprotective effects of electroacupuncture pretreatment on patients undergoing heart valve replacement surgery: a randomized controlled trial. *Ann Thorac Surg.* 2010;89:781-786.

LU 3

Tian Fu "Celestial Storehouse"

On the lateral aspect of the upper arm, 3 cun distal to the inferior limit of the anterior axillary fold, on the radial side of the biceps brachii muscle along the lateral bicipital groove, approximately at the level of insertion of the deltoid muscle. The tip of the nose is just able to reach this location.

Muscles

• **Biceps brachii tendon:** The biceps brachii muscle supinates the forearm and then can flex the elbow.

• **Brachialis muscle:** Flexes the elbow.

Clinical Relevance: Pain or weakness with elbow flexion or antebrachial supination.

Nerves

• **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. It continues as the lateral antebrachial cutaneous nerve.

• **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the cubital region, medial distal brachium, radial volar aspect of the forearm, and a small portion of the dorsal radial aspect of the distal forearm.

Clinical Relevance: Elbow flexor weakness, musculocutaneous nerve entrapment from local myofascial restriction, regional numbness or altered sensation.

Vessels

• **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

• **Anterior branch (also known as the radial collateral branch) of the deep artery of the arm (profunda brachii artery):** Participates in the anastomoses around the elbow.

Clinical Relevance: Degenerative joint disease of the elbow or other elbow dysfunction worsened by impaired oxygenation and elimination of metabolic end-products through circulatory waste removal.

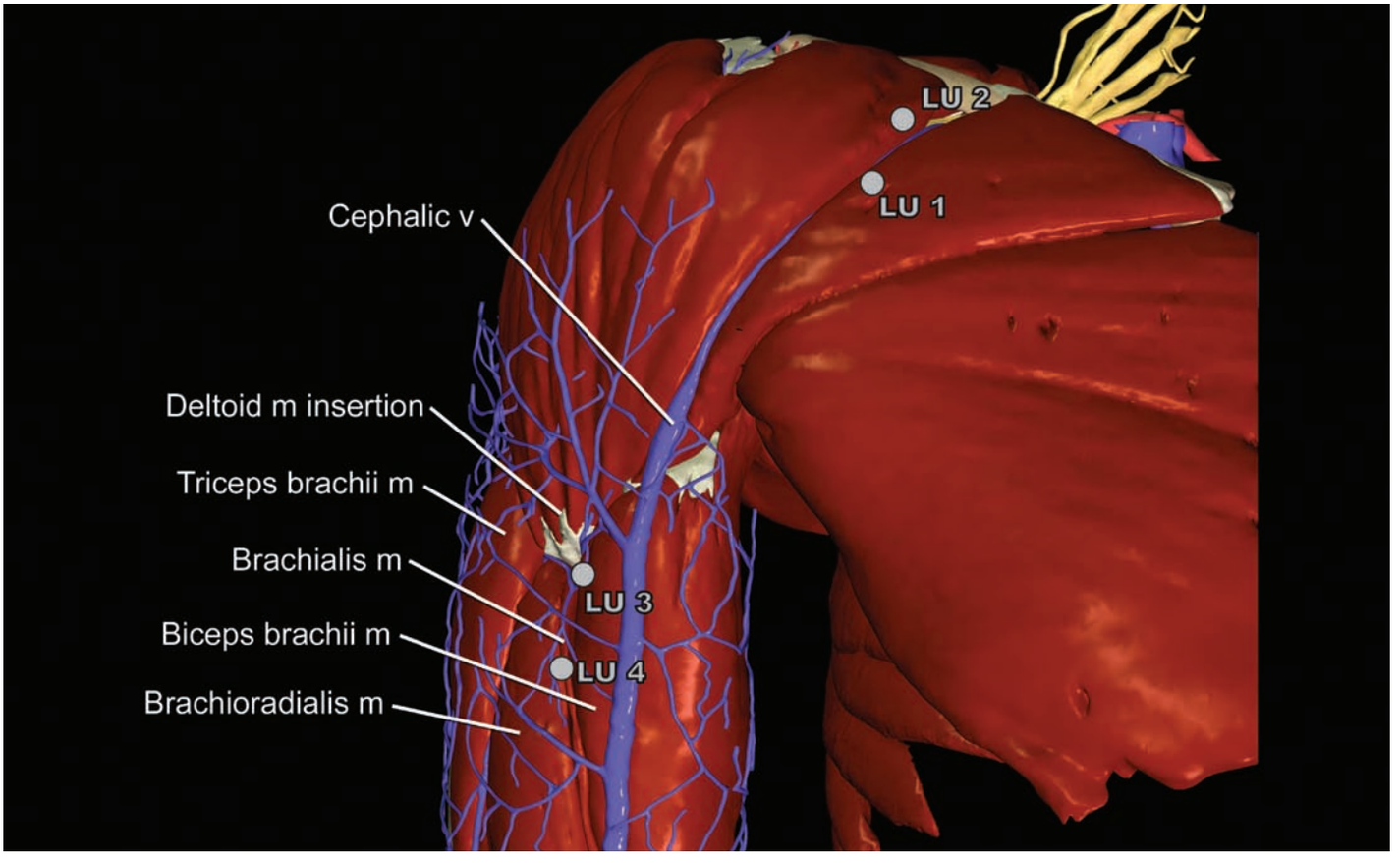


Figure 1-6. LU 3 and LU 4 reside on the lateral aspect of the biceps brachii muscle, in the lateral bicipital groove. The muscular intersections taking place in this region explain these points' value in treating myofascial restrictions and pain in the anterior brachium. LU 3, in particular, stands at the juncture of the myotendinous region of the biceps brachii and the insertion of the deltoid, heightening the potential for myofascial pain at this site. Considering the metaphoric actions attributed to this point, LU 3, as "Celestial Storehouse," receives the Qi (vital air and nutrients) that circulates in the cephalic vein coursing through this furrow.

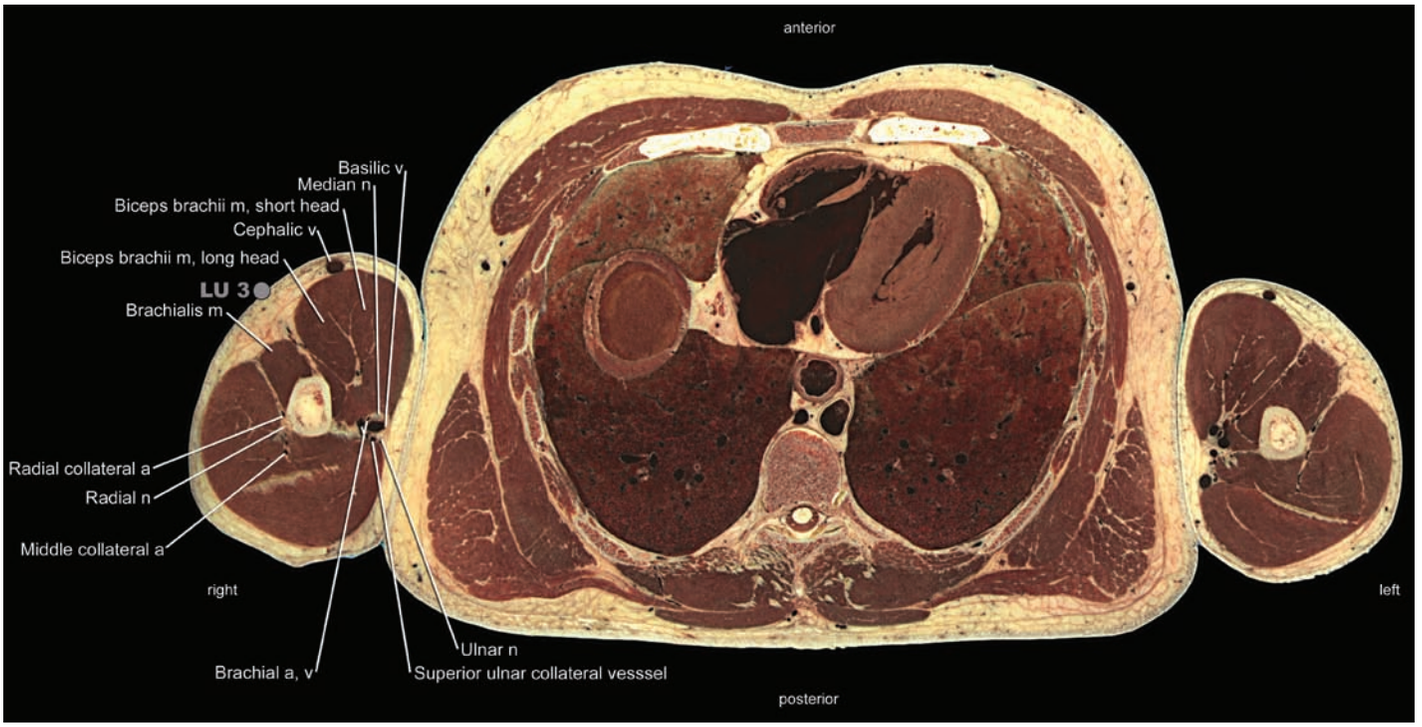


Figure 1-7. This view provides another perspective of the relationship of LU 3 to the muscles shown in the previous figure.

Indications and Potential Point Combinations

• **Bicipital tendinitis or strain:** LU 3, LI 15, TH 14, other local tender points.

• **Arm pain:** As a biceps brachii trigger point, LU 3 should be examined for tenderness, along with other muscles in the brachium to determine the location of myofascial dysfunction or the potential source of arm pain, including arthrodial, osseous, and neural structures (rule out nerve entrapments).

LU 4
Xia Bai "Pressing White"

1 cun distal to LU 3 (or 4 cun distal to the axillary fold) on the radial side of the biceps brachii muscle, along the lateral bicipital groove.

Muscles

• **Biceps brachii tendon:** The biceps brachii muscle supinates the forearm and then can flex the elbow.

• **Brachialis muscle:** Flexes the elbow.

Clinical Relevance: Compromised elbow flexion; restricted elbow extension due to anterior compartment shortening.

Nerves

• **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. It continues as the lateral antebrachial cutaneous nerve.

• **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the cubital region, medial distal brachium, radial volar aspect of the forearm, and a small portion of the dorsal radial aspect of the distal forearm.

Clinical Relevance: Faulty elbow flexion due to motor nerve damage; pain or paresthesias in the cubital fossa and proximal, radial aspect of the forearm.

Vessels

• **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

• **Anterior branch (also known as the radial collateral branch) of the deep artery of the arm (profunda brachii artery):** Participates in the anastomoses around the elbow.

Clinical Relevance: Elbow edema or compromised circulation; conditions affecting vascular supply to distal extremities, such as functional peripheral vascular disease (PVD) from smoking, stress, cold exposure, work involving vibrating machinery or organic PVD due to inflammatory, thrombotic, atherosclerotic, infectious, or degenerative circumstances.

Indications and Potential Point Combinations

• **Pain in upper arm or shoulder**

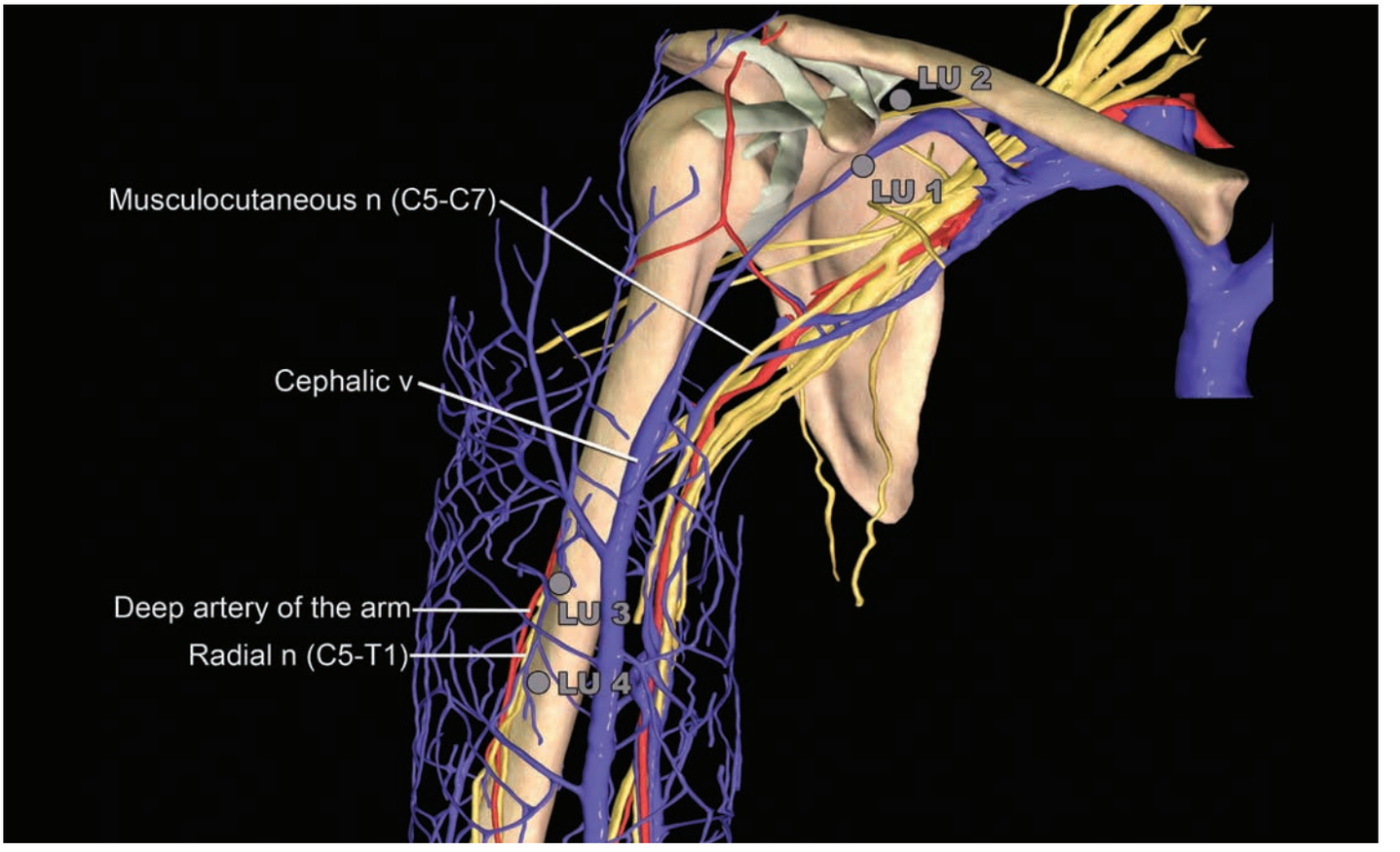


Figure 1-8. LU 3 and LU 4 relate to the musculocutaneous nerve, the deep artery of the arm, and the cephalic vein.

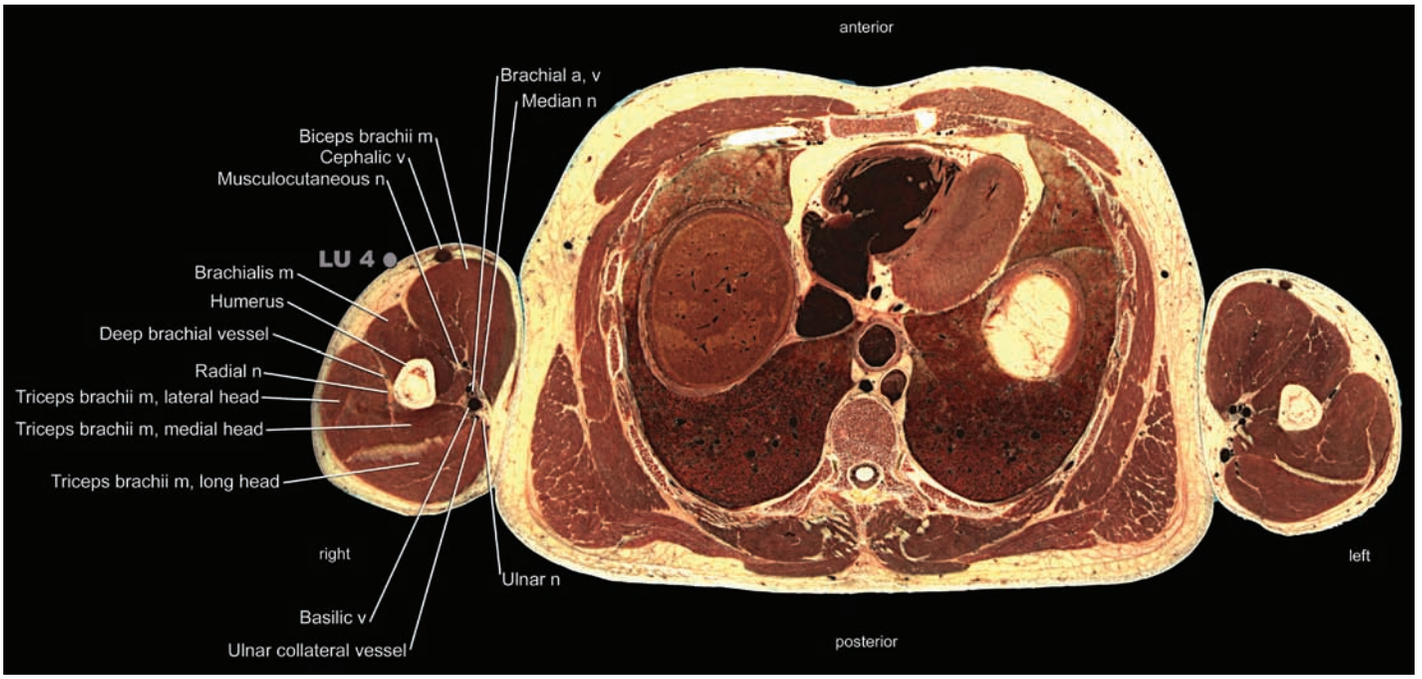


Figure 1-9. LU 4, adjacent to the brachialis muscle, addresses myofascial trigger points that arise in this location and radiate to the base of the thumb, near LU 10. Myofascial dysfunction in the brachialis that impinges upon the superficial sensory branch of the radial nerve may result in tingling, altered sensation, and numbness in the proximal thumb. (Simons DG, Travell JG, and Simons LS. Travell & Simons' Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 1. Upper Half of Body. 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 661-662.) Its name, "Pressing White," comes from an ancient method of finding this point which involved pressing the lighter skin on the medial surface of the arm against the chest. The site at which the nipple met the brachium identified the location of LU 4.

LU 5
Chi Ze "Cubit Marsh"

At the cubital crease, on the radial (i.e., lateral) side of the tendon of the biceps brachii muscle. Locate with the elbow slightly flexed.

Muscles

• **Biceps brachii tendon:** The biceps brachii muscle supinates the forearm and then can flex the elbow.

• **Brachialis muscle:** Flexes the elbow.

• **Brachioradialis muscle:** Flexes the forearm at the elbow.

Clinical Relevance: Elbow pain, degenerative joint disease, local tendinitis.

Nerves

• **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. It continues as the lateral antebrachial cutaneous nerve.

• **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the cubital region, medial distal brachium, radial volar aspect of the forearm, and a small portion of the dorsal radial aspect of the distal forearm.

• **Inferior lateral cutaneous nerve of the arm (C5, C6):** Supplies the lateral aspect of the distal brachium and proximal antebrachium. A branch of the radial nerve; it may be a branch of the posterior cutaneous nerve of the forearm in certain individuals.

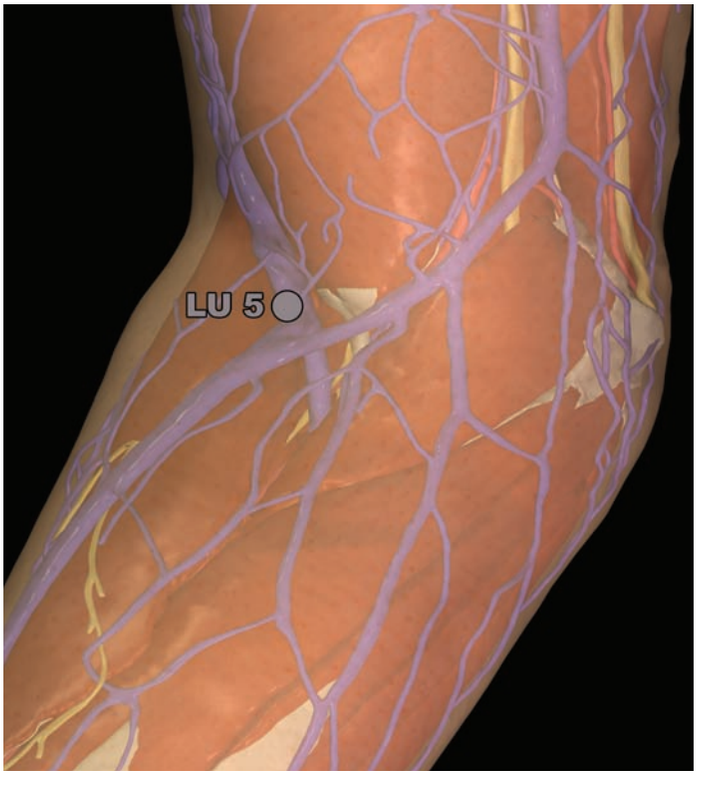


Figure 1-10. Right elbow, craniomedial view. LU 5 resides near a prominent venous intersection in the cubital fossa. This shallow depression in the elbow signifying a confluence of figurative waterways warrants the name "Cubit Marsh."

• **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.

Clinical Relevance: Weak elbow flexion; sensory loss or changes in the cubital fossa.

Vessels

• **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

• **Radial recurrent artery:** Branches from the radial artery and returns to the elbow region to participate in the elbow anastomoses.

• **Anterior branch (also known as the radial collateral branch) of the deep artery of the arm (profunda brachii artery):** Participates in the anastomoses around the elbow.

Clinical Relevance: Elbow edema, altered vascular supply or drainage, peripheral vascular disease affecting elbow function, swelling of distal thoracic limb with impaired venous drainage.

Indications and Potential Point Combinations

• **Respiratory conditions:** dyspnea, cough, pleuritis, asthma, pharyngitis: LU 5, LU 1, BL 13, LI 4.

• **Pain in elbow and shoulder:** LU 5, LU 2, LI 15, LI 11, isolate particular causes of pain and address accordingly (i.e., joint, myofascial, or neuropathic pain).

• **Skin disorders:** LU 5, LU 7, LI 4, ST 36, GV 14.

Evidence-Based Applications

• A case series indicated that LU 5 and CV 23 effectively treated **pseudobulbar paralysis**.[1]

• Spinal reflexes that exist between elbow articular afferents and the cardiac sympathetic efferent nerve may provide the avenues for **somatoautonomic reflexes** attributed to LU 5.[2]

• Injection of vitamin K3 into LU 5 reduced episodes of mild to moderate **hemoptysis** in patients suffering from respiratory ailments.[3]

• Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of **lateral epicondylalgia**.[4]

References

1. Wang C, Du S, Li H, and Ding Z. 120 cases of pseudobulbar paralysis treated by needling Lianquan and Chize. *Journal of Traditional Chinese Medicine.* 1998;18(2):96-98.
2. Nakayama T, Suzuki A, and Ito R. The articulo-cardiac sympathetic reflex in spinalized, anesthetized rats. *J Physiol Sci.* 2006;56(2):137-143.
3. Zhang L, Li Y. Two hundred and fifty-eight cases of hemoptysis treated by injection of vitamin K3 into Chize point. *J Tradit Chin Med.* 2004;24(3):177-179.
4. Haker E and Lundeberg T. Acupuncture treatment in epicondylalgia: a comparative study of two acupuncture techniques. *Clin J Pain.* 1990;6(3):221-226.

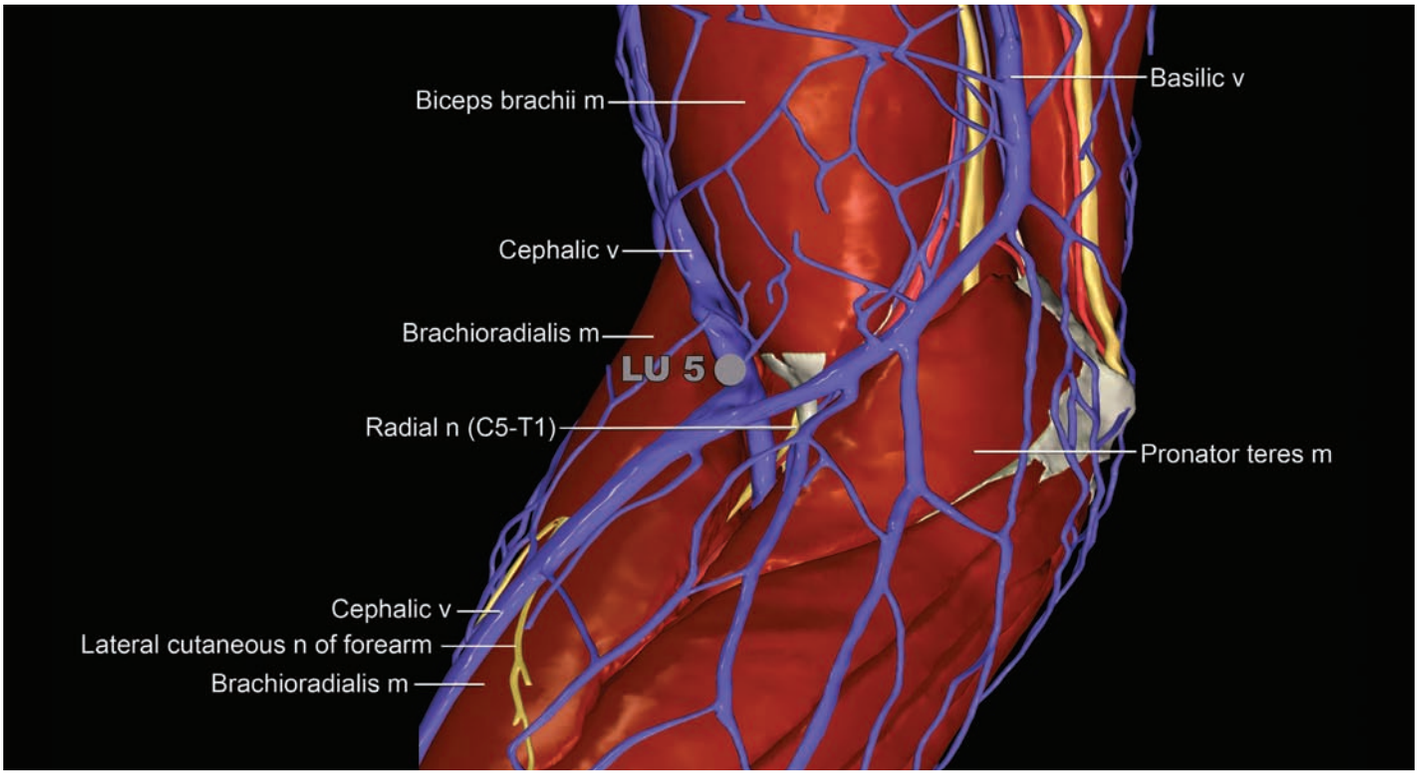


Figure 1-11. LU 5 often appears in treatments for elbow pain, in part because of its close association with the biceps tendon and the brachioradialis muscle.

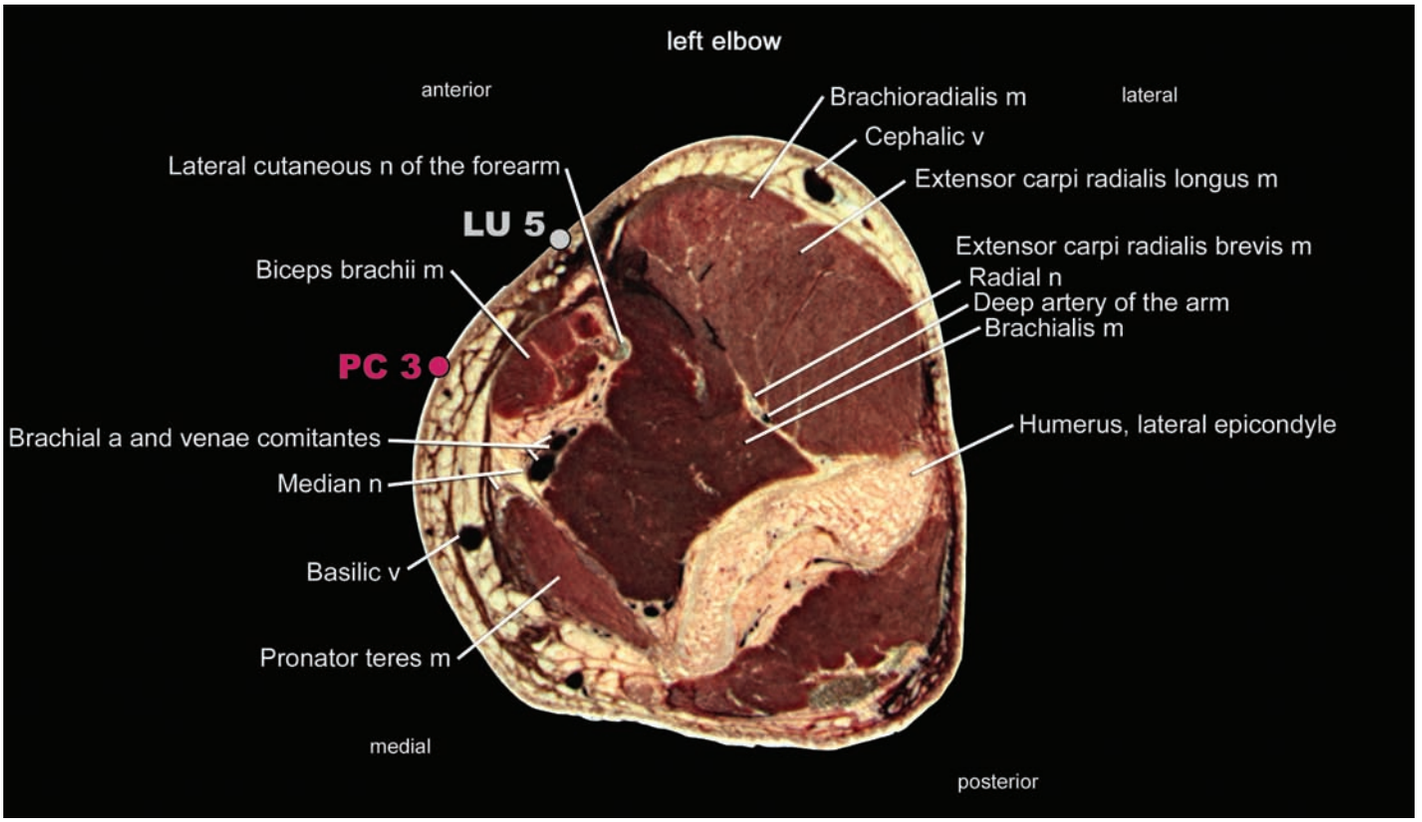


Figure 1-12. LU 5 impacts strong movers of the thoracic limb that appear in this cross section.

LU 6
Kong Zui "Collection Hole" or "Biggest Hole"

On the anterior forearm, on the ulnar side of the brachioradialis muscle, on the line connecting LU 5 and LU 9; 5 cun below LU 5, 7 cun above LU 9. Or, divide the distance between LU 5 and LU 9 in half. Take LU 6 1 cun proximal to this midpoint.

Muscles

• **Brachioradialis muscle:** Flexes the forearm at the elbow.

• **Pronator teres muscle:** Flexes the forearm at the elbow, and pronates the forearm.

• **Flexor carpi radialis muscle:** Flexes and abducts the hand at the wrist.

• **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.

• **Extensor carpi radialis brevis tendon:** Extends and abducts the hand at the wrist joint.

• **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist joint.

Clinical Relevance: Weakness of the hand or wrist due to myofascial restriction or pain generated from somatic dysfunction of the forearm and digital flexors.

Figure 1-13. LU 6, the "Collection Hole" occupies a position on the flexor surface of the antebrachium where the examiner can palpate a "hole" alongside the brachioradialis muscle. The "Xi-Cleft" point of the Lung channel which, according to Chinese medical lore, collects blood and Qi. Anatomically, the Xi-Cleft points occur near myotendinous junctures, as seen here.

Nerves

• **Median nerve (C6-T1):** Innervates the flexors of the forearm, including the pronator teres, flexor digitorum superficialis and flexor carpi radialis muscles.

• **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.

• **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.

• **Deep branch of the radial nerve (C7, C8):** Supplies the extensor carpi radialis brevis muscle.

Clinical Relevance: Weakness in motor function of the forearm and digital flexors; nerve entrapment due to myofascial restriction in this area; sensory changes due to local or more proximal sources of nerve entrapment or irritation (including brachial plexus and spinal nerve egress through encroaching foramina).

Vessels

• **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

• **Radial artery:** Provides, with the ulnar artery, all of the blood to the hand. Provides muscular branches to the flexor and extensor muscles on the radial side of the forearm, the radial recurrent artery, the superficial palmar branch of the radial artery, the palmar carpal branch of the radial artery, and the dorsal carpal branch of the radial artery.

• **Radial veins:** These paired veins arise from the radial side of the deep venous arcade, which is associated with the deep palmar arterial arch.

Clinical Relevance: Circulatory dysfunction or edematous maladies affecting the distal thoracic limb.

Indications and Potential Point Combinations

• **Respiratory problems:** dyspnea, cough, bronchitis, asthma: LU 6, LU 7, LI 4, BL 12, BL 13, GV 14.

• **Throat problems: tonsillitis, laryngitis, pharyngitis:** LU 6, LI 11, LI 4, CV 22.

• **Elbow pain and restricted range of motion related to restriction in the forearm flexor muscles:** LU 6, LU 5, LU 7, associated trigger points.

Evidence-Based Applications

• Electroacupuncture at LI 4 and LU 6 **normalized the pattern of leukocytes**, and decreased heart rate.[1]

• Electroacupuncture delivered at the homeostatic points LI 4 and ST 36, as well LU 6 for salivary gland stimulation and ST 6 may have **lessened stress and fatigue** in female athletes. This was

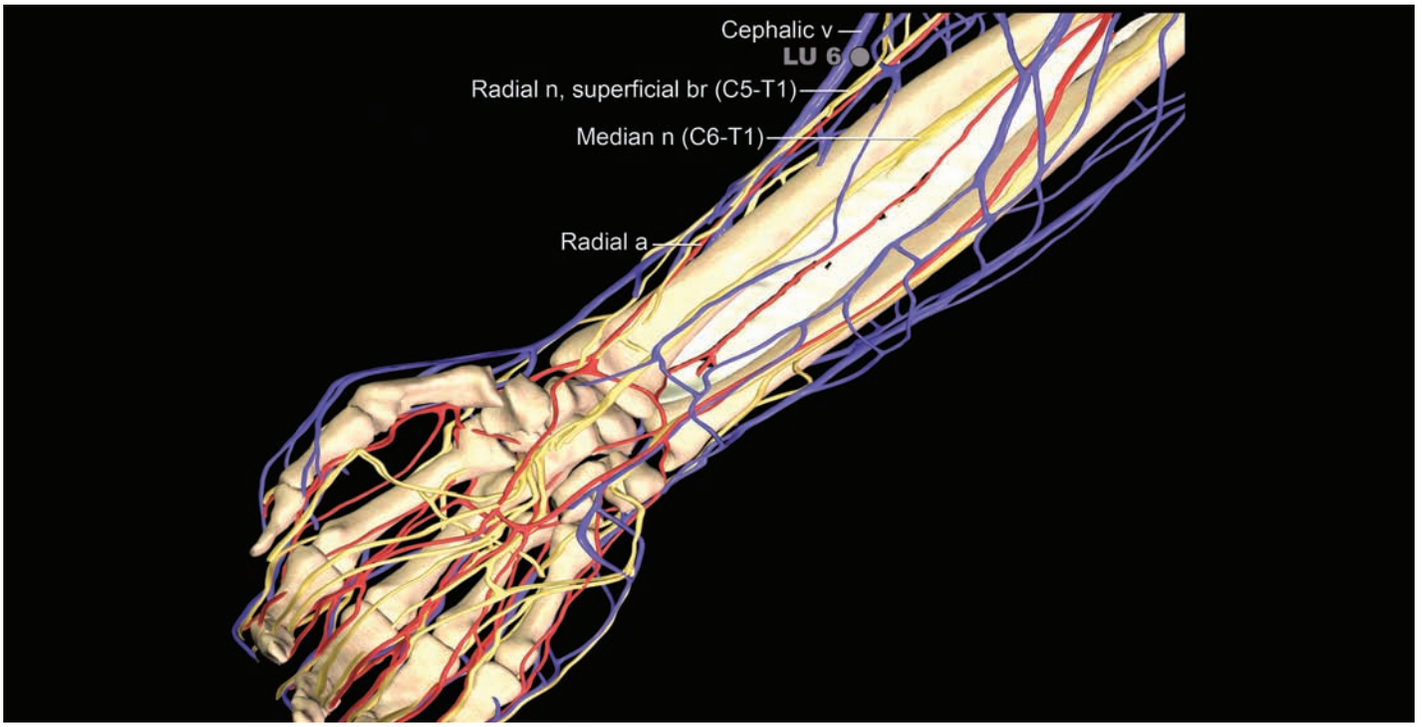


Figure 1-14. This view depicts the close communication between LU 6 and the radial nerve.

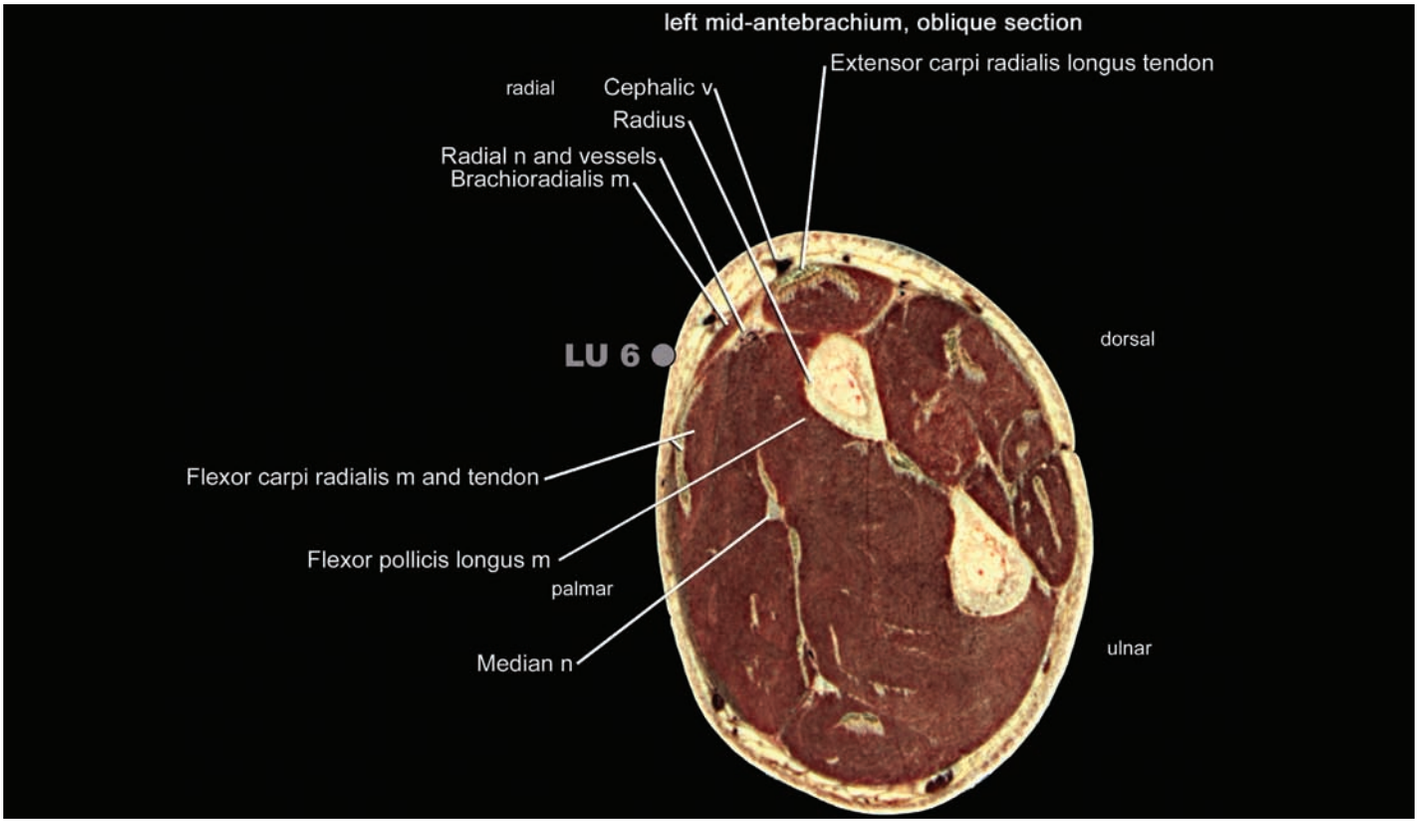


Figure 1-15. This cross sectional view provides additional perspective of the relationship between LU 6 and surrounding structures.

evidenced by 1) inhibition of salivary secretory immunoglobulin A (SIgA) levels during competition in female athletes, 2) inhibition of the exercise-induced increase in salivary cortisol during competition, 3) diminished subjective assessments of muscle tension, physical and mental fatigue, and 4) better emotional health.[2]

- A 40-minute treatment of needling at LU 10 and LU 6 reportedly delivered an "immediate **antiasthmatic** effect."[3]

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LU 7
Lie Que "Broken Sequence" or "Divergent Breach"

In a depression on the radial aspect of the distal, volar antebrachium, 1.5 cun proximal to the wrist joint, just proximal to the styloid process of the radius.

Muscles

- **Brachioradialis tendon:** Flexes the forearm at the elbow.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius to the ulna.
- **Flexor pollicis longus muscle:** Flexes the phalanges of the thumb.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.
- **Extensor pollicis brevis muscle:** Extends the thumb's proximal phalanx.
- **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint:
- **Extensor carpi radialis brevis tendon:** Extends and abducts the hand at the wrist joint.

Clinical Relevance: Restricted, painful, or weak wrist movement. Impaired motor function of the thumb due to pain or disuse.

Nerves

- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.

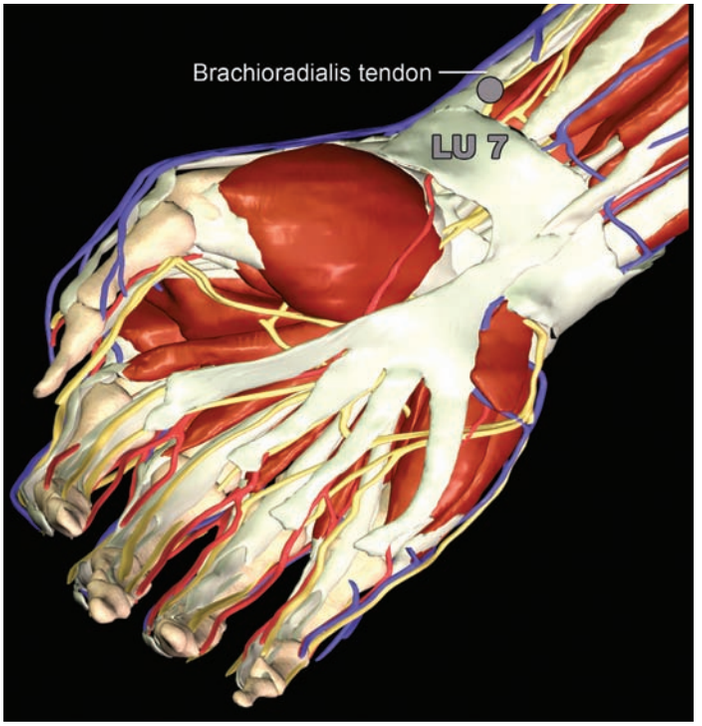

Figure 1-16. LU 7 lies in the groove along the ulnar aspect of the brachioradialis tendon, as shown here.

- **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which are innervated by the median nerve) as well as the radial aspect of the wrist.
- **Radial nerve, deep branch (C7, C8):** Innervates the extensor carpi radialis brevis muscle.
- **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.
- **Median nerve (C6-T1):** Innervates the flexors of the forearm.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve, the posterior interosseous nerve innervates the abductor pollicis longus muscle, the extensor pollicis longus and brevis muscles, the extensor digitorum, the extensor digiti minimi, and the extensor carpi ulnaris muscles, and the extensor indicis muscle.
- **Anterior interosseous nerve (C8, T1):** From the median nerve, the anterior interosseous nerve innervates the flexor pollicis longus and the pronator quadratus muscles.

Clinical Relevance: Nerve damage or entrapment affecting motor function of the thumb, hand, or wrist. Sensory changes or loss impacting the radial aspect of the wrist or thumb. Neuropathic or other sources of pain in the wrist or thumb.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Radial artery and the communications between the deep palmar arterial arch and the palmar carpal arches:** These anastomoses provide collateral circulation at the wrist.
- **Radial veins:** Paired veins arise from the radial side of the deep venous arcade, which follows the deep palmar arterial arch.

Clinical Relevance: Peripheral vascular disease or lymphatic congestion affecting the distal forearm, wrist, and/or hand. Do not needle through edematous tissue; select another method of neuromodulation such as manual lymphatic drainage or laser therapy.

Indications and Potential Point Combinations

- **Upper and lower respiratory problems, including rhinitis, tonsillitis, pharyngitis, cough:** LU 7, LU 5, LI 4, LI 11, BL 12, BL 13, BL 23, GV 14.
- **Skin disorders:** LU 7, LI 14, LI 11, GV 14, ST 36.
- **Worry, grief, sadness:** LU 7, LR 3, HT 7, HT 3, GV 20.
- **Neck pain and stiffness:** LU 7, local cervical trigger points, GB 21, BL 23.
- **Pain in the trigeminal nerve distribution:** LU 7, LI 4, local facial points as indicated by the pain presentation.

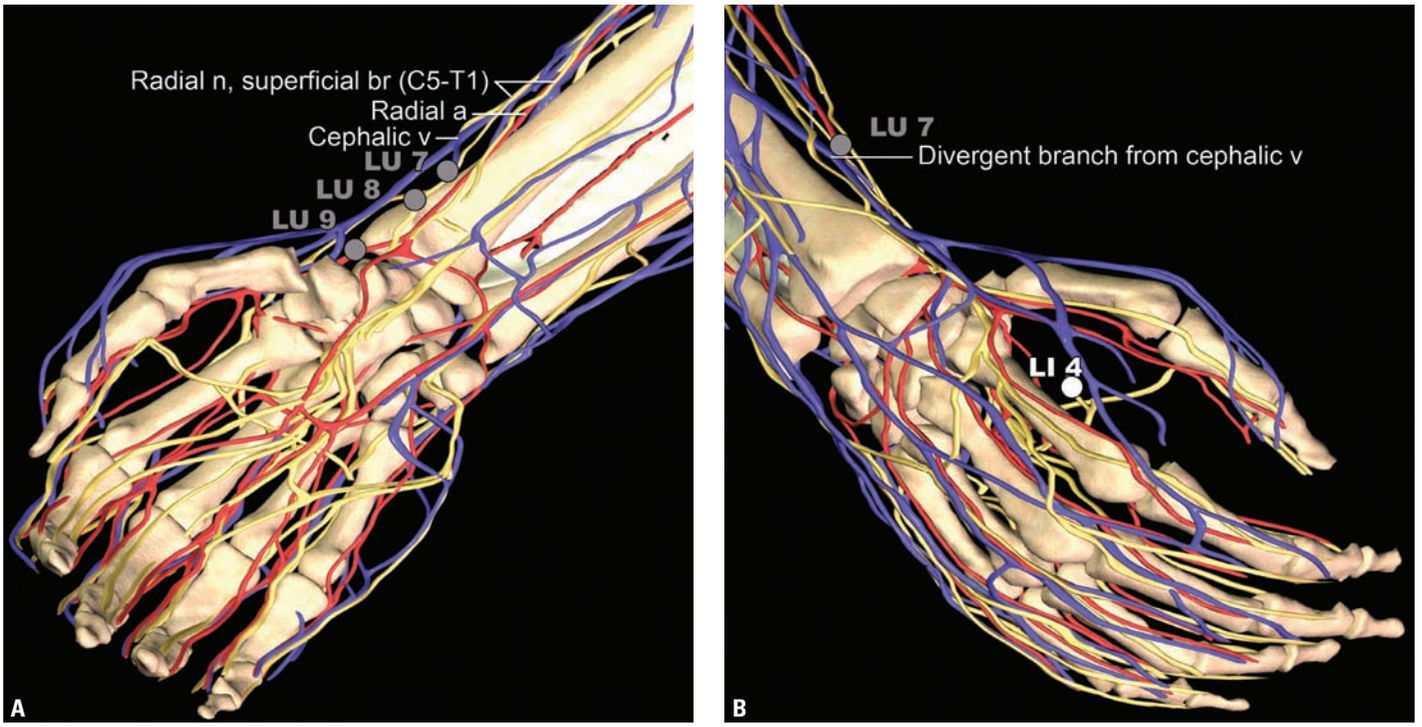

Figure 1-17A and B. "Broken Sequence," for LU 7, refers to the divergent neurovascular pathways that progress toward LI 4 on the dorsum of the hand, shown more clearly in Figure 1-17A.

Evidence-Based Applications

• Laser acupuncture at LU 7, LI 4, GB 14, and GB 20 reduced **chronic tension headache**.[2]

• Electroacupuncture at LI 4, LU 7, GV 14, GV 20, the thoracolumbar midline point San Tai and the lumbosacral midline point Baihui (veterinary) demonstrated a reduction of minimum alveolar concentration (MAC) of isoflurane by 16.7% in dogs. Acupuncture-assisted anesthesia thus **potentiated the anesthetic effects of volatile anesthetic agents**.[3]

• Following a series of acupuncture treatments, men with **poor sperm quality** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[4]

• Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[5]

• Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma** patients.[6,7]

• Patients who received EA (at LU 2, LU 7, and PC 6) prior to heart valve replacement surgery exhibited significantly lower serum troponin 1 release following aortic cross-clamp removal. This indicates potential benefit of EA in terms of reducing reperfusion injury from cardiac ischemia.[8]

• Acupuncture at LU 7, ST 8, GB 4, GB 5, GB 20, and GV 14 afforded large cost-savings for **migraineurs** who would otherwise have missed work, according to a controlled trial testing acupuncture against conventional drug treatment.[9]

• Acupuncture at LU 7, ST 40, GB 20, and GV 20, as well as plum-blossom hammer tapping at GV 14, alleviated vertigo and related symptoms in a majority of patients in a case series of patients with **vertebrobasilar ischemic vertigo**.[10]

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LU 8
Jing Qu "Channel Ditch"

On the radial, volar aspect of the wrist, 1 cun above the wrist crease (and also LU 9, at the level of the joint), in the depression between the radial artery and the styloid process of radius.

Muscles

- **Brachioradialis tendon:** The brachioradialis muscle flexes the forearm at the elbow.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius to the ulna.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.
- **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint.

Clinical Relevance: Tendonitis or myofascial dysfunction affecting wrist mobility, strength, and comfort. Tendinitis or local soft tissue restriction impairing thumb function and causing pain.

Nerves

- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.
- **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which are innervated by the median nerve) as well as the radial aspect of the wrist.
- **Radial nerve, deep branch (C7, C8):** Innervates the extensor carpi radialis brevis muscle.
- **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.
- **Median nerve (C6-T1):** Innervates the flexors of the forearm.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve, the posterior interosseous nerve innervates the abductor pollicis longus muscle, the extensor pollicis longus and brevis muscles, the extensor digitorum, the extensor digiti minimi, and the extensor carpi ulnaris muscles, and the extensor indicis muscle.
- **Anterior interosseous nerve (C8, T1):** From the median nerve, the anterior interosseous nerve innervates the flexor pollicis longus and the pronator quadratus muscles.

Clinical Relevance: Nerve damage or entrapment affecting motor function of the thumb, hand, or wrist. Sensory changes or loss impacting the radial aspect of the wrist or thumb. Neuropathic or other sources of pain in the wrist or thumb.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join

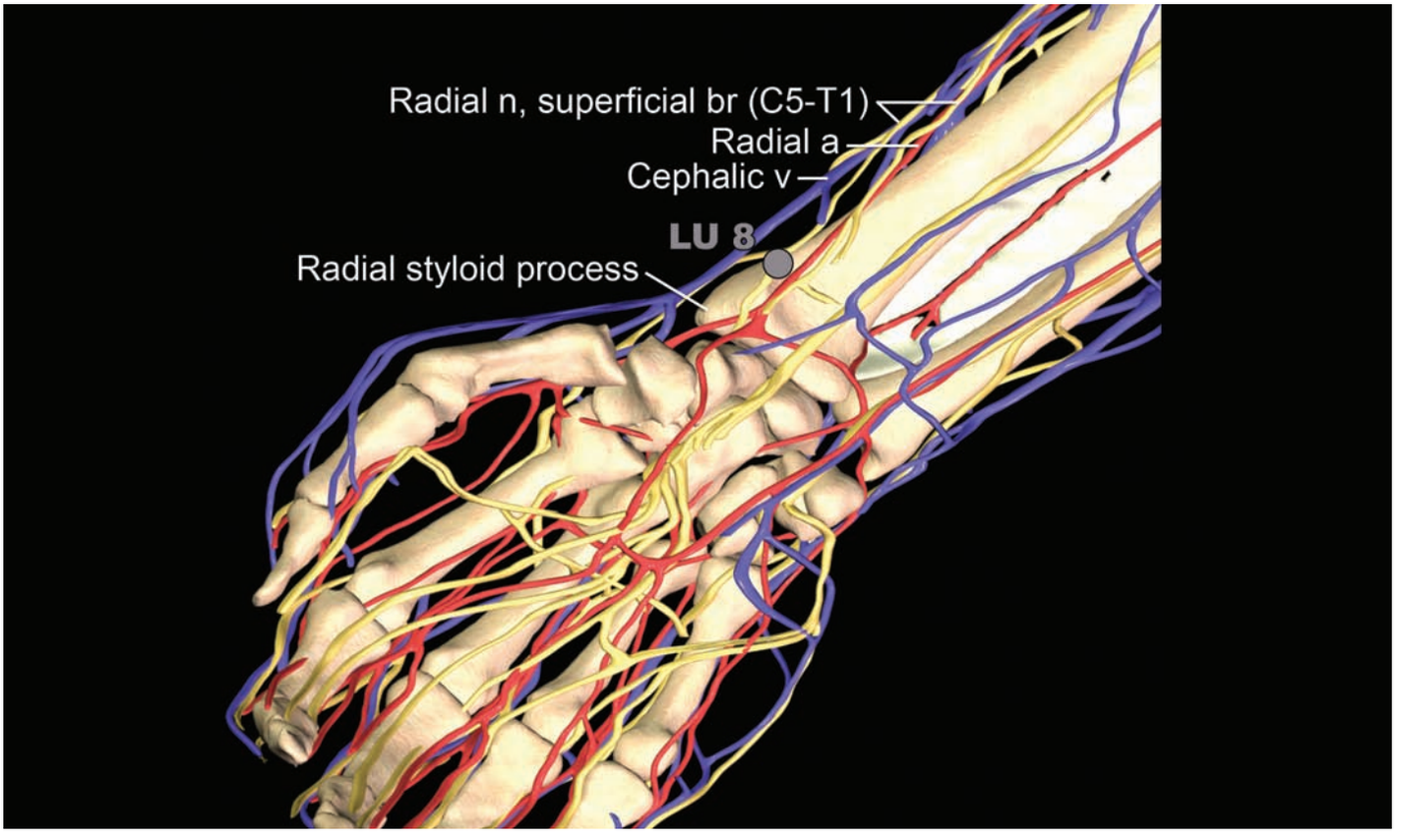

Figure 1-18. LU 8, the "Channel Ditch" point snugs up close to the prominence that forms the radial styloid process.

with the basilic vein. Ultimately empties into the axillary vein.

• **Radial artery and the communications between the deep palmar arterial arch and the palmar carpal arches**: These anastomoses provide collateral circulation at the wrist. Chinese pulse diagnosis assesses the quality of the impulse at various positions along the radial artery, including locations over LU 7, LU 8, and LU 9. System wide changes such as aging and stress alter histological features in the arterial wall, leading to changes in pulse quality.[2,3] For example, the Chinese pulse diagnosis of "liver qi stagnation" associated with emotional turmoil, taut pulse, and chest pain would equate with sympathetic nervous system arousal in contemporary biomedicine.

• **Radial veins:** These paired veins arise from the radial side of the deep venous arcade, which is associated with the deep palmar arterial arch.

Clinical Relevance: Circulatory insufficiency or compromise that limits oxygenation of distal tissues and elimination of metabolic waste and fluid accumulation.

Indications and Potential Point Combinations

• **Wrist pain:** LU 8 if tender. Check also PC 7, other local points. Identify myofascial restrictions in brachioradialis muscle and flexor pollicis longus (for referred pain).

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1. Staras K, Chang H-S, and Gilbey MP. Resetting of sympathetic rhythm by somatic afferents causes post-reflex coordination of sympathetic activity in rat. *Journal of Physiology*. 2001;533.2:537-545.

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LU 9
Tai Yuan "Great Abyss"

On the radial, volar (palmar) aspect of the wrist in the depression on the radial side of the radial artery, distal to the styloid process of radius. Level with HT 7 at the proximal border of the pisiform bone. On the ulnar aspect of the abductor pollicis longus tendon.

Muscles

• **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint.

• **Extensor pollicis brevis tendon:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.

• **Flexor pollicis longus muscle:** Flexes the phalanges of the thumb.

• **Brachioradialis tendon:** Flexes the forearm at the elbow.

• **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.

Clinical Relevance: Wrist pain from degenerative joint disease, other joint ailments; myofascial dysfunction of wrist tendons; loss of wrist function. Thumb pain, myofascial dysfunction in the thenar eminence impacting thumb mobility, strength, comfort.

Nerves

• **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.

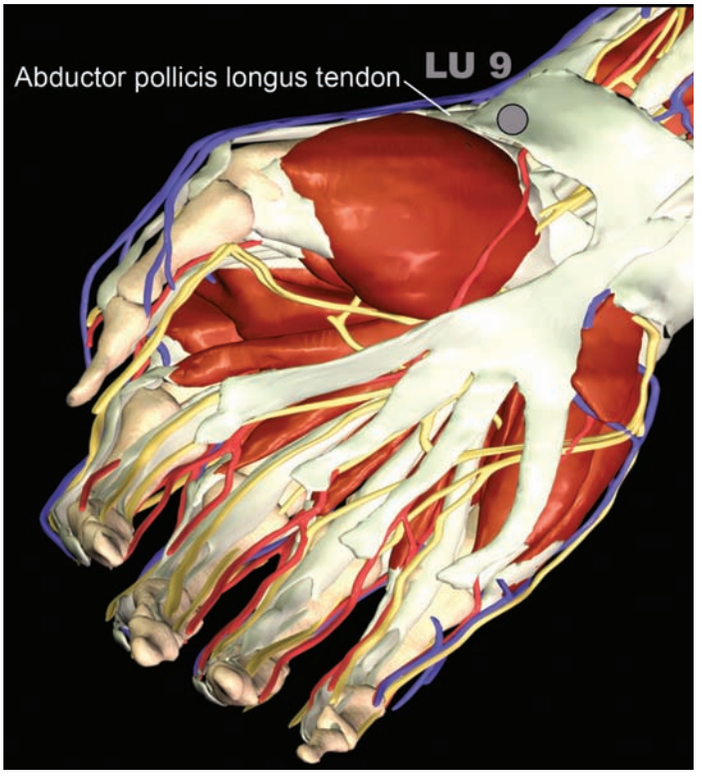

Figure 1-19. This image shows LU 9 on the ulnar aspect of the abductor pollicis longus tendon.

• **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.

• **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which the median nerve supplies) as well as the radial aspect of the wrist. Somatic afferent stimulation from the superficial radial nerve resets sympathetic discharges.[1]

• **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve, the posterior interosseous nerve innervates the abductor pollicis longus muscle, the extensor pollicis longus and brevis muscles, the extensor digitorum, the extensor digiti minimi, and the extensor carpi ulnaris muscles, and the extensor indicis muscle.

• **Anterior interosseous nerve (C8, T1):** From the median nerve, the anterior interosseous nerve innervates the flexor pollicis longus and the pronator quadratus muscles.

• **Median nerve (C6, C7):** Innervates the flexor carpi radialis muscle.

Clinical Relevance: Wrist or radiating thumb pain; neuropathic, inflammatory, or entrapment-related nerve irritation.

Vessels

• **Radial artery and the communications between the deep palmar arterial arch and the palmar carpal arches:** These anastomoses provide collateral circulation at the wrist.

• **Radial veins:** Arise from the deep venous arcade, associated with the deep palmar arterial arch.

Clinical Relevance: Peripheral vascular disease states affecting circulatory supply to the hand; generalized autonomic tone related to input from sympathetic afferents in the periphery; compression of local neurovascular supply from tension in the flexor retinaculum or other connective tissue or bone overgrowth in this region of the wrist.

Indications and Potential Point Combinations

• **Respiratory problems:** Cough, sore throat, bronchitis, asthma, emphysema: LU 9, LU 7, LU 2, BL 13, ST 36.

• **Pain in the forearm or wrist:** Try to identify the source; consider LU 9 for local pain or pain along the radial aspect of the forearm; add myofascial trigger points.

• **Epistaxis:** LU 9, LI 4, ST 44, GV 20.

Evidence-Based Applications

• Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary Raynaud's syndrome, demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[2]

• Acupuncture at LU 9, LU 11, LI 1, PC 9, TH 1, HT 9, SI 1, KI 1, SP 1, LR 1, ST 45, GB 44, BL 67, LI 4, CV 17, ST 36, ST 40, BL 58, SP 6, KI 7, and moxibustion at GV 14 resulted in rapid improvement in a 13-month old child with staphylococcal-infected skin wounds following a poor 50-day response to antibiotics.[3]

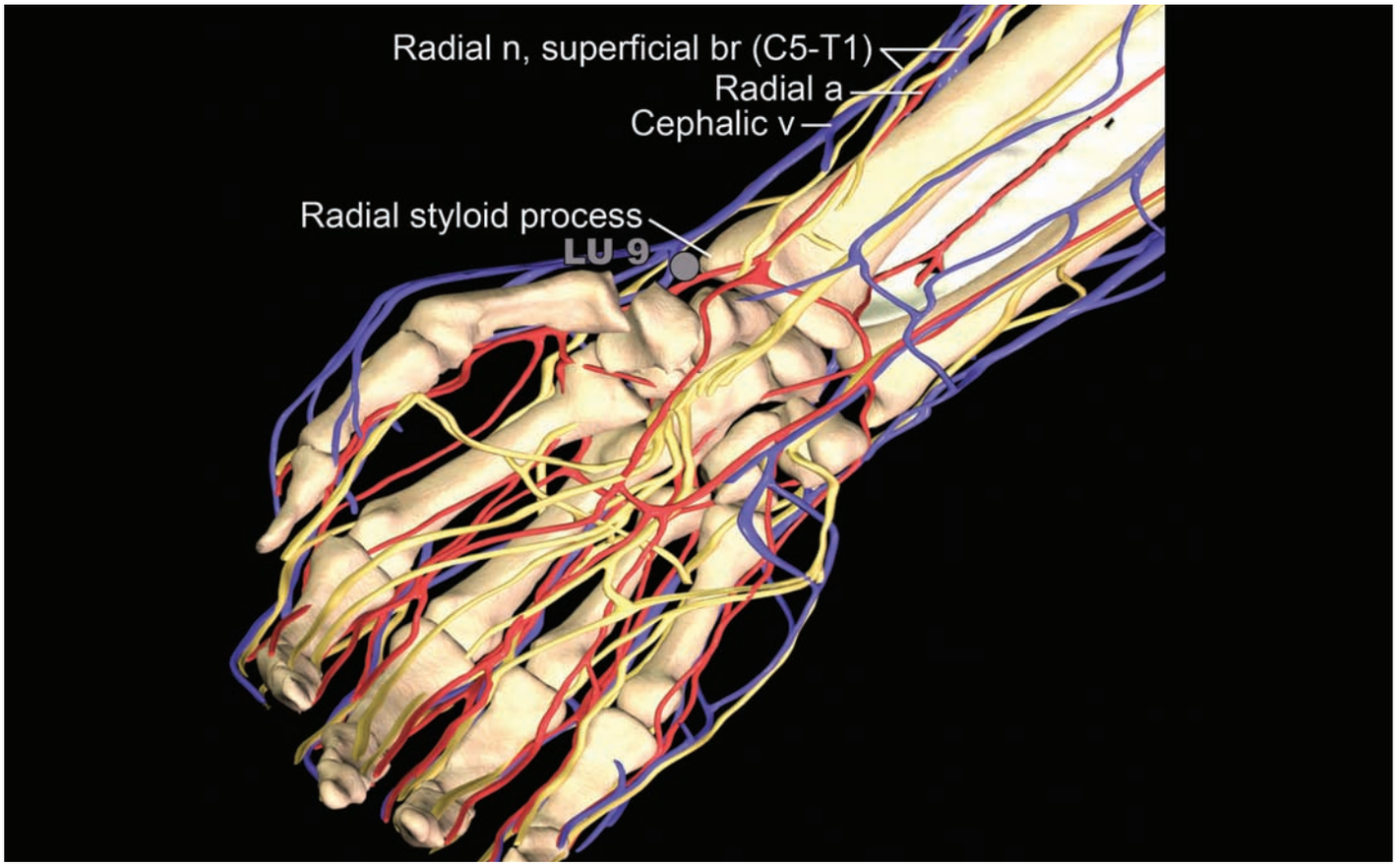

Figure 1-20. LU 9 lines up with the radiocarpal joint. Its name, "Great Abyss" connotes the deep depression one palpates at this site. The classical indication of LU 9 as an influential point for vasculature probably reflects the influence of local sympathetic afferents on blood flow through autonomic nervous system modulation.

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LU 10
Yu Ji "Fish Border"

On the thenar eminence, midway along the shaft of the first metacarpal bone, in a depression along the dorsal/palmar skin border.

Muscles

• **Abductor pollicis brevis muscle:** Abducts the thumb and extends the thumb at the carpometacarpal joint.

• **Opponens pollicis muscle:** Allows thumb opposition as when picking up an object.

• **Flexor pollicis brevis muscle:** Flexes the thumb.

Clinical Relevance: Loss of thumb strength and opposability, whether due to myofascial trigger points, arthritic pain, or muscle atrophy.

Nerves

• **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which are innervated by the median nerve) as well as the radial aspect of the wrist

• **Palmar cutaneous branch of the median nerve (C6-C8):** Innervates the skin over the radial palmar region.

Figure 1-21. LU 10 resides at the midpoint of the first metacarpal bone along the dorsal-palmar border. The term "Fish Border" connotes the fish-like shape of the thenar eminence. Its "border" identifies the dorsopalmar skin junction where the color changes.

• **Median nerve, recurrent branch (C6-T1):** Innervates the thenar muscles: the abductor pollicis brevis, flexor pollicis brevis (superficial part), and opponens pollicis.

• **Ulnar nerve (C6, C7):** Supplies the deep part of the flexor pollicis brevis muscle.

Clinical Relevance: Thumb pain or numbness, carpal tunnel syndrome or other nerve entrapment pathologies.

Vessels

• **Superficial palmar arch venous branches:** Its radial branches drain to the cephalic vein.

• **Deep venous arcade:** This series of anastomosing venous arches gives rise to the deep veins of the forearm, including the radial veins. The deep venous arcade parallels the deep palmar arterial arch.

• **Communications between the deep palmar arterial arch and the palmar carpal arches:** These anastomoses provide collateral supply to the wrist.

Clinical Relevance: Peripheral vascular disease, including Raynaud's disease or syndrome; thumb joint malfunction due to deficient oxygen perfusion.

Indications and Potential Point Combinations

• **Respiratory conditions, especially associated with inflammation:** cough, hemoptysis, fever, laryngitis, pharyngitis, tonsillitis, pneumonia, chest restriction, dyspnea: LU 10, LI 4, ST 36, KI 6, LI 11, BL 13, BL 14, GV 14.

• **Thumb pain from arthritis:** LU 10, LU 7, LI 4, local points as indicated by palpation.

Evidence-Based Applications

• A 40-minute treatment of needling at LU 10 and LU 6 reportedly delivered an "immediate **antiasthmatic** effect."[1]

References

1. Zang J. Immediate antiasthmatic effect of acupuncture in 192 cases of bronchial asthma. *J Tradit Chin Med.* 1990;10(2):89-93.

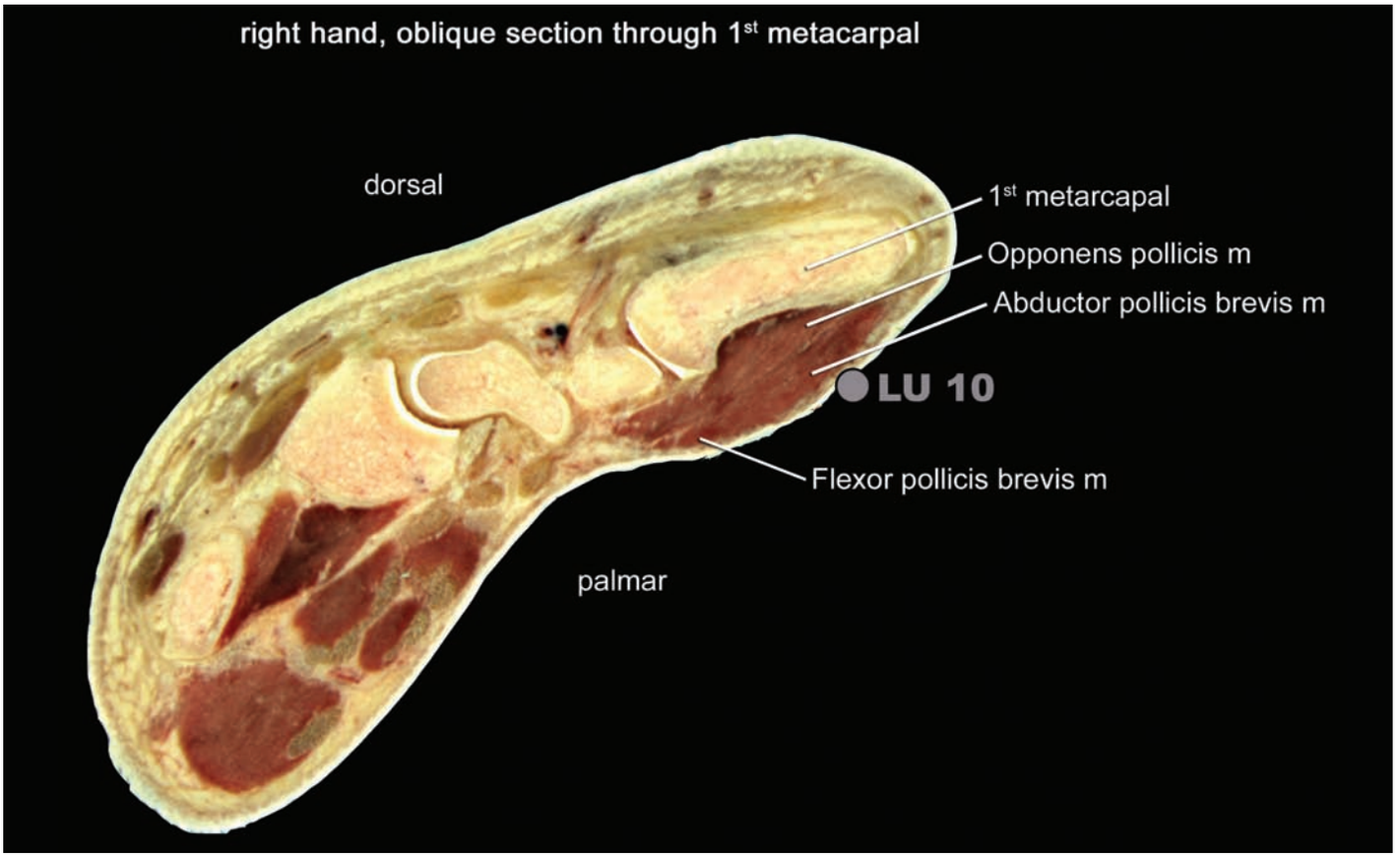

Figure 1-22. This oblique section identifies the relationship between LU 10 and muscles of the thenar eminence, so often beset by myofascial restriction leading to thumb pain. LU 10 corresponds to the motor point of the abductor pollicis brevis muscle. (Liu Y, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med.* 1975;3(4):347-358.)

LU 11
Shao Shang "Lesser Merchant"

On the radial side of the base of the thumb nail, the width of a Chinese leek leaf (approximately 0.1 cun; more like a chive than a leek) from the corner of the nail.

Nerves

• Distal network of the proper palmar digital n. , from the median nerve (C6): Provides sensation and sympathetic supply to the thumb.

Clinical Relevance: Local sensory loss; systemic autonomic dysfunction impacted through actions of the nervi vasorum and sympathetic supply.

Vessels

• Distal network of proper palmar digital artery: Participates in the arteriovenous network at the tip of the finger. No longitudinal arteries run along the dorsum; instead, branches from the proper palmar digital artery anastomosed along like links in a chain.

The most distal arterial branches turn into twigs on either side of the base of the nail that anatomose with their opposing partners, creating an arch at the nail matrix where the endpoints of the channels sit. Thus, these "Ting" or endpoints associate intimately with small, physiologically active vessels.

• Distal network of proper palmar digital vein: Participates in the arteriovenous network at the tip of the thumb.

• Note on the neurovascularization of the fingers: The pattern of vessels supplying the hand creates a complex area of study that still poses challenges for anatomists. Morphologic variations in the neurovascular supply for the thoracic limb may result from factors related to limb position during development.

Comparative anatomy note: Quadrupeds such as the dog exhibit a highly developed counter-current heat exchange system with abundant arteriovenous anastomoses and notable dermal venous plexuses in their footpads. These anatomic features give the paw the capacity to resist damage from contact with cold surfaces. Vasodilation of proximal vessels in the limb bolsters blood supply to the surface of the pad on the paw.[5]

Clinical Relevance: Problems with local or systemic autonomic tone and thermal regulation.

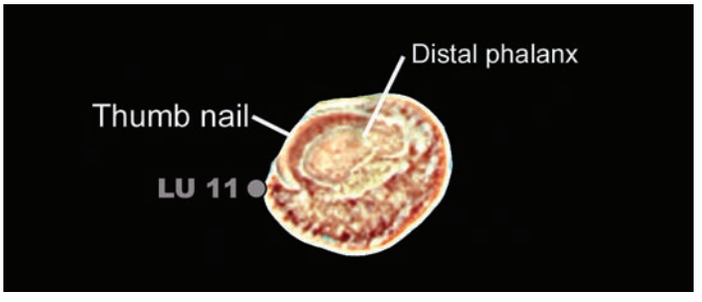

Figure 1-23. Note the small lumen of the vessel underlying LU 11, next to the thumb nail. This tiny location as the most distal point placement qualifies LU 11 for the name "Lesser Merchant."

Indications and Potential Point Combinations

• Typically used alone, LU 11 may help restore breathing, promote resuscitation, stop febrile seizures: Needle or bleed to break fever and sweat patient (classical/traditional approach).

Evidence-Based Applications

• Bloodletting at LU 11 or LI 1 in children may prevent and treat laryngospasm occurring post-extubation.[6]

• Acupuncture at LU 9, and all the Ting points (LU 11, LI 1, PC 9, TH 1, HT 9, SI 1, KI 1, SP 1, LR 1, ST 45, GB 44, BL 67), as well as LI 4, CV 17, ST 36, ST 40, BL 58, SP 6, KI 7, and moxibustion at GV 14 resulted in rapid improvement in a 13-month old child with staphylococcal-infected skin wounds following a poor 50-day response to antibiotics.[7]

• Figure 1-23. Note the tiny vessel extending from the thumb nail to LU 11. The point's small size suits the name "Lesser Merchant."

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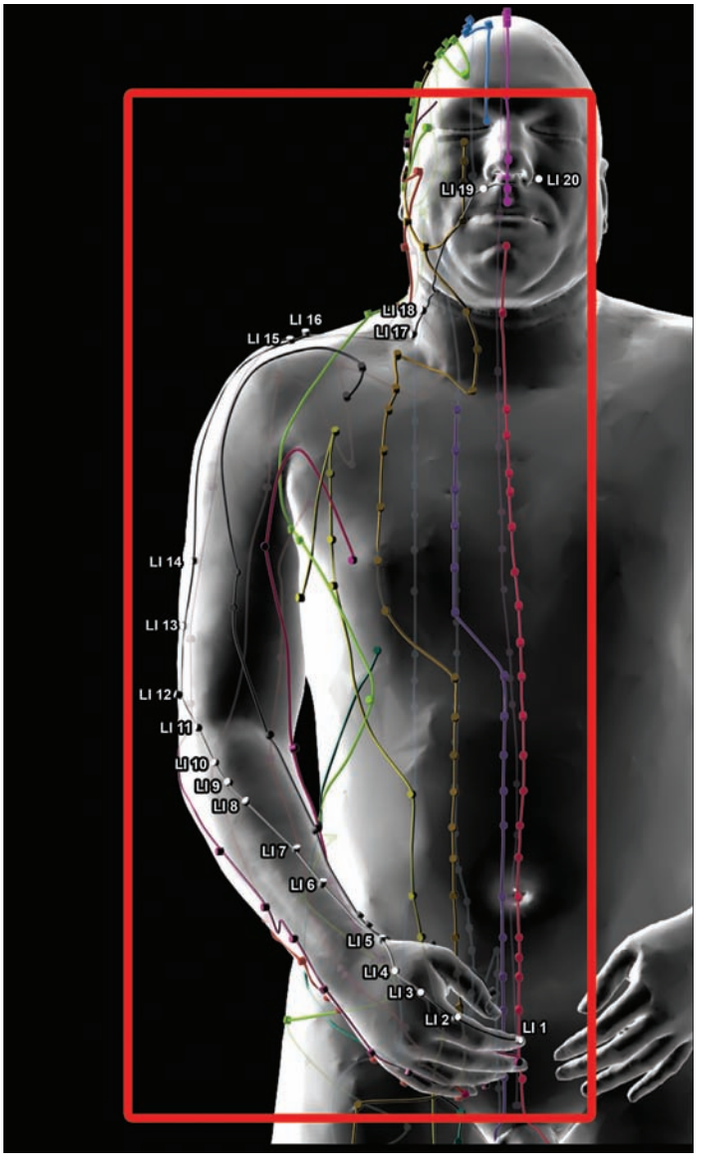
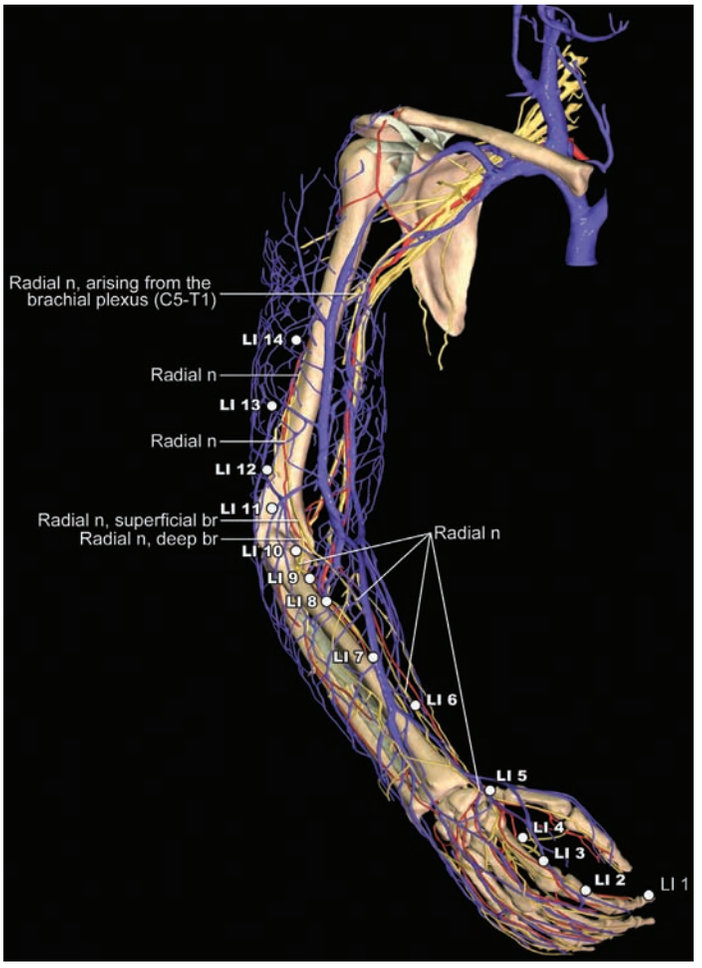
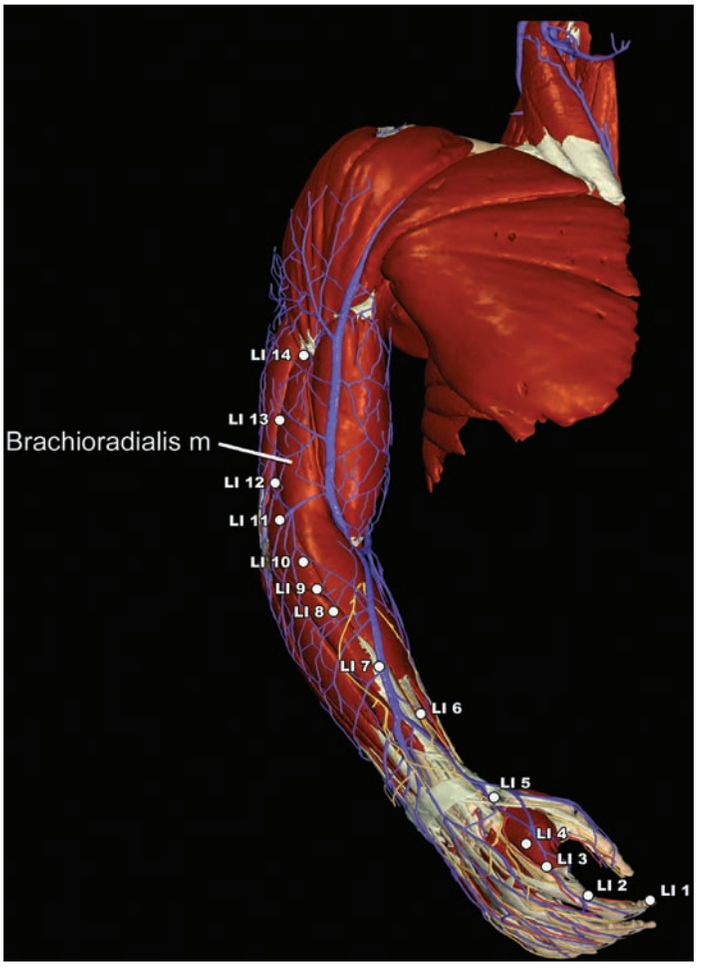
Channel 2:: The Large Intestine (LI)



The Large Intestine (LI) channel commences at LI 1 on the radial side of the index finger. Following its course toward the nose, the LI line follows the pathway determined by the radial nerve to the mid-humerus. After reaching the acromion and then the face, the LI channel arrives at LI 20, lateral to the contralateral naris.



The tight relationship between the radial nerve and the LI channel becomes apparent when tracing the course of both from the mid-humerus to the index finger.



The brachioradialis muscle overlies the radial artery and nerve as it travels from brachium to wrist. Thus, the LI channel describes the course of both the radial nerve and the brachioradialis muscle.

Chinese Medicine doctrine claims that several LI points such as LI 4 and LI 11 "clear heat," especially in the head, neck, or cranial thorax. The metaphor "clearing heat," suggests anti-inflammatory, anti-sympathetic effects.

The LI channel commences at LI 1 on the radial side of the index finger.

After tracking the radial nerve to the mid-humerus, the LI line jumps to the shoulder, ascends the neck, and crosses under the nose to LI 20, the only channel to start on one side of the body and end on the other.

The generalized (rather than local neural or musculoskeletal) effects of stimulating points on the LI channel involve somatosympathetic pathways that reflex through the trigeminocervical segments of the spinal cord.[1,2,3] These neuroanatomic connections explain the frequent appearance of LI points for toothache, migraine, facial myofascial and sinus pain.[4,5,6,7,8,9]

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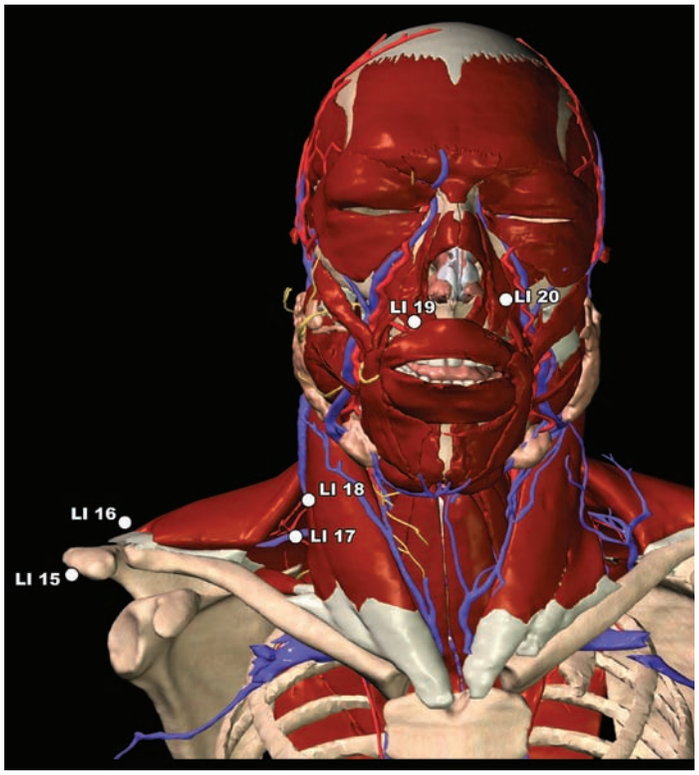
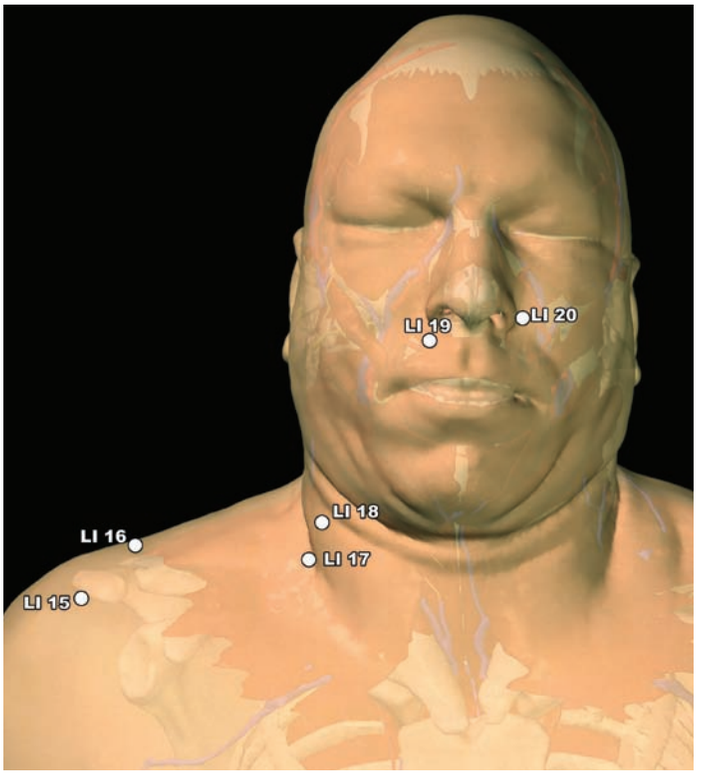


LI points treat afflictions of the face and mouth through neuroanatomic connections between cervical and trigeminal neurons. Trigeminocervical reflexes account for the spreading and referred pain patterns from migraine and sinusitis discomfort. Afferent stimulation from medical acupuncture and related techniques modulates nociceptive input to the CNS, activating endogenous analgesic mechanisms such as endogenous opioidergic systems in the periaqueductal gray.



Topographical locations of LI points on the head, neck, and shoulder region.

LI 1

Shang Yang "Metal Yang"

On the radial side of the base of the nail of the index finger, the width of a Chinese leek leaf from the corner of the nail.

Nerves

• **Median nerve (C6):** Distal branches of the proper palmar digital nerve from the median nerve provide sensation and sympathetic input to the index finger.

• **Note about fingertip nerve supply:** The highly sensate fingertip contains sensory end organs between the volar digital skin and the nail that allows for accurate prehension of small objects.[5] The proper palmar digital nerve accompanies its arterial companion on the ventral ulnar and radial aspects of the fingers. Proximal to the base of the nail fold, the nerve divides and sends branches into the pulp of the finger as well as to the nail bed.[1] These nerve fibers provide only part of the sensory supply to the nail bed. Additional sensation is supported by structures known as "glomus bodies," identified as intertwining clusters of fine vessels and nerves. Glomus bodies modulate blood flow to the fingertip by controlling fine vessel diameter. The close proximity of glomus bodies to the nail allows for thermal transfer, similar to the heat exchange that takes place when one places a hand against a window pane.[2] Too, the finger's tip serves as a temperature regulator, highlighting the indications of Ting points such as LI 1 for heat stroke and fever.

Clinical Relevance: Distal index finger numbness or nerve damage; intensive activation of autonomic reflexes influencing attention and arousal as well as heat distribution; autonomic reflexes to the head and neck through trigeminocervical reflexes.

Vessels

• **Distal network of dorsal branches of proper palmar digital artery of the radial side of the index finger:** Distributes to the fingertip.

• **Dorsal digital artery and vein:** Participate in the arteriovenous network at the tip of the finger.

• **Nailfold and fingertip microvasculature:** Blood flow in the nail bed and surrounding region correspond to circulatory dynamics. Microcirculatory pressure and blood flow at the distal points of acupuncture channels may afford insight into a patient's general wellness.[4] Too, microvessels in the nailfold capillary beds may serve as microcosmic windows into the macrocosmic alterations reflected in the vasculature, characteristic of conditions such as autoimmune rheumatic diseases.[3] Blood flow in the nail bed and surrounding region reflects circulatory dynamics; measuring microcirculatory pressure and blood flow may yield insights into a patient's overall cardiovascular status.[4] The highly sensate fingertip contains sensory end organs between the volar digital skin and the nail that allows for accurate prehension of small objects.[5] The fingertip also serves as a temperature regulator, highlighting the indications of Ting (most distal channel points) such as LI 1 for heat stroke and fever.

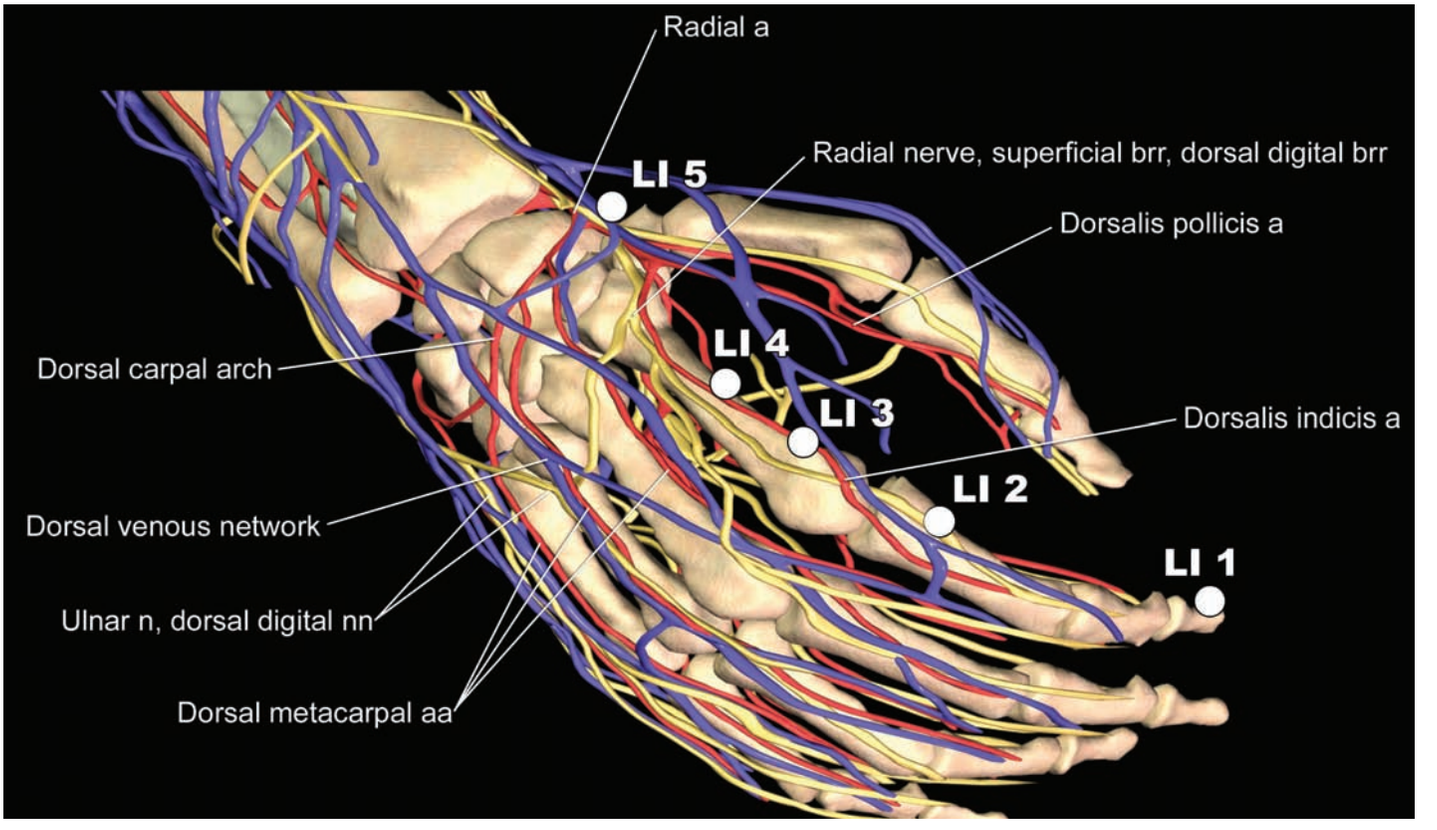


Figure 2-1. LI 1 exemplifies a typical "Ting" point or most distal point on the channel, lying just lateral to the base of the nail in densely neurovascular tissue. The microcirculatory network in this region offers an opportunity to deliver clinically relevant hemodynamic and temperature regulation through acupuncture treatment.

Clinical Relevance: As noted above in the section on LI 1 nerve supply, the rich arteriovenous supply of the distal finger produces profound autonomic shifts in hemodynamics and alertness, seemingly disproportionate to the vessels' sizes in this region.

Indications and Potential Point Combinations

- **Conditions of inflammation, hyperthermia, or sympathetic nervous system arousal, including heat stroke, fever, pharyngitis, tonsillitis, conjunctivitis:** LI 1, LI 4, LI 11, GV 14, ST 36.
- **Numbness of index finger:** LI 1, LI 2, LI 3, LI 4.
- **Coma:** LI 1, HT 9, consider other Ting points.

Evidence-Based Applications

- Bloodletting at LU 11 or LI 1 in children may prevent and treat **laryngospasm** occurring post-extubation.[6]
- Acupuncture at LU 9, and all the Ting points (LU 11, LI 1, PC 9, TH 1, HT 9, SI 1, KI 1, SP 1, LR 1, ST 45, GB 44, BL 67), as well as LI 4, CV 17, ST 36, ST 40, BL 58, SP 6, KI 7, and moxibustion at GV 14 resulted in rapid improvement in a 13-month old child with **staphylococcal-infected skin wounds** following a poor 50-day response to antibiotics.[7]

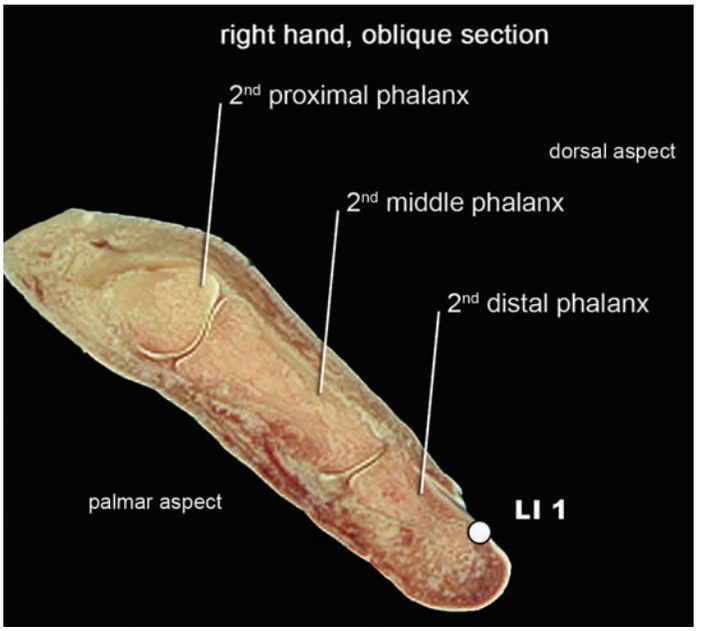


Figure 2-2. This section through the index finger shows the proper palmar digital artery coursing along the volar (palmar) surface toward the network of capillaries at the tip. LI 1, "Shang Yang," refers to the relation of this point to a Yang (hollow) organ and the metal phase, or element, both ideas from Chinese medicine. The association of organs and acupuncture points with the five phases (or elements) of metal, water, wood, fire, and earth is quaint but abstract and, as such, untestable.

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LI 2

Er Jian "Second Space"

On the radial side of the index finger, in a depression distal to the 2nd metacarpophalangeal joint, at the junction of the base and the shaft of the proximal phalanx, along the dorsal/palmar skin junction.

Tendons

• **First dorsal interosseous tendon:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and flex the metacarpophalangeal joints.

• **First lumbrical tendon:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.

• **Extensor digitorum tendon:** Extends the fingers at the metacarpophalangeal joints and the hand at the wrist.

• **Extensor indicis tendon:** Extends the index finger and helps extend the hand. Allows the index finger to operate independently of other fingers.

Clinical Relevance: Difficult or painful index finger movement; degenerative joint disease or other causes of arthralgia and arthrosis of the 2nd metacarpophalangeal joint, leading to tendinopathy; overuse syndromes.

Nerves

• **Radial nerve (C5-C8):** Supplies all muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of this deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm innervates the skin of the posterior the forearm to the wrist. The posterior antebrachial cutaneous nerve innervates the lateral arm, posterior forearm, and wrist.

• **Median nerve (C6-T1):** Gives motor function to the lumbrical muscles of the 2nd and 3rd digits and sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (i.e., thumb, forefinger, and middle finger), the radial aspect of the ring finger, and the adjacent palmar areas. The median nerve branches into the recurrent (thenar), lateral, medial, and palmar cutaneous nerves. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

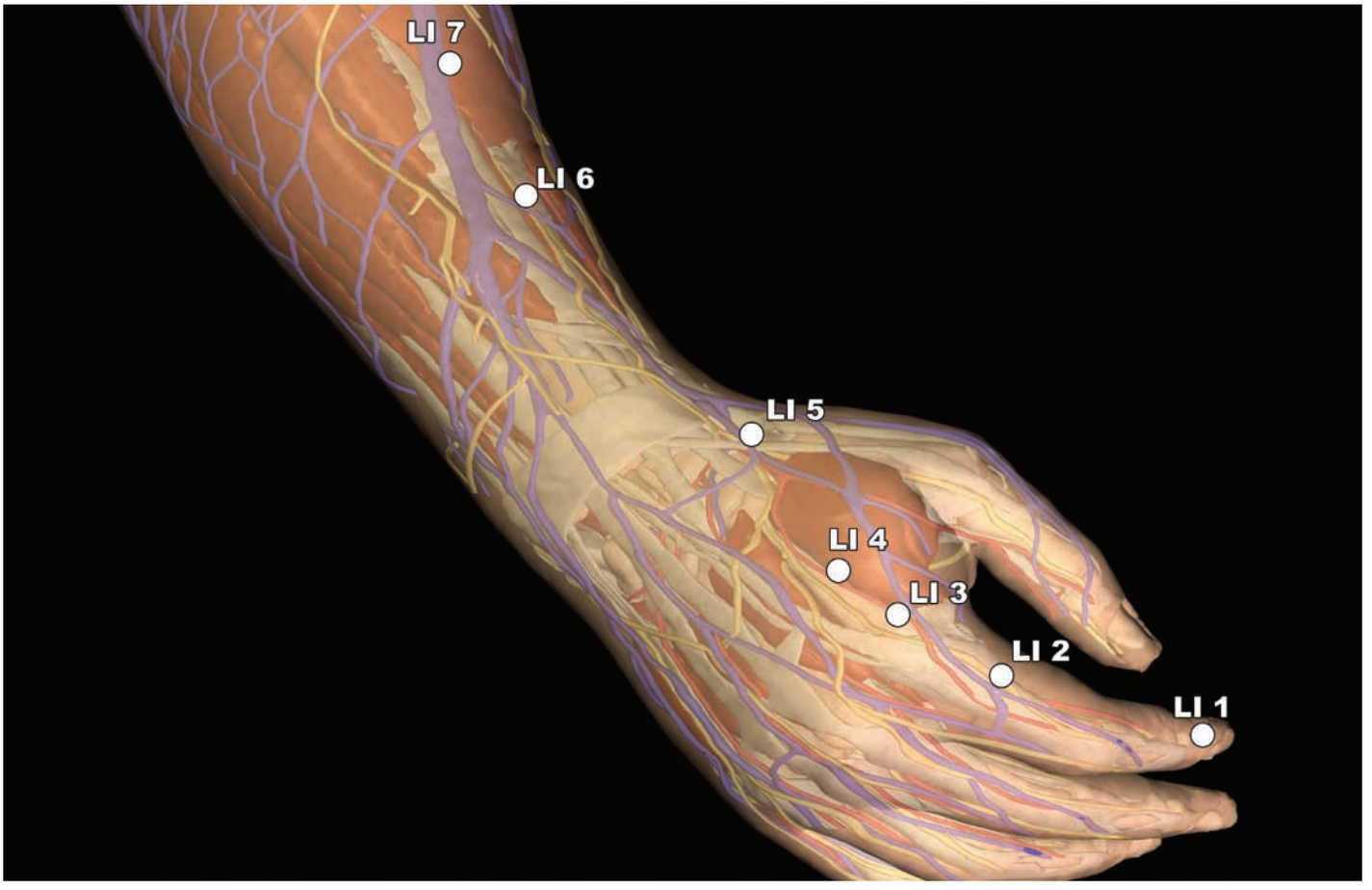

Figure 2-3. LI 2, "Second Space," the second point on the channel, sits at the metacarpophalangeal joint on the second (index) finger.

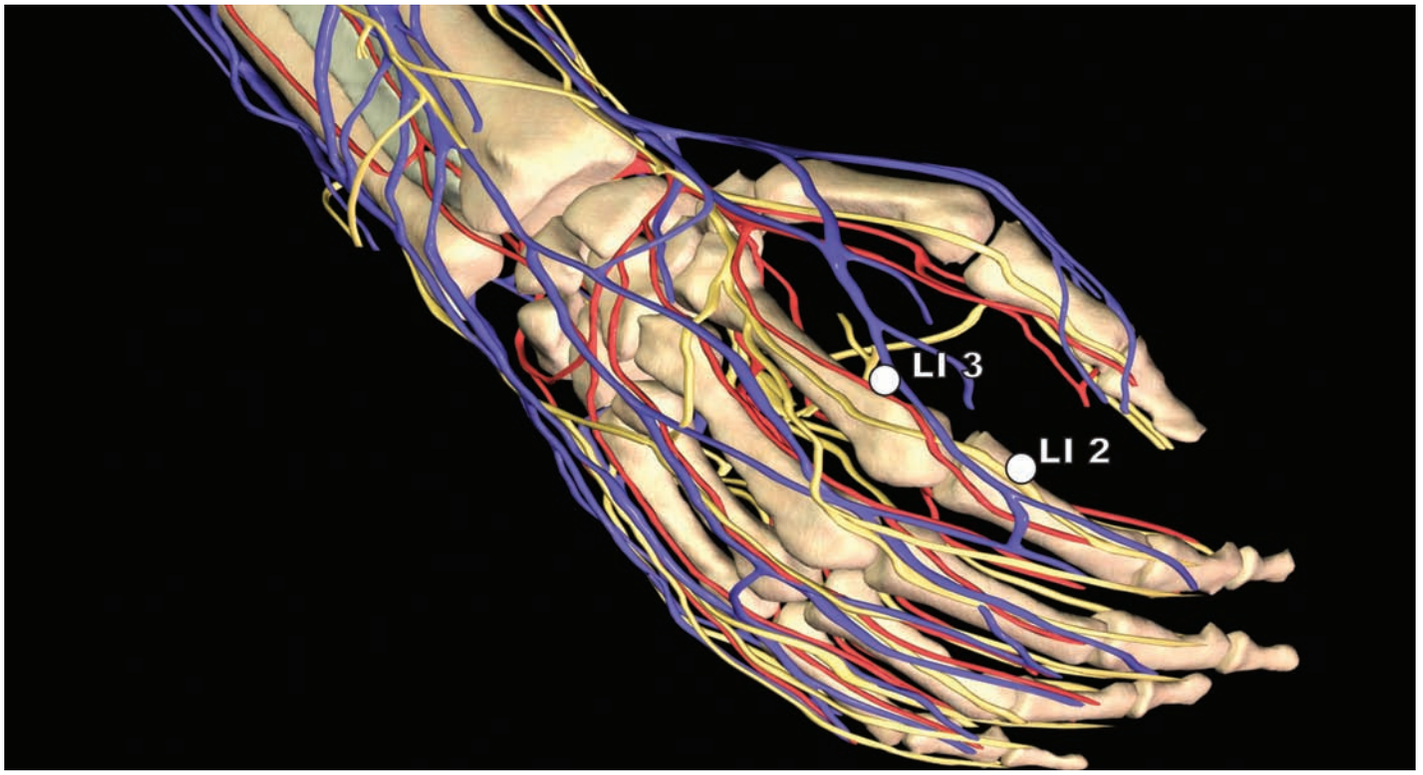

Figure 2-4. Both LI 2 and LI 3 treat local joint pain based on their periarticular locations. Their dense sympathetic and somatic sensory supply confer added effects on autonomic regulation.

Clinical Relevance: Carpal tunnel syndrome or other causes of median nerve entrapment; radial nerve injury, post-traumatic recovery of index finger injury; overuse syndromes involving the 2nd metacarpophalangeal joint.

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Radialis indicis artery:** Arises from either the radial artery or the princeps pollicis artery and passes along the radial aspect of the index finger.
- **Dorsalis indicis artery:** Supplies the dorsal radial aspect of the index finger.
- **Dorsal digital artery and vein:** Circulates blood to and from the fingertip, respectively.
- **Proper palmar digital artery and vein:** Distributes to the fingertip.

Clinical Relevance: Peripheral vascular disease affecting index finger mobility and/or tissue health.

Indications and Potential Point Combinations

- **Index finger arthralgia at the metacarpophalangeal joint:** LI 2, LI 3, LI 4.

Evidence-Based Applications

- Unilateral, manual acupuncture at LI 2 produced bilateral activation of the insula and operculum (sites in the brain associated with gustation and salivation) as well as improved saliva production compared to stimulation of a sham site.[1]

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LI 3

San Jian "Third Space"

On the radial side of the index finger, in a depression proximal to the 2nd metacarpophalangeal joint and head of the 2nd metacarpal bone, at the dorsal/palmar skin junction.

Muscles

• **First dorsal interosseous muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and flex the metacarpophalangeal joints.

• **First lumbrical muscle:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.

• **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints. Also flexes the proximal phalanges at the wrist and metacarpophalangeal joints.

• **Flexor digitorum profundus muscle:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.

Clinical Relevance: Difficult or painful index finger movement; restricted apposition of the thumb and forefinger (index finger); degenerative joint disease or other causes of arthralgia and arthrosis of the 2nd metacarpophalangeal joint, leading to tendinopathy; overuse syndromes.

Nerves

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

• **Median nerve (C6-T1):** Innervates all of the thenar muscles, except for the adductor pollicis and deep head of the flexor pollicis brevis. Supplies the lumbrical muscles for the 2nd and 3rd digits and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), the radial aspect of the ring finger, and the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

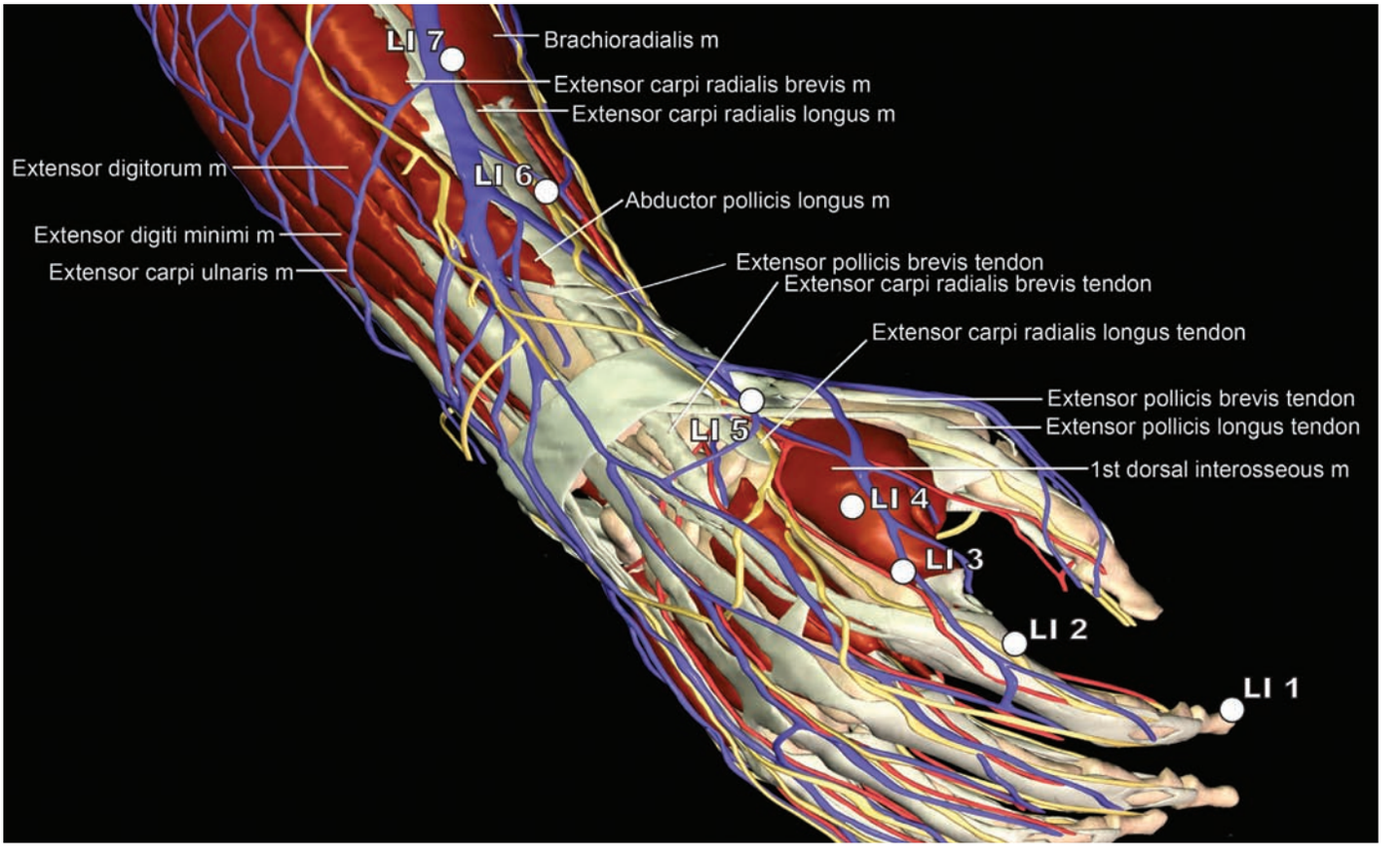

Figure 2-5. LI 3, "Third Space," identifies this third point on the LI channel.

• **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles, i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It splits into four branches: the palmar cutaneous, dorsal, superficial, and deep branches of the ulnar nerve. The palmar cutaneous branch supplies the skin overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring fingers. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal little finger, the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), as well as the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Carpal tunnel syndrome or other causes of median nerve entrapment; radial nerve injury, post-traumatic recovery of index finger injury; overuse syndromes involving the 2nd metacarpophalangeal joint; dysfunction of intrinsic muscles of the hand from ulnar or median neuropathy.

Vessels

• **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.

• **Radialis indicis artery:** Arises from the radial artery or the princeps pollicis artery and passes along the radial aspect of the index finger.

• **Dorsalis indicis artery:** Courses along the dorsal radial aspect of the index finger.

Clinical Relevance: Peripheral vascular disease affecting index finger mobility and/or tissue health.

Indications and Potential Point Combinations

• **Index finger arthralgia at the metacarpophalangeal joint:** LI 3, LI 2, LI 4.

LI 4

He Gu "Union Valley"

On the dorsum of the first interosseous space of the hand, closer to the index finger than the thumb, at the midpoint of the shaft of the 2nd metacarpal bone, in the belly of the first interosseous dorsalis muscle. The point occurs at the highest part of the muscle bulge when the thumb and index finger are squeezed together. Take LI 4 at the point where the bulge is level with the end of the crease.

Caution when treating pregnant women!

Muscles

• **First dorsal interosseous muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and to flex the metacarpophalangeal joints.

• **First lumbrical muscle:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.

• **Adductor pollicis muscle:** Adducts the thumb toward the middle finger.

• **Extensor pollicis longus tendon:** Extends the distal phalanx of the thumb at the metacarpophalangeal joint and the interphalangeal joint.

Clinical Relevance: Complaints of thumb pain and arthritis may develop not only due to joint degeneration, but also myofascial trigger points in the thumb movers (i.e., flexors, extensors, abductors, adductors). Thus, one should employ scientific, medical acupuncture and related techniques (SMARTs) to address soft tissue restriction and trigger point pathology that limits motion from a regional perspective as well as treat pain and tenderness locally.

Nerves

• **Radial nerve (C5-C8):** Supplies all the muscles in the dorsal brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the dorsal forearm to the wrist. The posterior antebrachial cutaneous nerve supplies the skin of the lateral brachium, dorsal antebrachium, and wrist.

• **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. Its four terminal nerves include: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin overlying the carpal bones on the ulnar

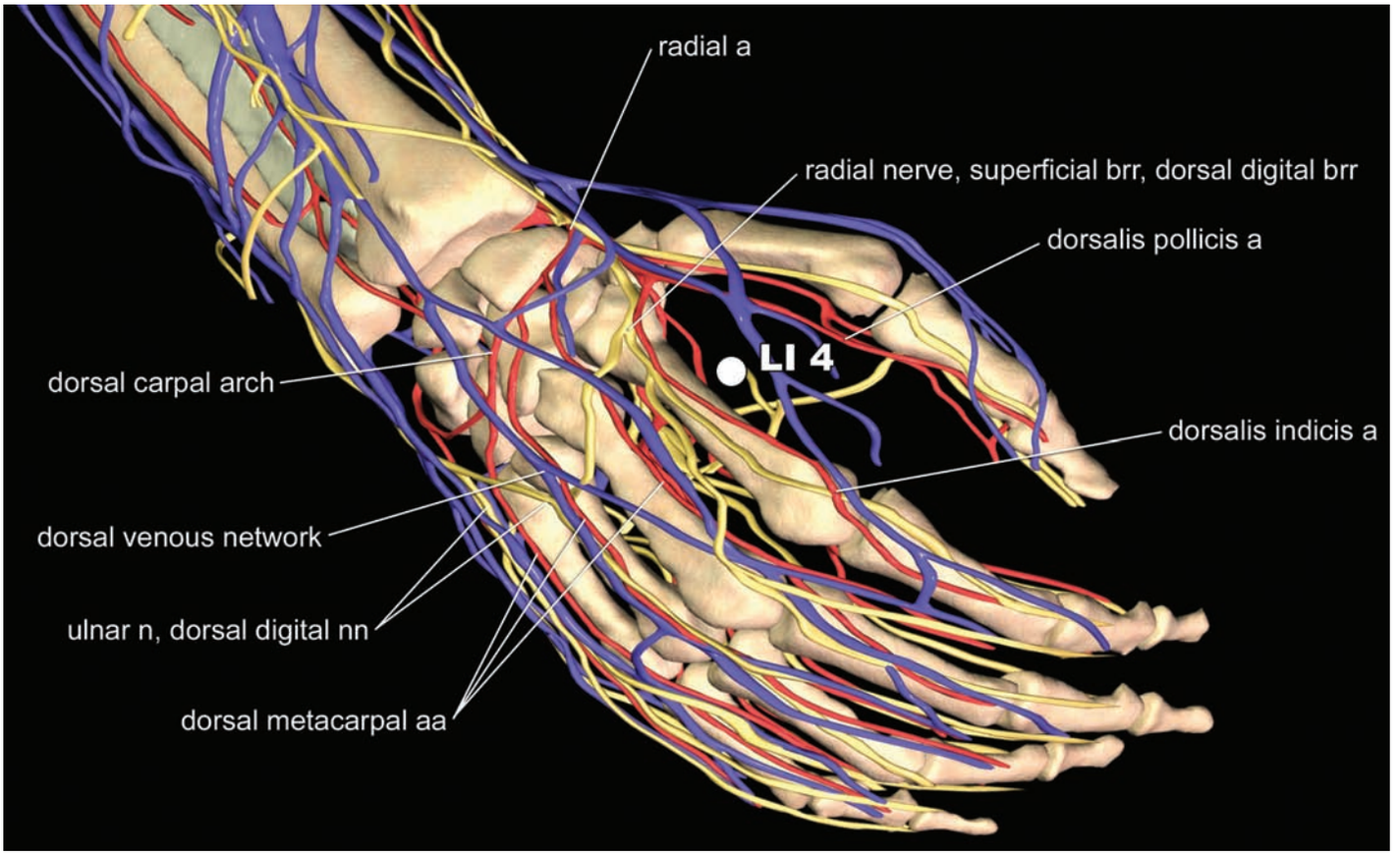

Figure 2-6. LI 4 sits midway along the radial aspect of the shaft of the second metacarpal bone, seen here, and also in the mid-belly of the first dorsal interosseous muscle, as shown in Figure 2-7. The name "Hegu" refers both to a mountain metaphorically formed when approximating the thumb and forefinger. "Hegu" also means "Union Valley," for the dip that develops by pulling those digits apart.

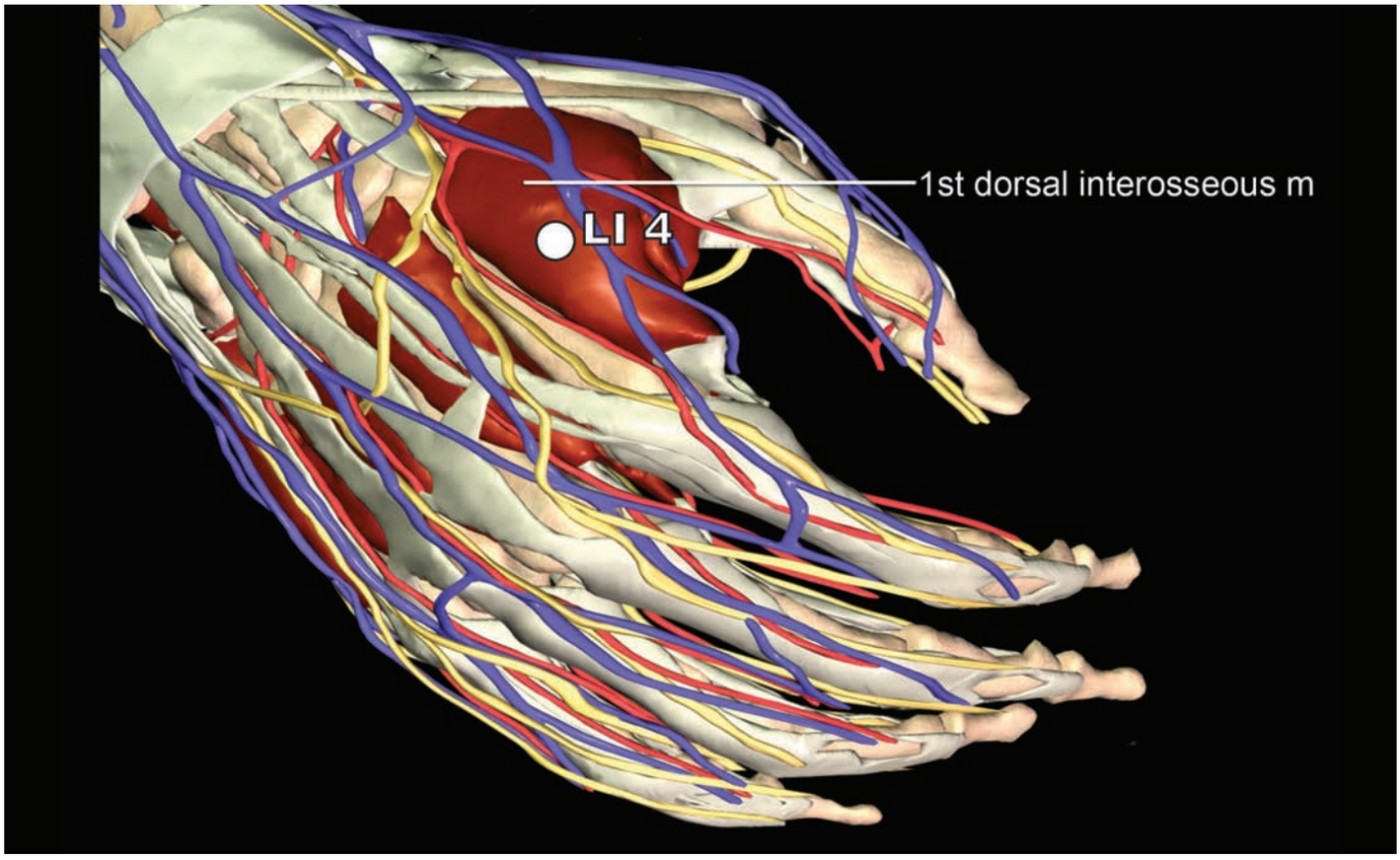

Figure 2-7. The fleshy first dorsal interosseous muscle provides a suitably large target for this highly regarded acupuncture point.

side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle and sensation to the skin of the palmar and distal dorsal aspects of the little finger, the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), along with the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

• **Median nerve (C6-T1):** Innervates all thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Supplies the lumbrical muscles for the 2nd and 3rd digits and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), the radial aspect of the ring finger, and the adjacent palmar areas. Four terminal median nerves include the recurrent (thenar), lateral, medial, and palmar cutaneous branches. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

• **A note about sympathetic fibers:** The brachial plexus conveys sympathetic and sensory fibers to the lower two-thirds of the brachial artery and all of its branches. Near their destination, these fibers exit the nerve and course through connective tissue to the vessel.

• As described more fully below, distal vessels are more densely innervated than are proximal ones. This, in part, accounts for the stronger autonomic responses associated with distal acupuncture points, especially those at the ends of the channels. Nearly all endpoints land adjacent to the base of the nail of fingers and toes. The Chinese call these "Ting" points.

• Specifically, the proximal third of the brachial artery receives its sensory and sympathetic nerves from the radial, median, and musculocutaneous nerves, as does the posterior humeral circumflex artery. The middle third of the brachial artery carries fibers mainly from the medial and musculocutaneous nerves, with some filaments possible from the radial and ulnar nerves. The distal third of the brachial artery is supplied by the median and musculocutaneous nerves, whereas the profunda brachii artery is innervated by fibers from the radial nerve.

• The superior and inferior ulnar collateral arteries receive sensory and sympathetic input from the median nerve.

• As arteries travel toward the fingers, their sympathetic and sensory nerve supply intensifies. That is, more sensory and sympathetic nerve fibers attach to blood vessels per unit area in distal, as opposed to proximal, segments.

• In the forearm, the vasculature's sympathetic and sensory fibers emit from the radial, medial, ulnar nerves, and antebrachial cutaneous nerves.

Specifically:

Radial artery: The proximal third of the radial artery receives input from the median nerve and the lateral antebrachial cutaneous nerves. The radial recurrent artery receives nerve fibers from the deep branch of the radial nerve and the lateral

antebrachial cutaneous nerves. Innervation of the mid-portion of the radial artery is thought to be minimal. The distal third of the radial artery receives fibers from the superficial branch of the radial nerve, the lateral antebrachial cutaneous nerves, and possibly the median nerve.

Ulnar artery: The median nerve innervates the upper third of the ulnar artery and the ulnar recurrent artery. The ulnar nerve sends sensory and sympathetic fibers to the mid-portion of the ulnar artery. The ulnar nerve and the medial antebrachial cutaneous nerve supply the distal third of the ulnar artery. The palmar interosseous nerve supplies the palmar interosseous artery. **Arteries of the Hand:** The deep palmar arterial arch is innervated by the deep branch of the ulnar nerve. The superficial palmar arterial arch receives a rich nerve supply from the common digital nerve branches of the ulnar and median nerves. **The proximity of LI 4, HT 8, and PC 8 to the arterial arches of the hand explains, at least in part, their notable autonomic influences.** Each proper digital nerve innervates its accompanying artery comparable to its nerve supply of the skin. **Effects of sympathetic activation:** Sympathetic fibers provide control over both vasoconstriction and vasodilation. The largest arteries of the upper limb (subclavian and axillary) contain few vasomotor fibers. Distal vessels, in contrast, have many vasomotor fibers, as mentioned previously. Increased sympathetic drive from emotions, hemorrhage, or cold provokes vasoconstriction. Sympathetic nerves contain some vasodilator fibers; the fingers carry more vasodilator sympathetic fibers than do the toes. (Parasympathetic cholinergic vasodilator fibers, on the other hand, innervate the arteries of the external genitalia and the pial arteries of the brain.)

• The intimate anatomical relationships between nerves and blood vessels raises the question of which depends on the other during development; i.e., do nerves follow vessels or do vessels follow nerves? A series of experiments reported in 2002 suggested that peripheral nerves secrete vascular endothelial growth factor (VEGF) and thereby outline the pattern of blood vessel branching and arterial differentiation in the skin.[49]

Clinical Relevance: The plurality of nerves congressing near or around LI 4 justify the point's major significance in acupuncture. Every nerve reaching the hand supplies structures located in the vicinity of this point, including the median, radial, ulnar, and sympathetic nerves. This neural diversity reflects the multiplicity of clinical applications, from motor dysfunction to sensory disturbances, as well as from local dysregulation of vasomotor tone to upper body dysautonomia.

Vasoregulation determines how much blood reaches tissues. Periarterial autonomic nervous plexuses alter arterial tone, aided by endothelium-dependent, myogenic, and humoral mechanisms. Defects in hemodynamic homeostasis cause dysfunctional thermoregulation, abnormal blood pressure, and insufficient redirection of flow to the heart and brain under stress states such as hypoxia.[50] VEGF, along with a host of neurotransmitters, neuropeptides, and neurotrophins, orchestrate the regulation of vessel diameter through periarterial nerves.

Vessels

• **Double (superficial and deep) palmar arch:** An arterial and venous network in the palm; each has a superficial and deep loop, formed by the terminating ulnar and radial arteries and veins.

• **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.

• **Radialis indicis artery:** Arises from the radial artery or the princeps pollicis artery and passes along the radial aspect of the index finger.

• **Dorsalis indicis artery:** Courses along the dorsal radial aspect of the index finger.

Clinical Relevance: Vasculature near LI 4 not only feeds and drains the tissues at the site, but also affects autonomic tone system-wide. Bidirectional signaling between periarterial sympathetic nerve fibers and vascular smooth muscle cells govern local circulation in the hand. Neuromodulation through acupuncture (and activation of a panoply of peripheral, central, and autonomic reflex arcs) thus extends to hemodynamic regulation, opening up an entirely new domain of neuro-effector sites accessible to acupuncture. Disease states characterized by altered neuro-effector function include Raynaud's phenomenon, migraine, orthostatic hypotension, essential hypertension, and congestive heart failure.[51]

Indications and Potential Point Combinations

• The far-reaching influences of LI 4 on brain function, autonomic activity, cervicothoracic spinal cord reflexes and, secondarily, trigeminal nerve actions create a long list of neuromodulatory changes promoted by this popular acupuncture point, most widely recognized as a treatment for headache.

• **Headache:** Trigeminal origin (face, teeth, rostral dura) – LI 4, local tender points on the face or scalp, BL 10, GV 20. Cervical origin (occipitofrontalis tension, neck pain in conjunction with head pain): LI 4, BL 10, GB 21, GB 20, GV 20, other tender points in the cervicothoracic region.

• **Dental and oral pain:** LI 4, LU 7, ST 7, CV 24, BL 10.

• **Urticaria and skin problems:** LI 4, LI 11, LI 10, ST 36, GV 14.

• **Nose and throat disorders:** tonsillitis, pharyngitis, epistaxis, rhinitis, sinusitis: LI 4, LU 7, ST 9, CV 23. For frontal sinusitis, add BL 2, GB 14, BL 3. For maxillary sinusitis, add ST 3.

• **Conjunctivitis and eye problems:** LI 4, TH 23, GB 2, BL 2.

• **Delay of menses ("menstrual block"):** LI 4, SP 6, ST 36.

• **Arm and hand pain or restricted movement:** LI 4, identify painful or dysfunctional muscles and nerves. Consider Baxie (web spaces between the fingers) to promote nerve communication to the digits. Examine paraspinal points for tenderness or linkage to dysfunction in order to impact relevant spinal cord segments in the cervicothoracic cord. First dorsal interosseous referred pain extends to the radial aspect of the index finger and secondarily the dorsum of the hand and palmar surface of the index finger as well as the palm itself.

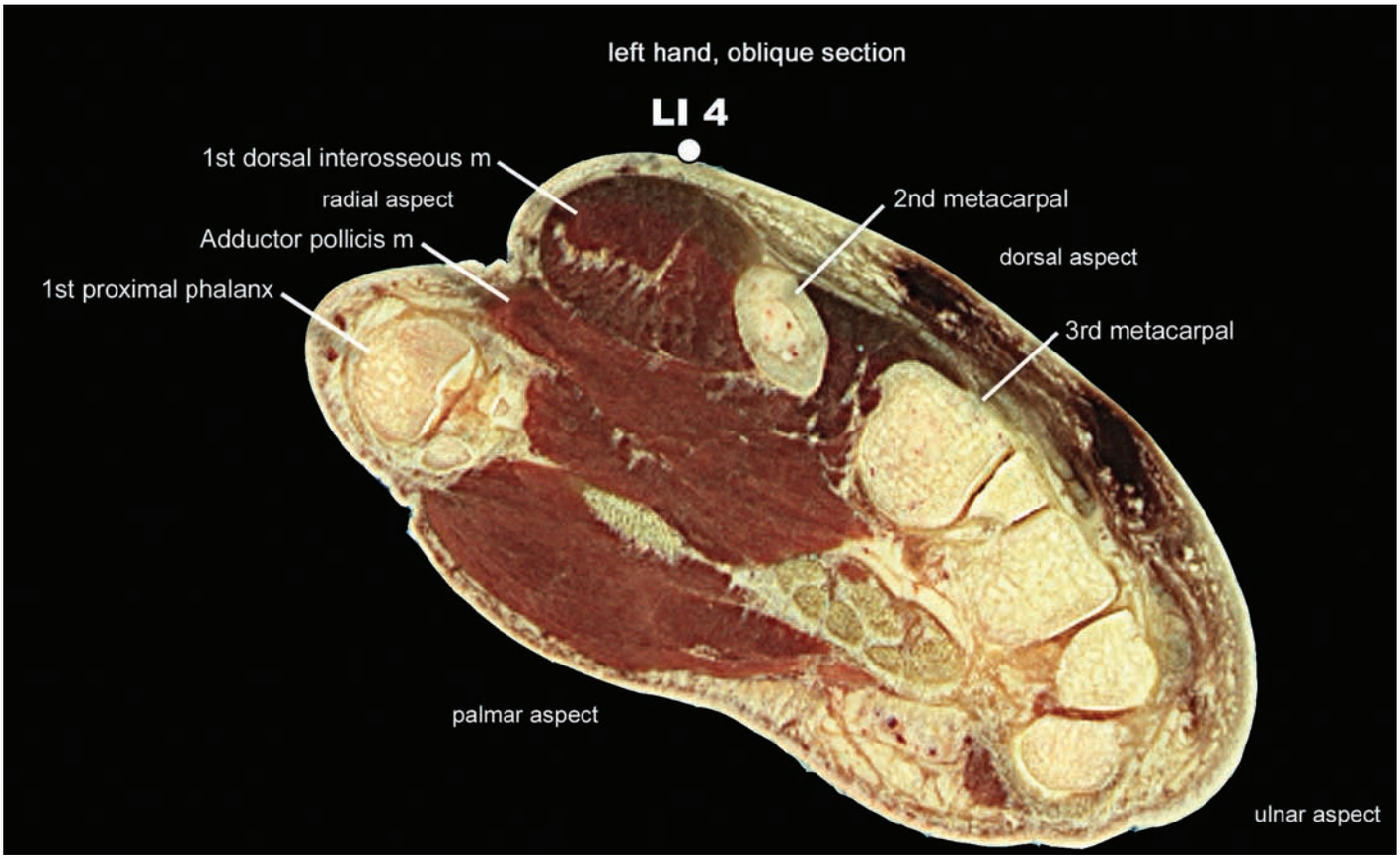

Figure 2-8. This image depicts the roundish nature of the first dorsal interosseous muscle, exhibiting the depth and potential resistance it would deliver to an acupuncture needle.

Evidence-Based Applications

• Both manual acupuncture and low-frequency EA to LI 4, ST 4, ST 7, ST 36, HT 7, SP 6, and KI 5 caused significant increases in local blood flow overlying the parotid gland, suggesting a mechanism for increased salivary flow in **xerostomia** patients.[1]

• Electroacupuncture at LI 4 and SI 3 produce significant **changes in skin temperature** of the hand.[2,3]

• Acupuncture at LI 4 and LI 10 had a **modulatory effect on skin blood flow and heart rate.**[4]

• Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with **kerato-conjunctivitis sicca** (KCS, or dry eye).[5]

• Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an **increase in the local blood flow in the skin over the parotid gland** in patients with Sjögren's syndrome.[6]

• Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **KCS**.[7]

• Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus**.[8]

• Acupuncture at LI 4 and SP 6 can **shorten** the time interval between estimated date of confinement (EDC) and **actual delivery time**. Helps **support cervical ripening**.[9]

• Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[10]

• Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6 plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome)**.[11]

• Acupuncture at SP 6 and LI 4 was shown to **increase cervical dilatation** without causing changes in human chorionic gonadotropin (HCG).[12]

• Acupuncture at LI 4 reduced the level of expression of COX-2 enzyme in uterine endometrium and myometrium in pregnant and nonpregnant rats. Acupuncture at LI 4 also **reduced uterine motility** in pregnant rats, supporting the suggestion that LI 4 acupuncture inhibits the expression of COX-2 enzyme and may be useful in regulating complicated preterm labor.[13]

• Acupressure at LI 4 and BL 67 significantly **decreased labor pain** during the active phase of the first stage of labor.[14]

• Electroacupuncture at LI 4 and LU 6 **normalized the pattern of leukocytes**, and decreased heart rate.[15]

• Case series reported electroacupuncture at GB 14, SI 18, ST 7, GB 20, and LI 4 was effective treatment for peripheral **facial paralysis**.[16]

• Electroacupuncture at LI 4, LU 7, GV 14, GV 20, the thoracolumbar midline point San Tai and the lumbosacral midline point Baihui (veterinary) demonstrated a reduction of minimum alveolar concentration (MAC) of isoflurane by 16.7% in dogs. Acupuncture-assisted anesthesia thus **potentiated the anesthetic effects of volatile anesthetic agents**.[17]

• LI 4, CV 21, and CV 22 **improved cancer-related breathlessness**.[18]

• Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[19]

• Laser acupuncture significantly outperformed sham laser for the treatment of mild to moderate **depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[20]

• Acupuncture stimulation of LI 4 and PC 6 **modulates heart rate variability** differently under fatigue or non-fatigue states.[21]

• Acupuncture at LI 4 **modulates cortical excitability**.[22]

• Pain relief following acupuncture at LI 4 may relate at least in part to decreased regional cerebral blood flow in the putamen.[23]

• Acupuncture at LI 4, LR 3, and PC 6 inhibited sympathetic activation during mental **stress** in advanced heart failure patients.[24]

• Acupuncture at LI 4 and ST 36 activated the hypothalamus and nucleus accumbens. Both of these brain structures are important in mediating acupuncture analgesia. Acupuncture at LI 4 and ST 36 deactivated areas within the limbic system, including the rostral part of the anterior cingulate cortex, amygdala formation, and hippocampal complex. **Limbic deactivation** may play a role in acupuncture analgesia by affecting pain perception – in particular, its affective-cognitive aspect.[25]

• Acupuncture of LI 4 **activated the hypothalamus** (thought to be a key neural substrate mediating acupuncture analgesia), the insula (a cortical region integrating critical functions including visceral sensory, visceral motor, motor association, vestibular, and language activities), the anterior cingulate cortex (possibly involved in mediating the de qi phenomenon), and the cerebellum (interconnected to the hypothalamus by both direct and indirect pathways).[26]

• LI 4 deactivated the nucleus accumbens, amygdala, hippocampus, parahippocampus, hypothalamus, ventral tegmental area, anterior cingulate gyrus, caudate, putamen, temporal pole, and insula, while it caused activation of the somatosensory cortex. This suggests that the complex mechanisms of acupuncture may involve **modulation of activity of subcortical structures**.[27]

• Acupuncture at LI 4 **modified somatosensory evoked potentials**.[28]

• Acupuncture at LI 4, ST 36, SP 6, and SP 9 **reduced discomfort and anxiety** in patients undergoing **colonoscopy**.[29]

• Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with **irritable bowel syndrome**.[30]

• Transcutaneous electrical nerve stimulation (TENS) at LI 4, LU 10, BL 57, and ST 36 effectively **reduced rectal hypersensitivity** in diarrhea-predominant irritable bowel syndrome.[31]

• Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully **treated sleep-related laryngospasm with gastroesophageal reflux**, refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[32]

• Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma** patients.[33]

• Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis** (tennis elbow).[34]

• A controlled trial found "aqueous acupuncture" at LI 4 and GB 34 effective for the treatment of **postoperative pain**.[35]

• Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders**, prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[36]

• Acupuncture and acupressure may be helpful in reducing **orthodontic post-adjustment pain**.[37]

• A randomized, placebo-controlled trial suggested that treatment with laser acupuncture at LU 7, LI 4, GB 14, and GB 20 benefits **chronic tension headache**.[38]

• Unilateral acupuncture for advanced **osteoarthritis of the knee** was effective as bilateral acupuncture, using SP 9, SP 10, ST 34, ST 36, and LI 4 on the ipsilateral hand.[39]

• Acupuncture at LI 4 and PC 6 effectively treated **acute postoperative pain** in a patient with pregnancy-induced thrombocytopenia.[40]

• Acupuncture at LI 4 and PC 6 **increased pain threshold and pain tolerance** in the skin over the thyroid.[41]

• Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in **prophylaxis of migraine** compared to flunarizine.[42]

• Acupuncture at LR 3, SP 6, LI 4, GB 20, GV 20, and Taiyang outperformed transcutaneous electrical nerve stimulation and laser therapy in **reducing the frequency of migraine**, although all three treatments were effective.[43]

• Acupuncture at LI 4, ST 6, ST 7, and TH 17 was superior to placebo for the prevention of **postoperative dental pain**.[44]

• A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 7, ST 6, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders**.[45]

• Acupuncture at LI 4 provided significant short-term pain reduction in **chronic orofacial pain**.[46]

• Electroacupuncture (at ST 29 and TH 5 to LI 4) with manual acupuncture at GV 20 and ST 36 serve as an effective **analgesic during oocyte aspiration**; these analgesic effects equal those of conventional analgesics.[47] Neuropeptide Y (NPY) concentrations in follicular fluid were higher in the electroacupuncture group than in the medication group; NPY may be important for human ovarian steroidogenesis.[48]

• Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with chronic **low back pain**.[49]

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LI 5

Yang Xi "Yang Ravine"

On the radial side of the wrist, distal to the tip of the styloid process of the radius, in a depression that appears between the tendons of the extensor pollicis longus and brevis muscles, when the thumb is extended, in the anatomical snuff box. Avoid needling the radial artery and the cephalic vein.

Anatomical Snuff Box (Tabatière Anatomique)[1]

• A narrow triangular area associated with the following geometry and structures:

Radial side: Extensor pollicis brevis tendon
Ulnar side: Extensor pollicis longus tendon
Base: Distal edge of the extensor retinaculum
Bony floor: Distal radius, scaphoid, trapezium, and proximal end of the first metacarpal bone.
Neurovascular contents: Superficial radial nerve branches. Radial artery with a dorsal carpal branch and venae comitantes. Tributaries of the cephalic vein. Connections between the cephalic vein and the venae comitantes of the radial artery may exist within the anatomical snuff box.

Clinical Relevance: Structures inhabiting the anatomical snuff box may suffer iatrogenic injury following surgery (e.g., distal radius fixation) or intravenous catheterization of the distal cephalic vein.[2] Resultant morbidity may respond to acupuncture and related techniques implemented with the goal of reducing inflammation, scarring, and pain while normalizing circulation.

Tendons

• **Extensor pollicis brevis tendon:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.

• **Extensor pollicis longus tendon:** Extends the distal phalanx of the thumb at the metacarpophalangeal joint and the interphalangeal joint.

• **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.

Clinical Relevance: Iatrogenic injury, overuse syndrome, wrist sprain, tendinitis, weakness in the wrist.

Nerves

• **Posterior interosseous nerve (C7, C8):** The terminal branch of the deep branch of the radial nerve, the posterior interosseous nerve supplies the extensor digitorum, extensor digiti minimi, extensor carpi ulnaris, abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, and extensor indicis muscles.

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm

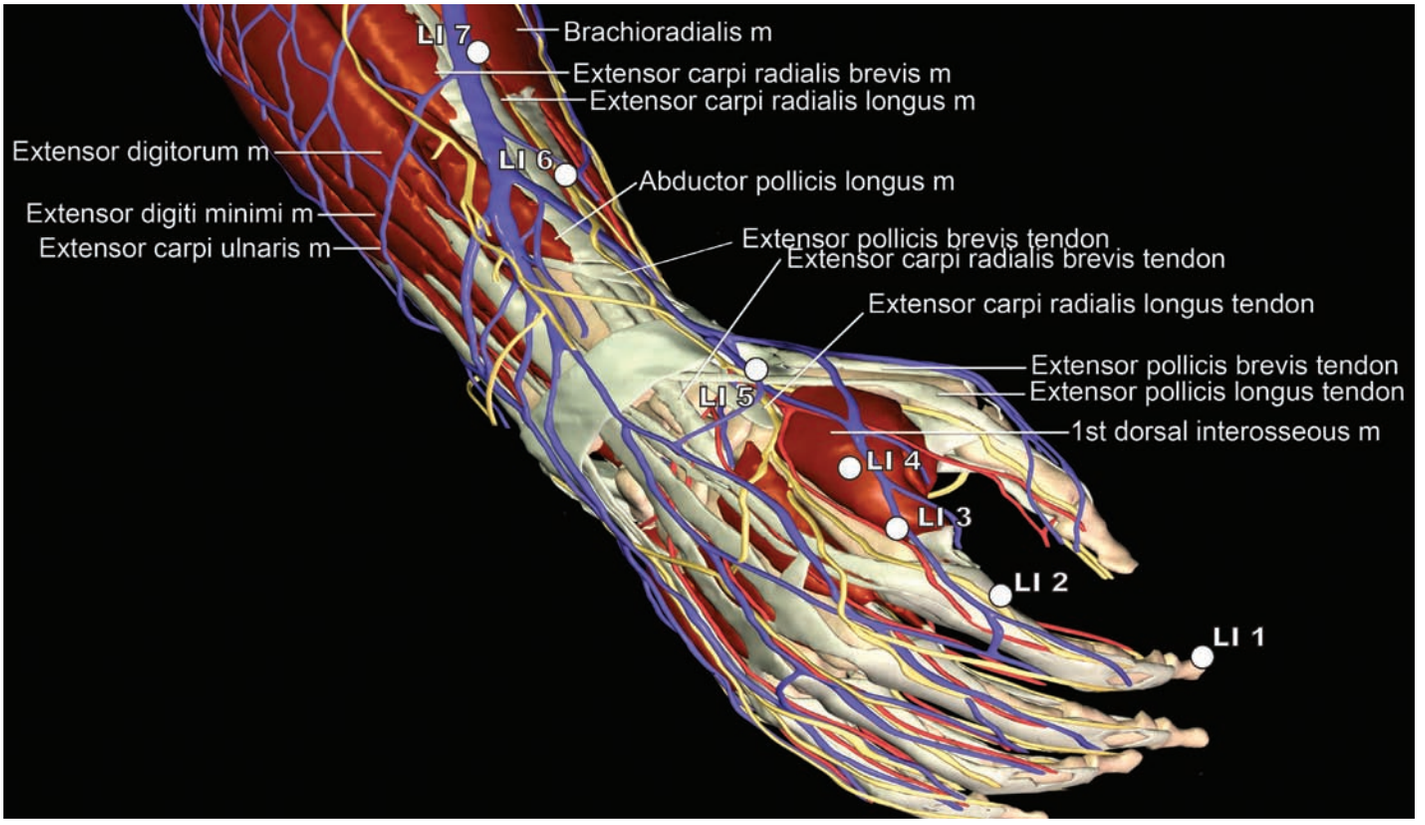

Figure 2-9. This image shows the tendinous borders (the extensor pollicis brevis and longus tendons) of the anatomical snuff box, between which LI 5 nestles. This alley on the dorsal (Yang) surface connotes a stream, hence the name "Yang Ravine."

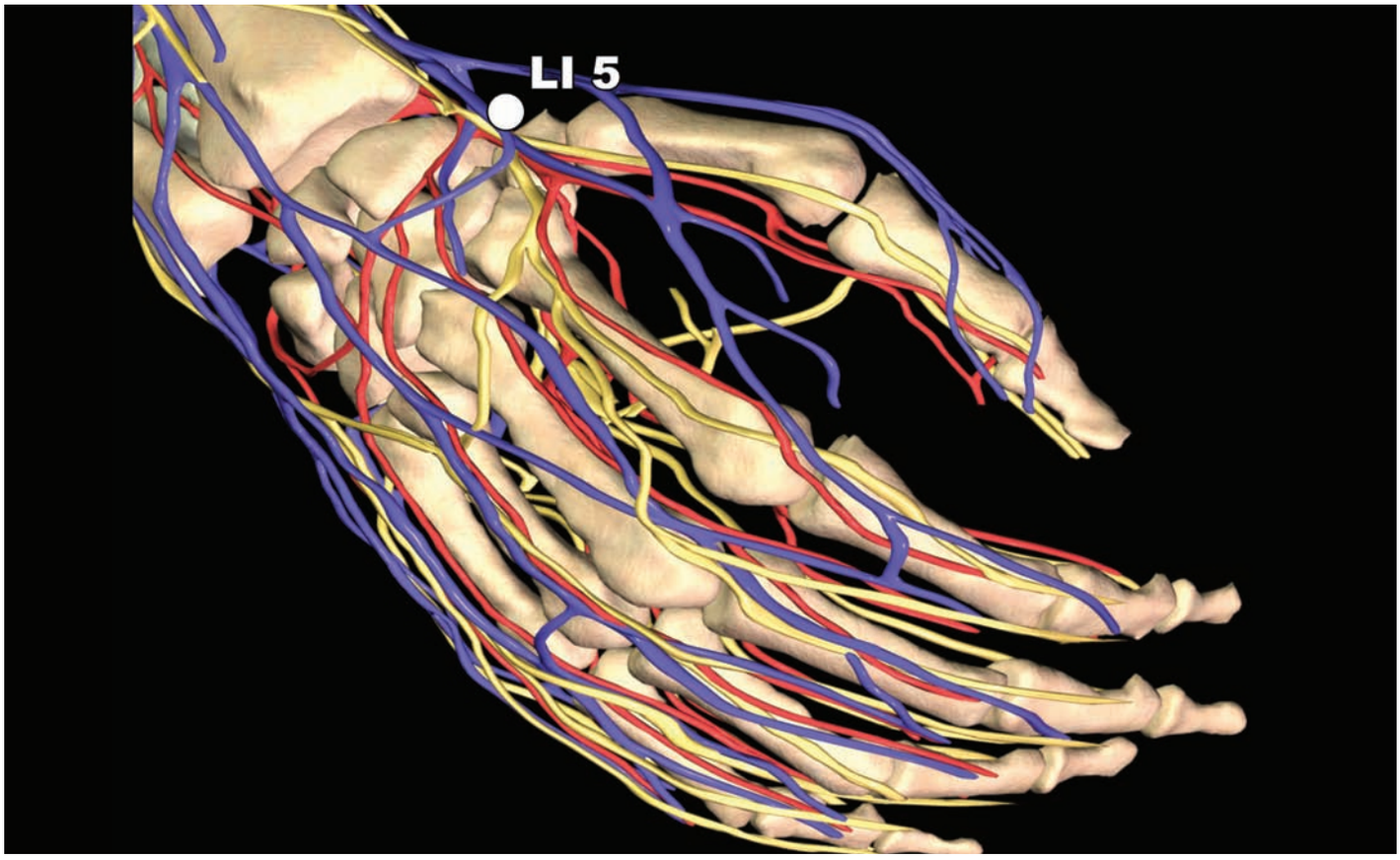

Figure 2-10. The "anatomical snuff box" or "tabatière anatomique" provides a basin that coddles the radial artery and its dorsal carpal branch, tributaries of the cephalic vein, and branches of the superficial radial nerve.

and posterior forearm and wrist.

Clinical Relevance: Iatrogenic injury, neuropathic pain, sensory loss, compressive neuropathy of the superficial branch of the radial nerve by dorsal wrist ganglion or other structures.

Vessels

• **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.

• **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

Clinical Relevance: Trauma to the radial artery may produce an aneurysm in the anatomical snuff box.[3] Injury to the distal radial artery at this site may lead to digital emboli to the thumb and forefinger.[4]

Indications and Potential Point Combinations

• Extensor pollicis brevis or longus tendinitis, deQuervain's tenosynovitis: LI 5, LI 6, LI 10, LU 7, LU 10.

Evidence-Based Applications

Acupuncture at LI 5 in dogs produced a sympathomimetic effect similar to atropine in dogs with sinus arrhythmia and pulsus alternans.[5]

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LI 6

Pian Li "Veering Passageway"

On the radial side of the dorsal antebrachial region, 3 cun proximal to the dorsal wrist crease, or one-fourth the distance from LI 5 to LI 11, along the line that connects them. Divide the distance between LI 5 and LI 11 in half, and then halve the distance between LI 5 and the midpoint.

Muscles and Tendons

• **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.

• **Extensor carpi radialis brevis tendon:** Extends and abducts the hand at the wrist.

• **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Trigger points referring to the wrist, thumb, or hand; local discomfort.

Nerves

• **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

• **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

• **Local pain or neuralgia:** LI 6, LI 4, LI 10, other local points that

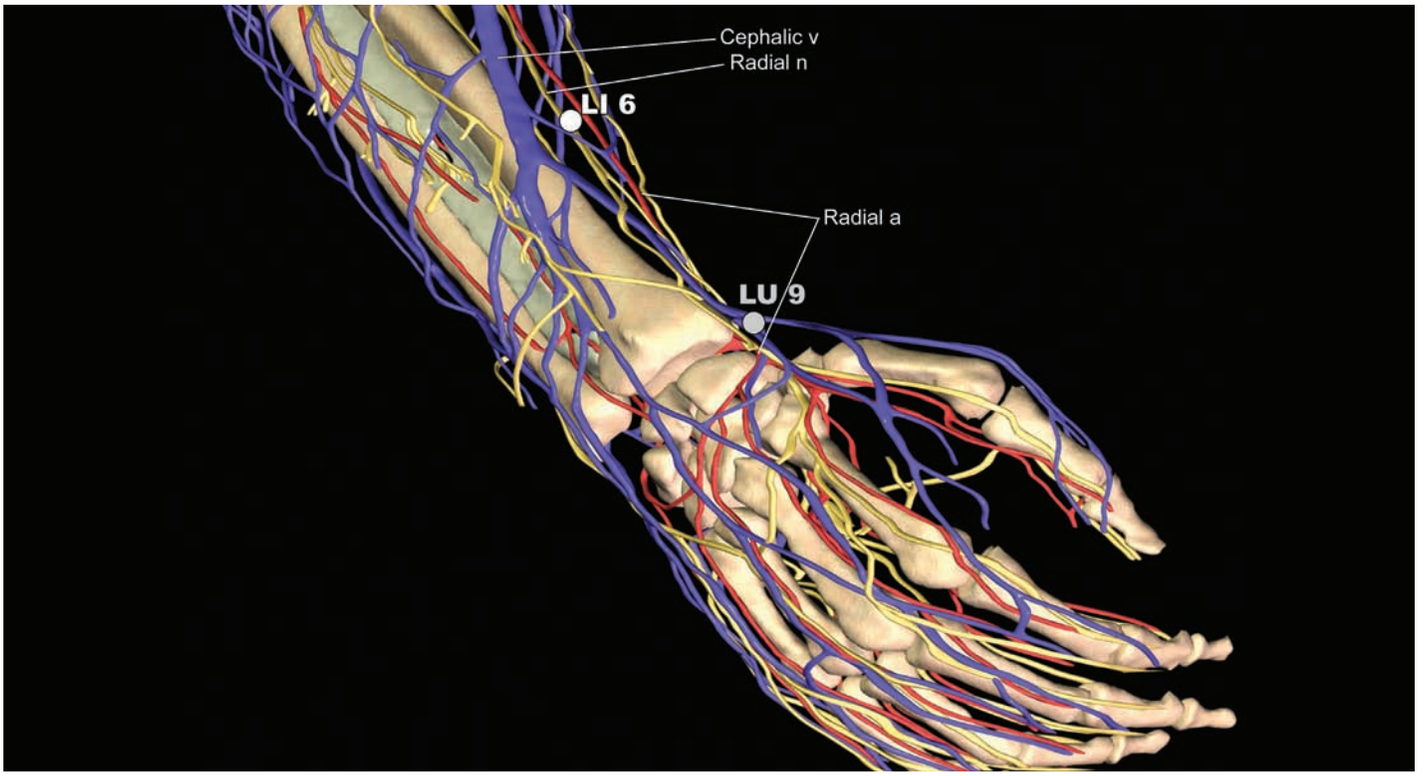

Figure 2-11. This neurovascular view of LI 6 reveals the anatomic underpinning of the Chinese medicine "Luo-Yuan" connection. That is, the Traditional Chinese Medical (TCM) approach to acupuncture asserts that connections exist between certain points on coupled channels. TCM practitioners classify these shunting points as "Luo" and "Yuan" and describe their job as one of shifting "energy" between Yang and Yin "meridians" (a term employed to describe energy pathways) or vice versa. Scientifically based medical acupuncturists, on the other hand, acknowledge the anatomic and neurovascular foundations of acupuncture, in keeping with the original viewpoint by the Chinese that acupuncture pathways constituted blood vessels and associated neural elements. As such, this beautifully portrayed neurovascular connection between LU 9 and LI 6 serves as an example of the anatomical basis of acupuncture. The Chinese name for LI 6 means "Veering Passageway" and refers to the detour taken by these structures toward the thumb.

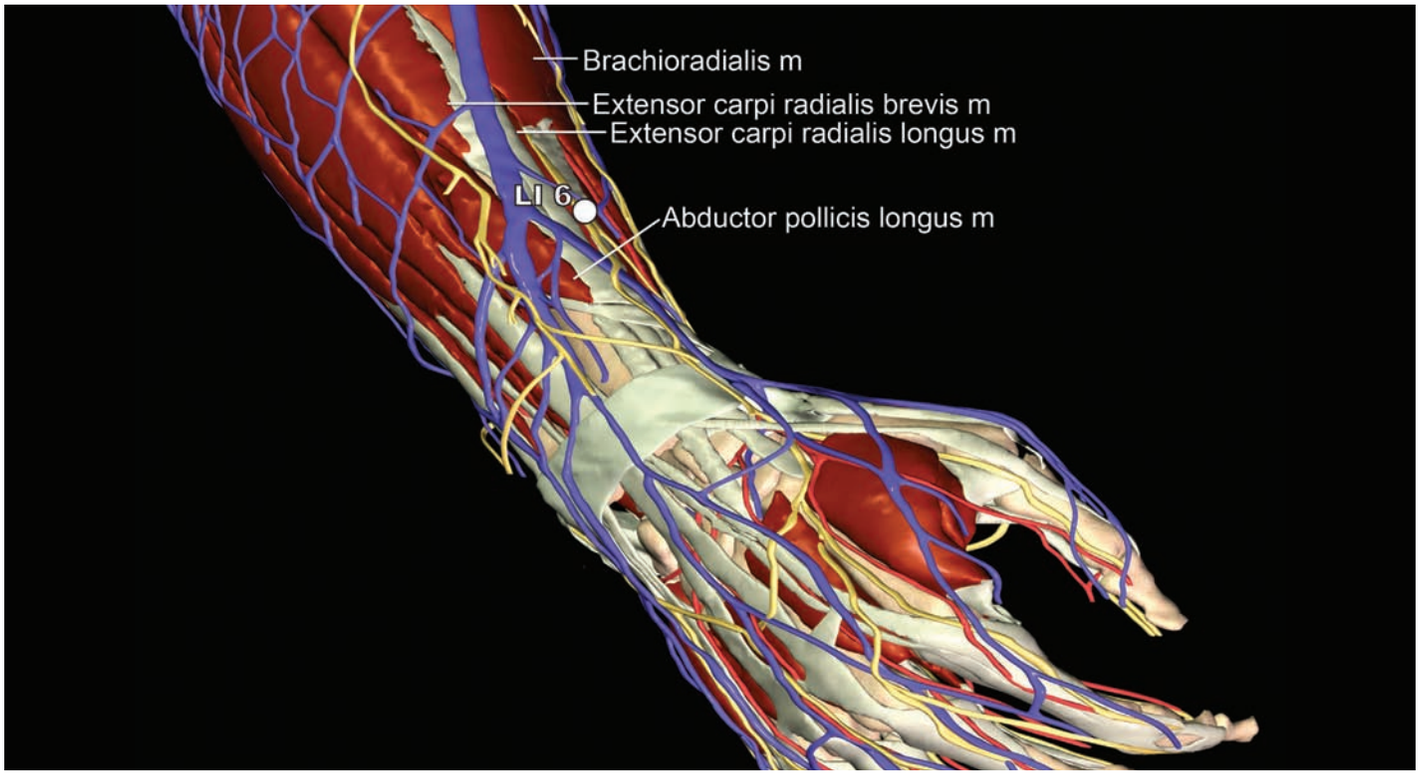

Figure 2-12. This image depicts the muscles local to LI 6 and highlights the indications of LI 6 for myofascial dysfunction affecting the elbow, antebrachium, and wrist.

exhibit tenderness to palpation or relate neuroanatomically to a neuropathic nerve branch.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

• **Local pain or neuralgia:** LI 6, LI 4, LI 10, other local points that exhibit tenderness to palpation or relate neuroanatomically to a neuropathic nerve branch.

LI 7

Wen Liu "Warm Flow"

On the radial side of the posterior antebrachial region, 5 cun proximal to the dorsal wrist crease, on the line connecting LI 5 and LI 11. Locate by dividing the distance between LI 5 and LI 11 in half; take LI 7 one cun distal to this midpoint.

Muscles and Tendons

• **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.

• **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.

• **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Myofascial dysfunction affecting wrist, hand, and/or thumb function, mobility, and/or strength.

Nerves

• **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.

• **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.

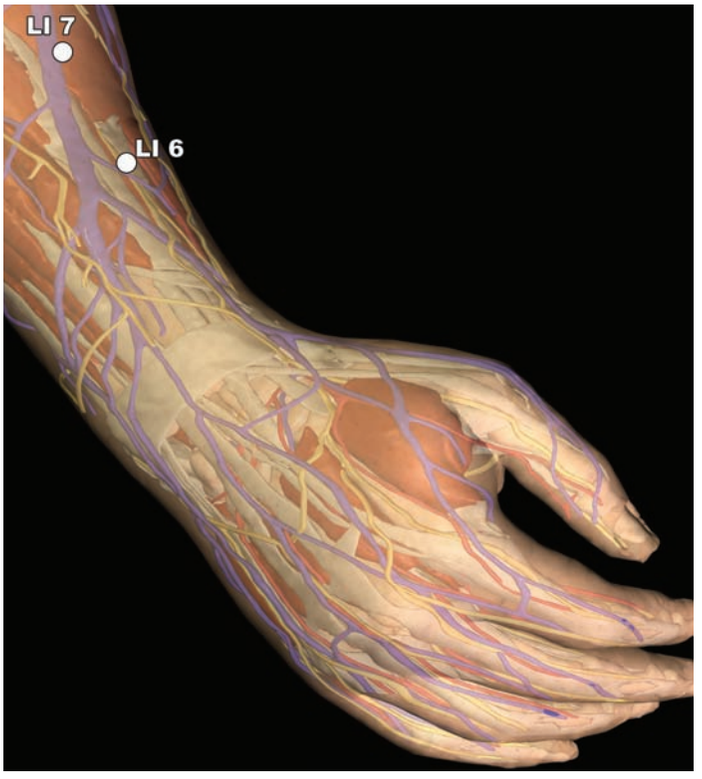

Figure 2-13. The LI 7 point designation as the "Xi-Cleft" point indicates its indications for pain and blockage along the channel. Trigger points located at myotendinous junctions may exhibit tenderness to palpation; these sections of muscles thus serve as fertile territory for myofascial palpation examination.

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

• **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

• **Forearm pain:** LI 7 if tender, palpate for trigger points in the proximal extensor carpi radialis longus and brevis muscles, as well as the abductor pollicis longus muscle.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

• **Forearm pain:** LI 7 if tender, palpate for trigger points in the proximal extensor carpi radialis longus and brevis muscles, as well as the abductor pollicis longus muscle.

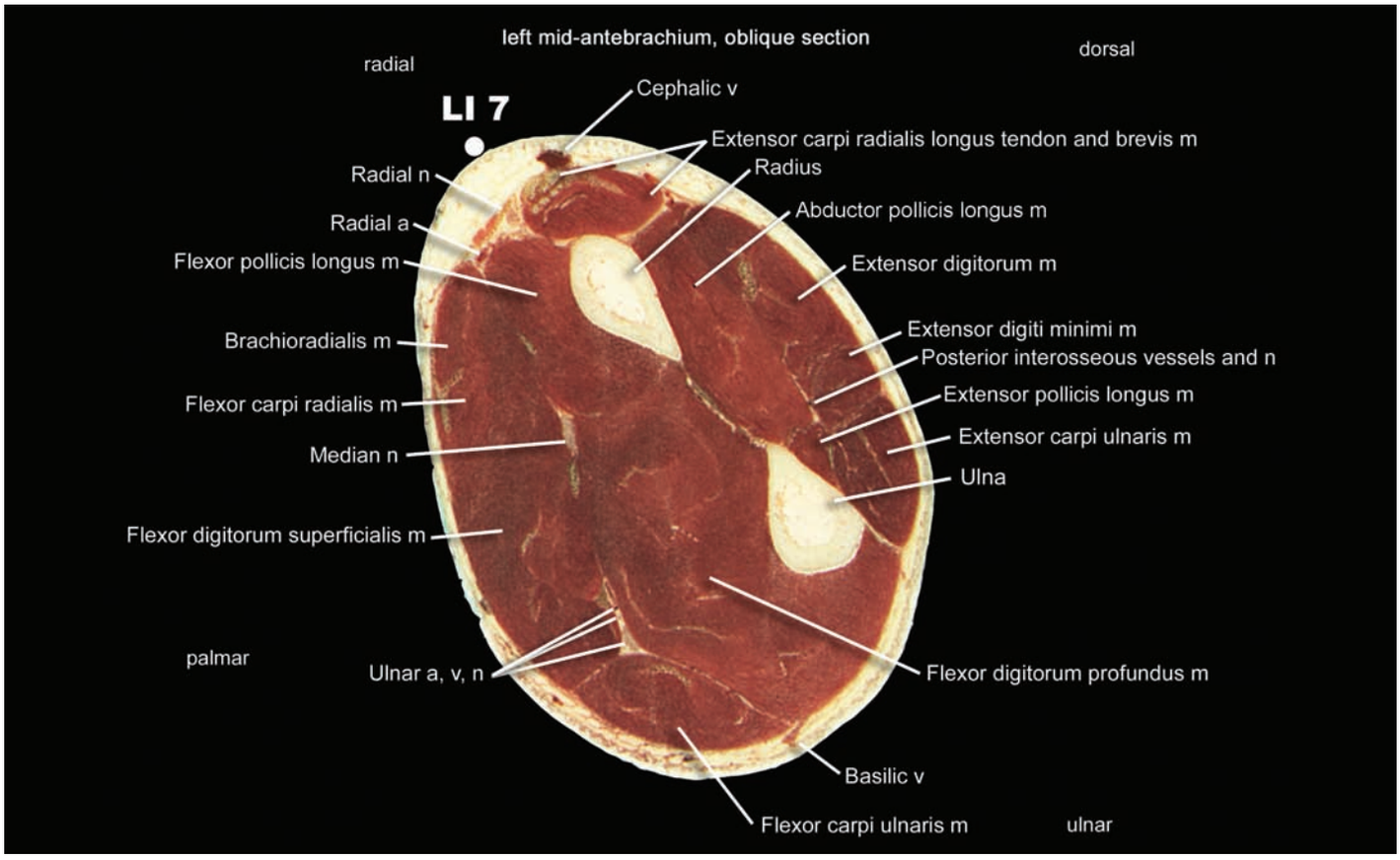

Figure 2-14. LI 7 sits atop several antebrachial structures that accompany the LI channel and produce the expected physiologic results from acupuncture stimulation. These include the radial nerve and artery, the cephalic vein, and the extensor carpi radialis (ECR) longus tendon and ECR brevis muscle. The cephalic vein ushers through the "Warm Flow" associated with LI 7.

LI 8

Xia Lian "Lower Ridge"

On the radial side of the dorsal antebrachial region, 4 cun distal to LI 11 at the cubital crease, on the line connecting LI 5 and LI 11. Divide the distance between LI 5 and LI 11 into thirds. LI 8 is located between the junction of the middle and proximal thirds.

Muscles and Tendons

• **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.

• **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.

• **Supinator muscle:** Supinates the forearm as it rotates the radius.

• **Brachioradialis muscle:** Flexes the forearm.

• **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Myofascial dysfunction affecting wrist, hand, and/or thumb function, mobility, and/or strength.

Nerves

• **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.

• **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

• **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

• **Extensor carpi radialis brevis myofascial trigger point (with radiating pain to the dorsal wrist and hand):** LI 8, TH 4, TH 3.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

• Extensor carpi radialis brevis myofascial trigger point (with radiating pain to the dorsal wrist and hand): LI 8, TH 4, TH 3.

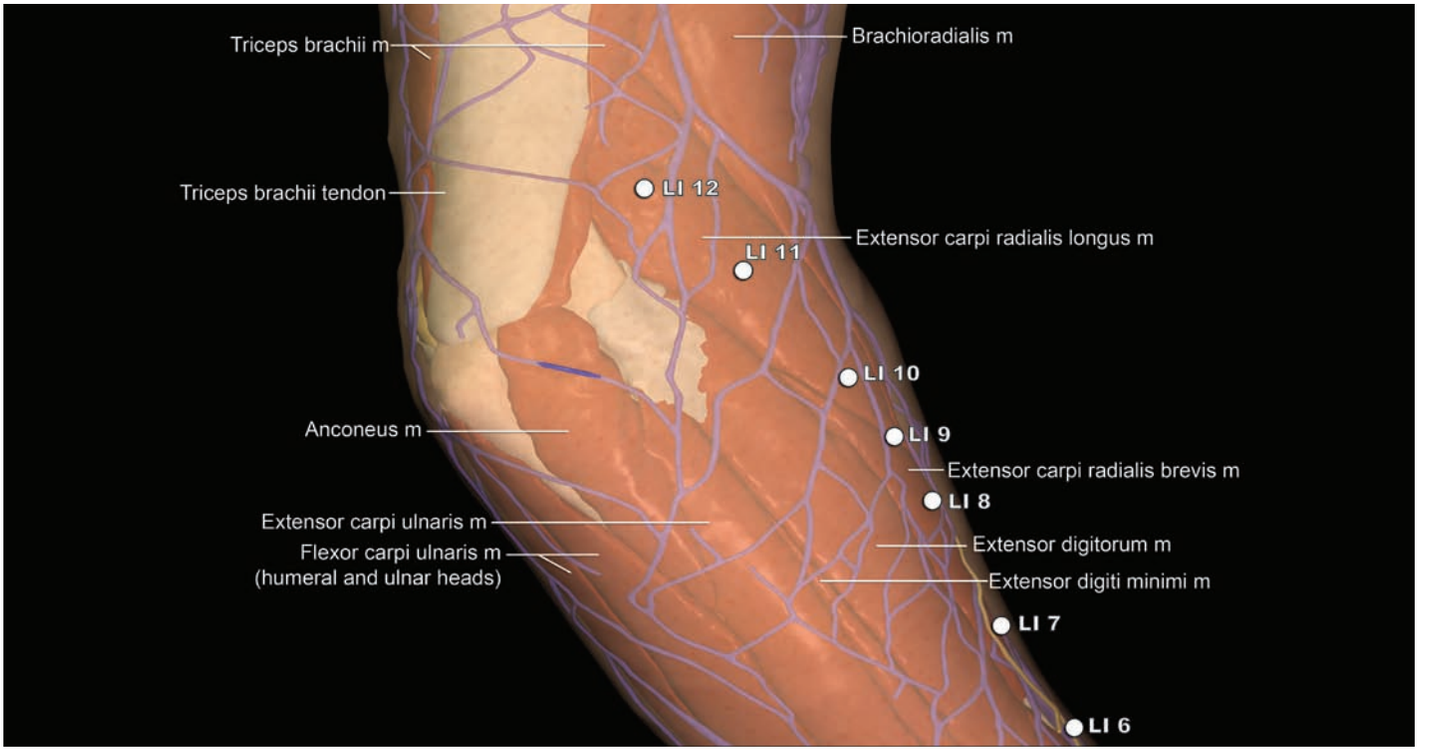

Figure 2-15. The lineup of LI points along the brachioradialis and antebrachial extensors exposes their indications for pain or discomfort involved with actions requiring these muscles' effort. LI 8 huddles on the lower ridge of the extensor bulge over the belly of the extensor carpi radialis brevis muscle.

LI 9

Shang Lian "Upper Ridge"

On the radial side of the dorsal antebrachial region, 3 cun distal to LI 11 at the cubital crease, on the line connecting LI 5 and LI 11. One way to find the point is to divide the distance between LI 5 and LI 11 in half, then bisect the distance between this midpoint and LI 11.

Muscles

- **Extensor carpi radialis longus muscle:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.
- **Extensor digitorum muscle:** Extends digits II-V at the metacarpophalangeal joints and extends the hand at the wrist.
- **Brachioradialis muscle:** Flexes the forearm.
- **Supinator muscle:** Supinates the forearm as it rotates the radius.
- **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Myofascial dysfunction affecting wrist, hand, and/or thumb function, mobility, and/or strength. Pain, weakness, or restriction with antebrachial supination.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.
- **Tension or pain in the extensor carpi radialis longus or brevis:** LI 9, LI 8, LI 10, LI 11, and/or LI 6.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

Tension or pain in the extensor carpi radialis longus or brevis: LI 9, LI 8, LI 10, LI 11, and/or LI 6.

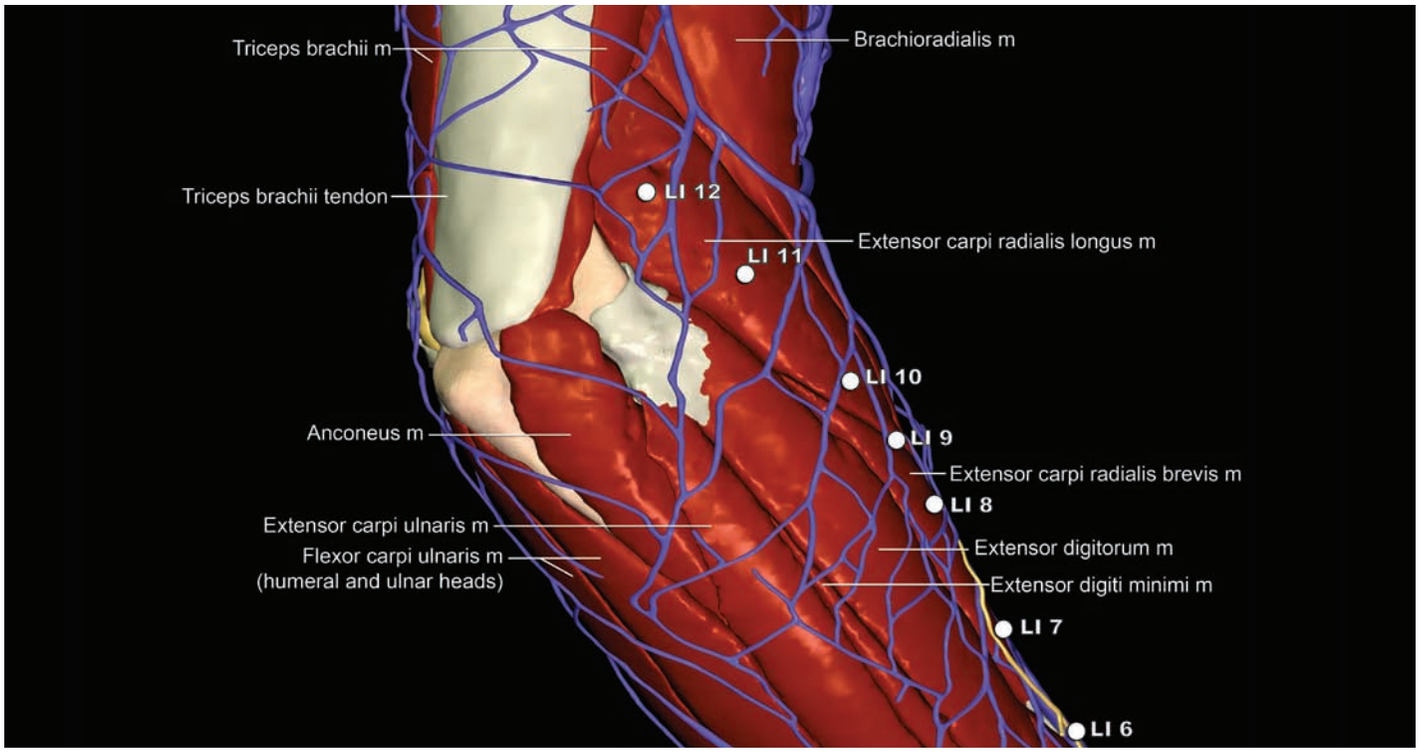

Figure 2-16. LI 9, "Upper Ridge" resides on the ridge of the radius and LI line from hand to elbow. To compare, LI 8, the "Lower Ridge," lurked below this bony ledge.

LI 10

Shou San Li "Arm Three Li"

On the radial side of the dorsal antebrachial region, 2 cun distal to LI 11, at the cubital crease, on the line connecting LI 5 and LI 11. Usually tender to palpation for its location near the trigger point of the extensor carpi radialis longus muscle.

Muscles

- **Extensor carpi radialis longus muscle:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.
- **Extensor digitorum muscle:** Extends digits II-V at the metacarpophalangeal joints and extends the hand at the wrist.
- **Brachioradialis muscle:** Flexes the forearm at the elbow.
- **Brachialis muscle:** Flexes the forearm at the elbow.
- **Supinator muscle:** Supinates the forearm as it rotates the radius.

Clinical Relevance: Myofascial dysfunction affecting elbow, wrist, and/or hand, function, mobility, and/or strength. Pain, weakness, or restriction with antebrachial supination, wrist motion, and elbow movement. Lateral epicondylitis, lateral epicondylalgia.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist. Radial nerve compression can produce motor impairments and pain.[1] The signs and symptoms associated with radial tunnel syndrome can produce pain in the lateral elbow and antebrachium, producing symptoms that overlap with lateral epicondylitis. Posterior interosseous nerve compression may additionally cause weakness in the hand.

Clinical Relevance: Altered sensation on the forearm; loss of extensor function due to radial nerve injury or entrapment. Sympathetic neuromodulation in the head, neck, and cranial thorax, pertaining mainly to respiratory conditions and immunologic dysregulation.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist

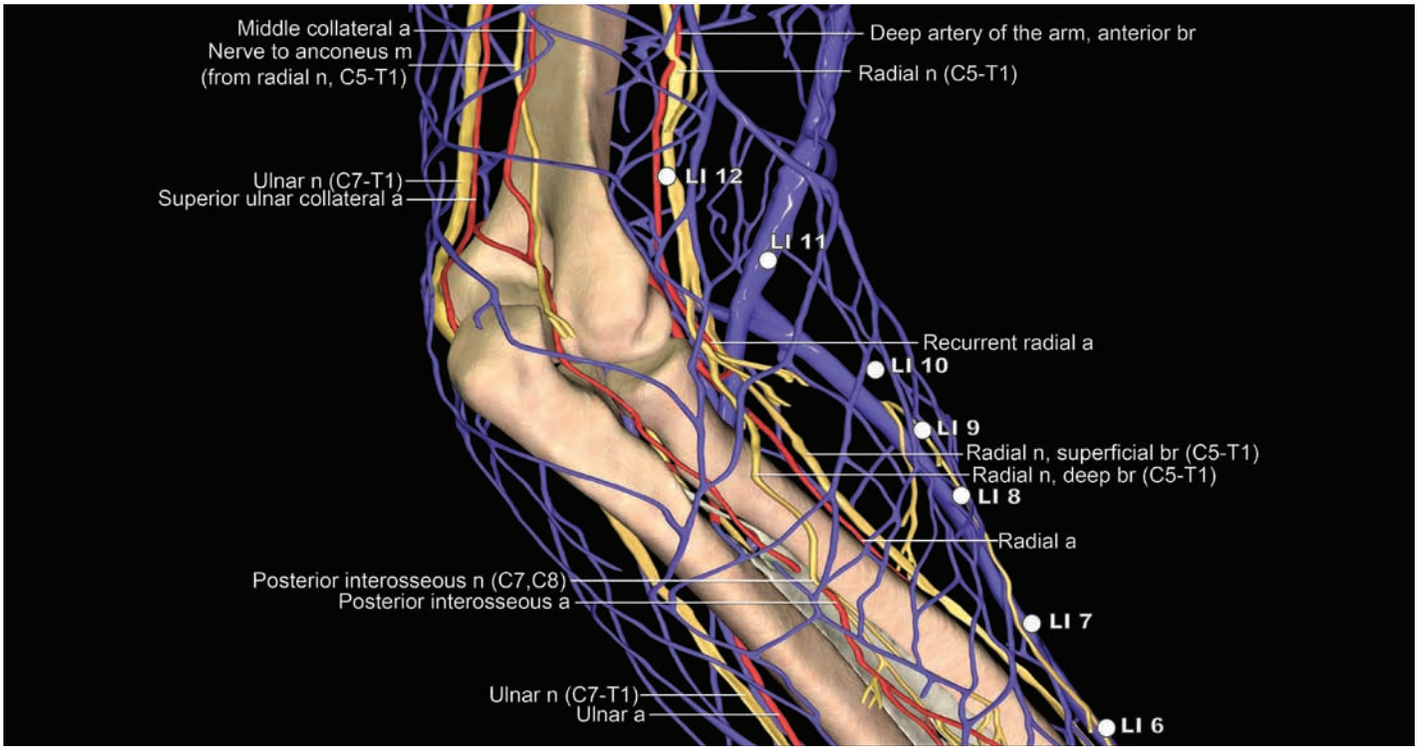

Figure 2-17. LI 10, "Arm Three Li" resembles ST 36, "Leg Three Li" by occupying a relatively similar position on the extensor surface of the limb amid prominent extensor muscles. This image shows LI 10 in relation to the underlying superficial and deep branches of the radial nerve. It also depicts the continuation of the radial nerve as the posterior interosseous nerve. Compression of these structures generates look-alike nerve compression syndromes (e.g., radial tunnel and posterior interosseous nerve syndrome) with overlapping symptoms that clinicians may confuse with lateral epicondylitis. Accurate diagnosis requires careful palpation, serial examination, and determination of which nerves couple with specific pain and motor impairment.

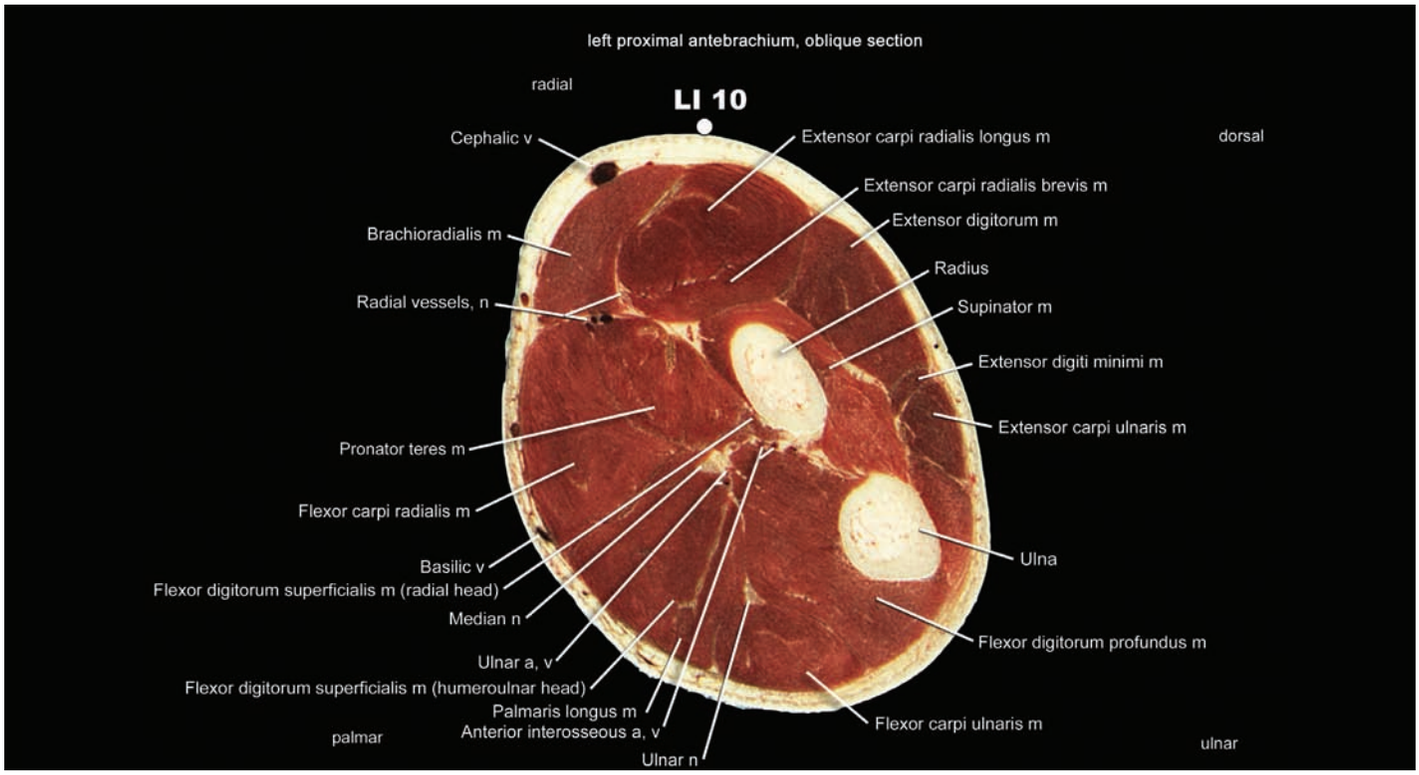

Figure 2-18. Tension in the forearm extensors, as well as in the supinator muscle, may contribute to chronic lateral elbow pain. This cross section at the level of LI 10 demonstrates the relationship of the point to these structures, as well as the compressible radial nerve, illustrating the value of LI 10 in addressing myofascial restriction for the alleviation of chronic lateral elbow pain.

and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Radial recurrent artery:** Arises from the radial artery and supplies the brachioradialis and brachialis muscles and the elbow joint. Anastomoses with the radial collateral artery from the profunda brachii artery.

• **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

• **Gastrointestinal problems:** abdominal pain, dyspepsia, vomiting, diarrhea: LI 10, PC 6, ST 36, CV 12.

• **Thoracic limb pain and weakness:** LI 10, LI 11, LI 4, other points as they relate to neuroanatomically relevant painful or dysfunctional structures in the patient.

• **Tennis elbow (lateral epicondylitis):** LI 10, LI 11, local tender points.

Evidence-Based Applications

• Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis** (tennis elbow).[2]

• Causes a transitory reduction in heart rate, possibly by **reducing sympathetic drive** to the heart.[3]

• Acupuncture at LI 4 and LI 10 had a modulatory effect on skin blood flow and heart rate.[4]

• Moxibustion and point injection at LI 10 and LI 11 helped relieve **lateral epicondylitis** discomfort according to a case series.[5]

• Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma** patients.[6]

• Electroacupuncture at LI 10-LI 11, TH 5-LI 4, and direct moxa to each point significantly reduced **spasticity due to stroke**; when applied repeatedly, effects became longer lasting.[7]

• Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of lateral epicondylalgia.[8]

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LI 11

Qu Chi "Pool at the Bend"

On the lateral side of the elbow, in a depression at the end of the cubital crease when the elbow is close to full flexion, approximately midway between the tendon of the biceps brachii and the lateral epicondyle of the humerus.

Muscles

- **Brachioradialis muscle:** Flexes the forearm at the elbow.
- **Extensor carpi radialis longus muscle:** Extends and abducts the hand at the wrist.
- **Brachialis muscle:** Flexes the forearm at the elbow.

Clinical Relevance: Lateral elbow pain, restricted movement, tension.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation on the forearm; loss of extensor function due to radial nerve injury or entrapment. Radial nerve injury affecting wrist and hand sensation. Sympathetic neuromodulation in the head, neck, and cranial thorax, pertaining mainly to respiratory conditions and immunologic dysregulation.

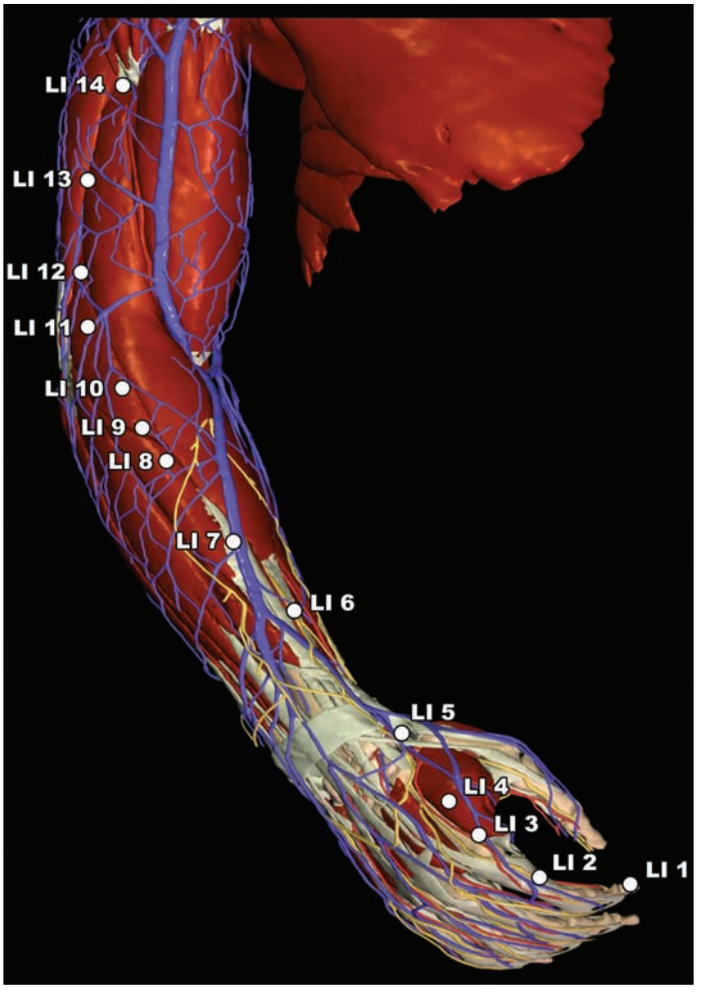

Figure 2-19. The meaty muscle beneath LI 11 beckons dry needling, massage, and laser therapy for lateral elbow pain.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Anterior descending branch of the profunda brachii artery (also known as the radial collateral artery):** Anastomoses with the radial recurrent branch of the radial artery to participate in the arterial anastomoses of the elbow.
- **Radial recurrent artery:** Arises from the radial artery and supplies the brachioradialis and brachialis muscles and the elbow joint. Anastomoses with the radial collateral artery from the profunda brachii artery.

Clinical Relevance: Deep needling of LI 11 accesses the radial nerve as well as the profunda brachii artery. Activation of the nervi vasorum associated with branches of these neurovascular structures would influence autonomic function near and far through sympathetic connections. The proximity of LI 11 to the cephalic vein suggests an application to enhance drainage of an edematous elbow.

Indications and Potential Point Combinations

- **Febrile and viral illnesses:** LI 11, LI 4, GV 14, ST 36, BL 13.
- **Throat problems, tonsillitis, pharyngitis:** LI 11, LI 10, CV 22, ST 36.
- **Radial nerve injury:** LI 11; isolate injury location if possible, needle proximal and distal, as well as cervicothoracic spinal nerves, LI 4, GV 14.
- **Lateral elbow pain:** LI 11, LI 10, trigger points related to elbow pain. Check for trigger points in the triceps brachii.

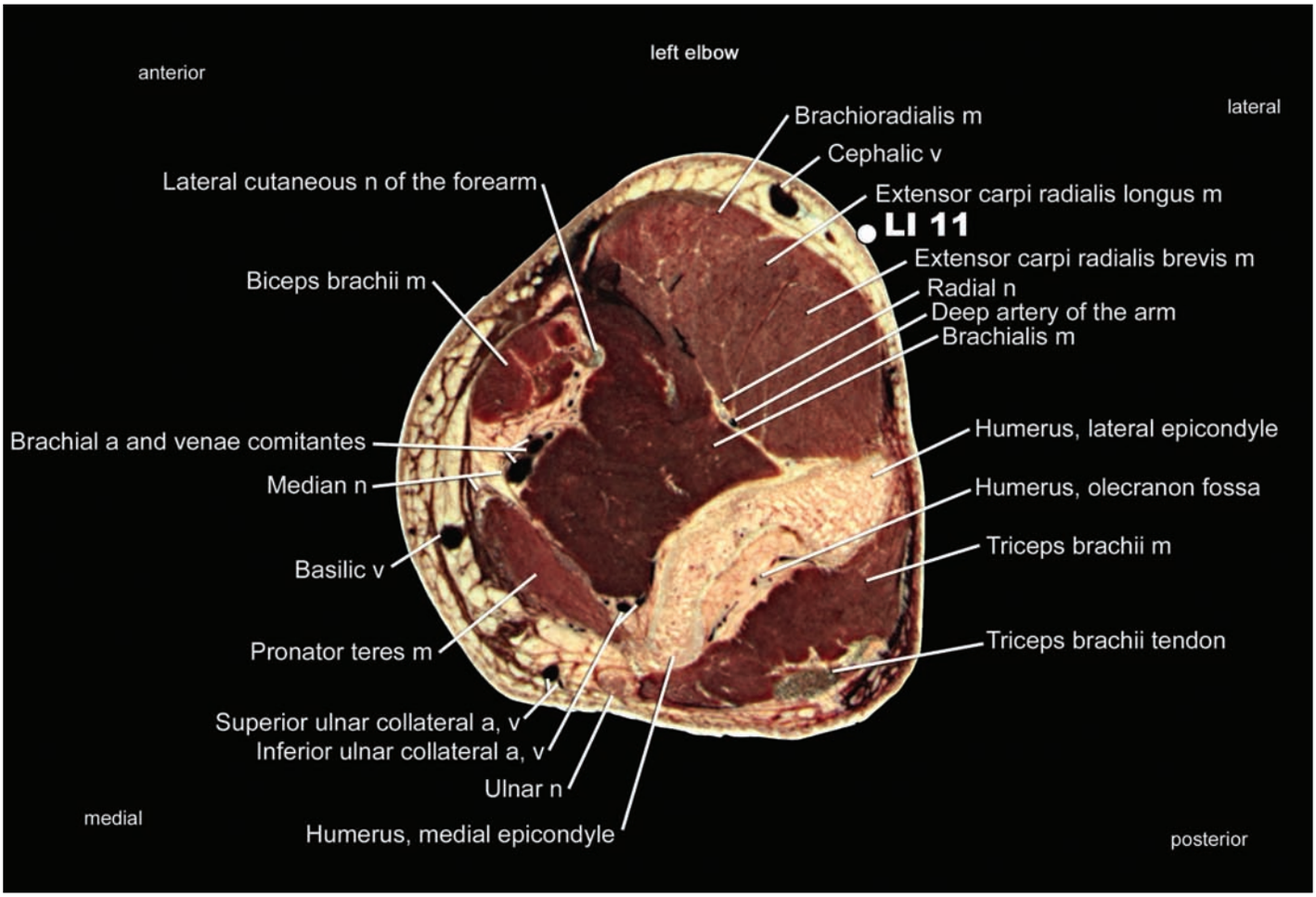

Figure 2-20. LI 11, "Pool at the Bend," occupies a palpable depression, or pool, at the bend, or elbow. The sink in the tissue appears when the elbow flexes. Notably, the median cubital vein (unlabeled) shows in this cross section as a broad venous ditch just lateral to the biceps brachii muscle, superficial to the bicipital aponeurosis, in the cubital fossa. It connects the basilic and cephalic veins distal to this site.

Evidence-Based Applications

• Acupuncture using magnetic needles at LI 11, ST 40, and LR 3 **lowered endothelin-1**, a potent vasoconstrictive peptide.[1]

• Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an **immunomodulatory** effect for patients with **lichen ruber planus**.[2]

• A case series evaluating acupuncture for **poison ivy contact dermatitis** reported effectiveness with the acupuncture points SP 10, LI 11, and ST 36.[3] These points were also effective in reducing the severity and **preventing recurrences of herpes simplex infections**[4] and in **clearing psoriasis lesions**.[5]

• Treatment for fever using GV 14, GB 20, and LI 11 in patients with **common cold, influenza, acute tonsillitis, or acute bronchitis** helped normalize vital signs and increased T-lymphocytes.[6]

• The four points LI 11, SP 10, SP 6, and ST 36 treat **acute urticaria**.[7]

• Pre-treatment with acupuncture at LI 11 provided a **significant reduction in experimentally-induced (i.e., application of histamine) itch and wheal formation,** compared to acupuncture within the same (C6) dermatome but at a non-acupuncture point, and also to no pre-treatment.[8]

• Effectively relieves **refractory uremic pruritus** in hemodialysis patients.[9,10]

• Repeated acupuncture at ST 36, LI 11, SP 10, and GV 14 significantly decreased leukocyte and lymphocyte values in healthy humans, although cortisol and norepinephrine plasma levels remained unchanged. The mechanism whereby acupuncture affected **leukocyte circulation** was unknown.[11]

• Acupuncture at SP 6 produced a strong vasoconstriction in the ipsilateral leg and a slight vasoconstriction in the contralateral leg with no change in the arms. Stimulation of ST 36 produced a superficial vasoconstriction in the skin of both legs but no change in the arms. Stimulation of PC 6 or LI 11 caused **ipsilateral vasoconstriction** in the arms only. This information suggests a topographical representation in the neural segments responsible for the change in sympathetic activity.[12]

• Electroacupuncture (EA) at LI 11 is **antipyretic**, possibly through inhibiting the action of prostaglandin E_2.[13]

• Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with **irritable bowel syndrome**.[14]

• Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[15]

• Following a series of acupuncture treatments, men with **poor sperm quality** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile

spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[16]

• Electroacupuncture of SI 19 and LI 11 was more effective in **lowering blood pressure** than were other points paired with LI 11.[17] This effect appeared to be related to central opioid and/or noradrenergic mechanisms.[18]

• Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain**.[19]

• Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis** (tennis elbow).[20]

• Moxibustion and point injection at LI 10 and LI 11 helped relieve **lateral epicondylitis** discomfort according to a case series.[21]

• Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of lateral epicondylalgia.[22]

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LI 12

Zhou Liao "Elbow Bone Hole"

With the elbow flexed, LI 12 is one cun proximal to LI 11, at the junction of the lateral supracondylar ridge of the humerus with the lateral epicondyle.

Muscles

• **Triceps brachii muscle:** Extends the forearm at the elbow. Steadies the head of an abducted humerus with the long head.

• **Brachioradialis muscle:** Flexes the forearm at the elbow.

• **Brachialis muscle:** Flexes the forearm at the elbow.

Clinical Relevance: Painful or difficult elbow extension. Tender myofascial trigger points. Lateral arm pain.

Nerves

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

• **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.

Clinical Relevance: Radial nerve injury, entrapment, or neuropathy, leading to pain, myofascial dysfunction, and possibly neurogenic inflammation in the lateral elbow region.

Vessels

• **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Anterior descending branch of the profunda brachii artery (also known as the radial collateral artery):** Anastomoses with the radial recurrent branch of the radial artery to participate in the arterial anastomoses of the elbow.

Clinical Relevance: Local circulatory compromise or altered vasoregulation.

Indications and Potential Point Combinations

• **Pain in the lateral elbow or arm:** Check for brachialis trigger

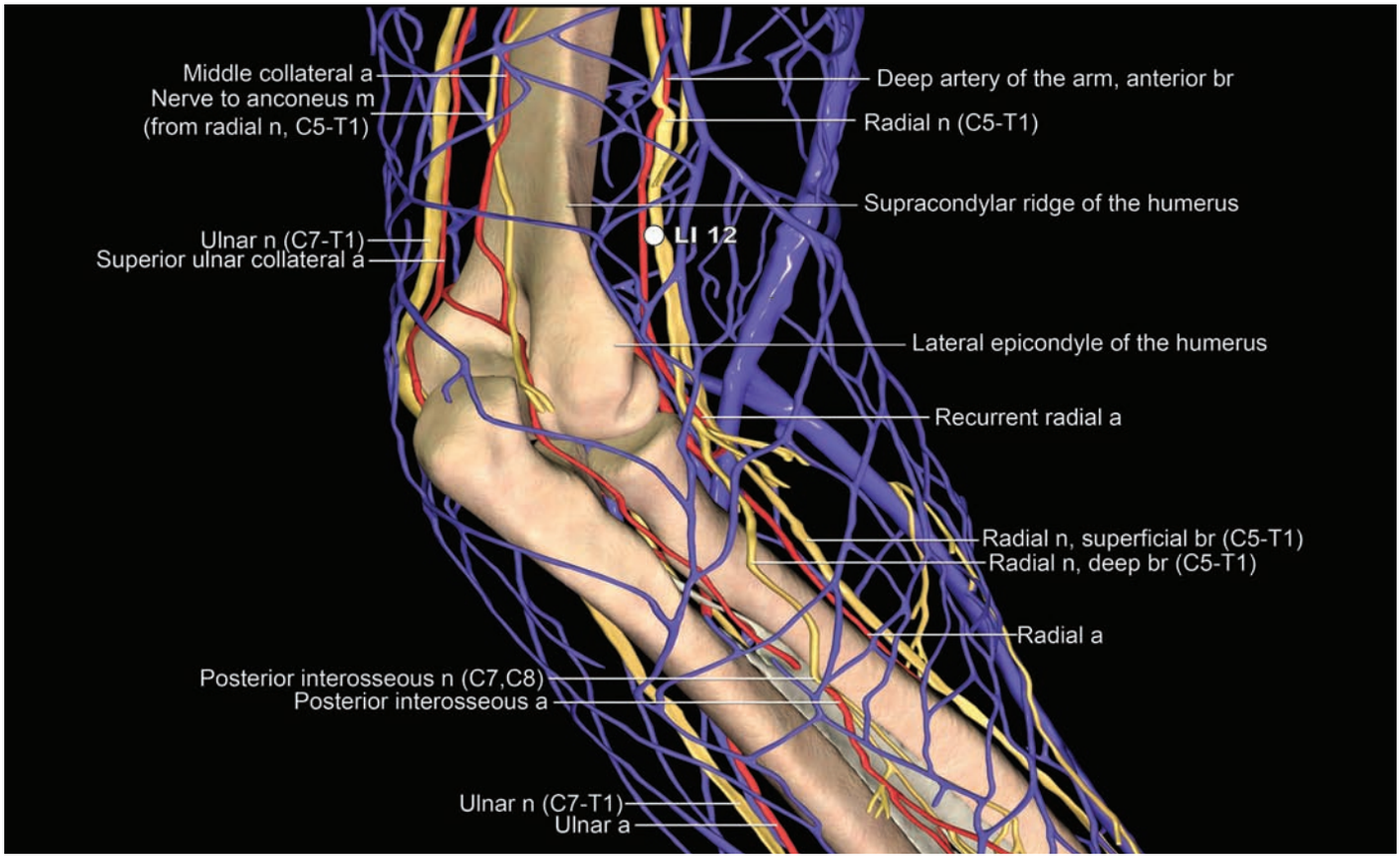

Figure 2-21. The name for LI 12 of "Elbow Bone-Hole" refers to the palpable depression just proximal to the lateral epicondyle of the humerus, atop the supracondylar ridge.

points, or the lateral portion of the medial head of the triceps brachii muscle. Select LI 12 if tender. Consider adding LI 11, LI 10, PC 3.

• **Radial nerve injury:** Locate site of injury if possible; stimulate proximal and distal to injury; treat myofascial compression associated with injured nerve and neuromodulate locus of impact. Consider LI 12, LI 11, LI 10, LI 4, GV 14, spinal nerve points for lower cervical spinal nerves.

Evidence-Based Applications

• Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of lateral epicondylalgia.[1]

• Electroacupuncture at LI 12, TH 5, GB 30, and ST 36 in patients with acute ischemic cerebrovascular disease was associated with significantly increased somatostatin levels in the cerebrospinal fluid and blood and no significant change in pancreatic polypeptide amounts.[2]

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LI 13

Shou Wu Liu "Arm Five Li"

On the lateral brachium, 3 cun proximal to LI 11, on the line connecting LI 11 to LI 15, approximately level with where the radial nerve sulcus crosses the lateral margin of the humerus.

Muscles

• **Brachialis muscle:** Flexes the antebrachium at the elbow.

Clinical Relevance: Local trigger point pathology or myofascial dysfunction.

Nerves

• **Inferior lateral brachial cutaneous nerve (C5, C6):** A branch of the radial nerve, this nerve supplies the skin over the infero-lateral brachium. It may appear as a branch of the posterior cutaneous nerve of the forearm, also a branch of the radial nerve.

• **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.

• **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

• **Musculocutaneous nerve (C5, C6):** Supplies all of the muscles in the anterior, or flexor, compartment of the brachium: the biceps brachii, brachialis, and coracobrachialis muscles. Becomes the lateral cutaneous nerve of the forearm, supplying a large portion of the skin of the antebrachium.

Clinical Relevance: Stiff elbow flexion and/or extension from neuropathic nerves or their spinal nerve roots. Radial nerve injury.

Vessels

• **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes

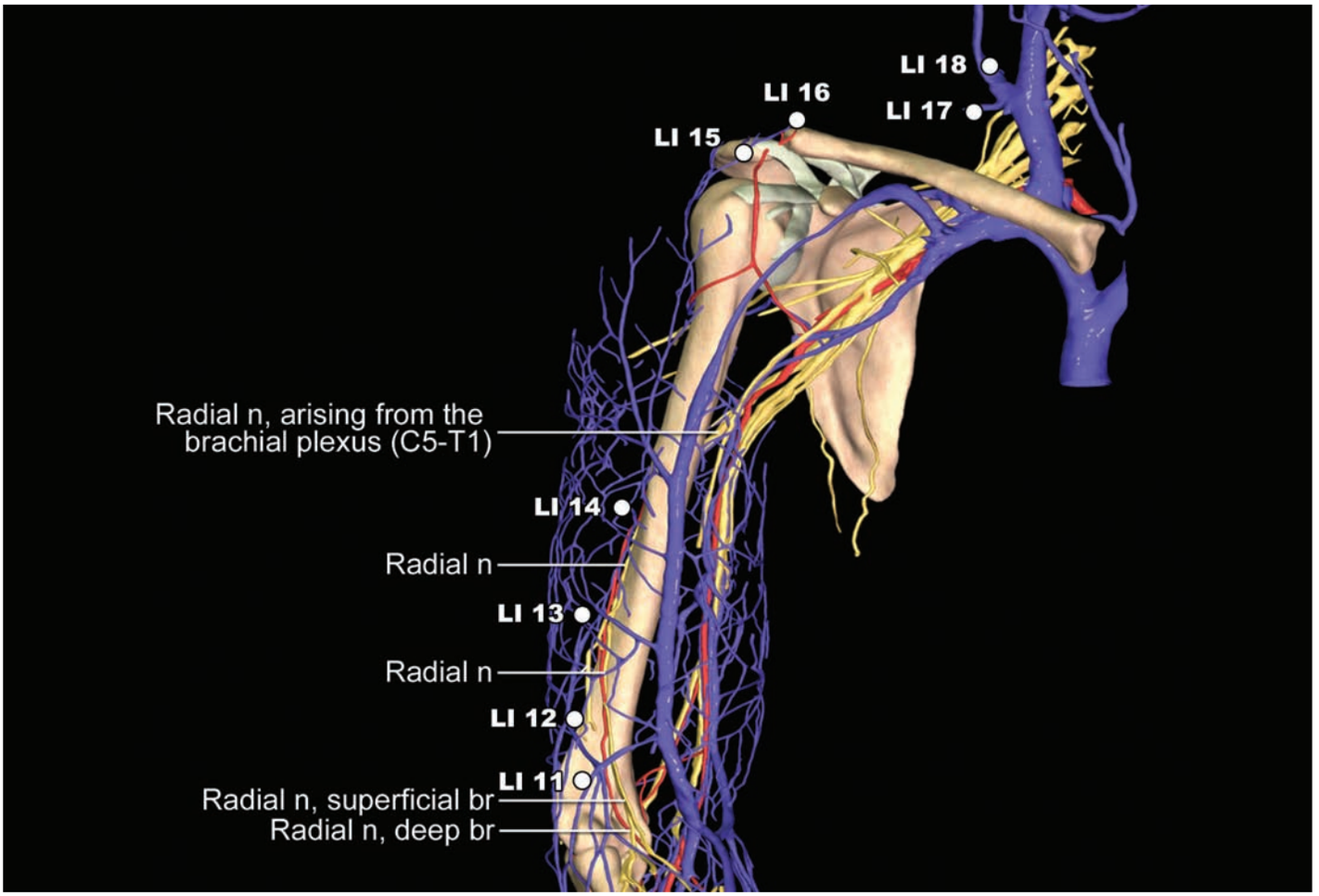

Figure 2-22. LI 13, "Arm Five Li" lands 5 cun proximal to the lateral epicondyle. In this instance, "li" refers to "cun." Note the radial nerve winding around the humerus.

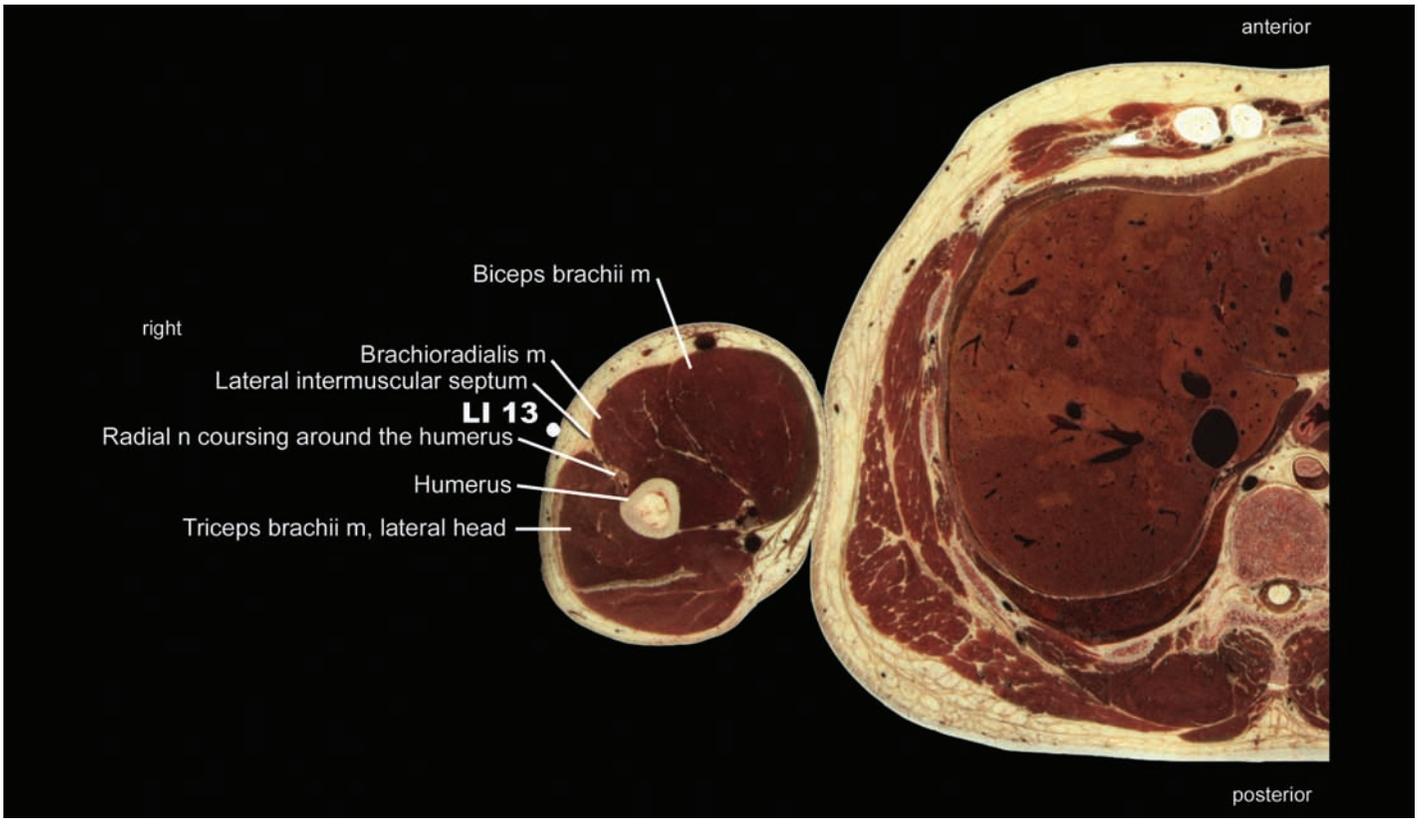

Figure 2-23. Deep to LI 13, the radial nerve nests amid the lateral intermuscular septum.

across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

• **Anterior descending branch of the profunda brachii artery (also known as the radial collateral artery):** Anastomoses with the radial recurrent branch of the radial artery to participate in the arterial anastomoses of the elbow.

Clinical Relevance: Supports circulatory supply and drainage to and from the elbow, respectively.

Indications and Potential Point Combinations

• **Lateral arm pain:** Check for trigger points in the brachioradialis, triceps brachii, and brachialis muscles. LI 13 for local pain. Consider LI 12, LI 11.

LI 14

Bi Nao "Upper Arm"

On the lateral brachium, on the anterior margin of the insertion of the deltoid muscle, on the line connecting LI 11 with LI 15. Puncture obliquely upward for deltoid and shoulder problems.

Muscles

• **Deltoid muscle:** Anterior part medially rotates and flexes the arm at the shoulder; middle part abducts the arm; posterior part laterally rotates the arm and extends it.

Clinical Relevance: Deltoid insertion pain, shoulder restriction, local tissue inflammation and trigger points.

Nerves

• **Superior lateral brachial cutaneous nerve (from the axillary nerve):** Supplies the skin over the inferior portion of the deltoid muscle.

• **Axillary nerve (C5, C6):** Supplies the teres minor and deltoid muscles, the skin over the inferior portion of the deltoid (via the superior lateral brachial cutaneous nerve), and the shoulder joint.

Clinical Relevance: Neuropathic nerves due to compression, trauma, or surgery.

Vessels

• **Profunda brachii artery (Deep brachial artery):** This is the largest branch of the brachial artery and accompanies the radial nerve through the radial groove. It divides into anterior and posterior descending branches which take part in the elbow arterial anastomoses.

Clinical Relevance: Consider role of local vasculature (including nervi vasorum) in shoulder recovery from trauma, surgery, adhesive capsulitis, and dislocation.

Indications and Potential Point Combinations

• **Arm pain:** Check for trigger points in the deltoid muscle insertion as well as the lateral border of the lateral head of the triceps brachii muscle.

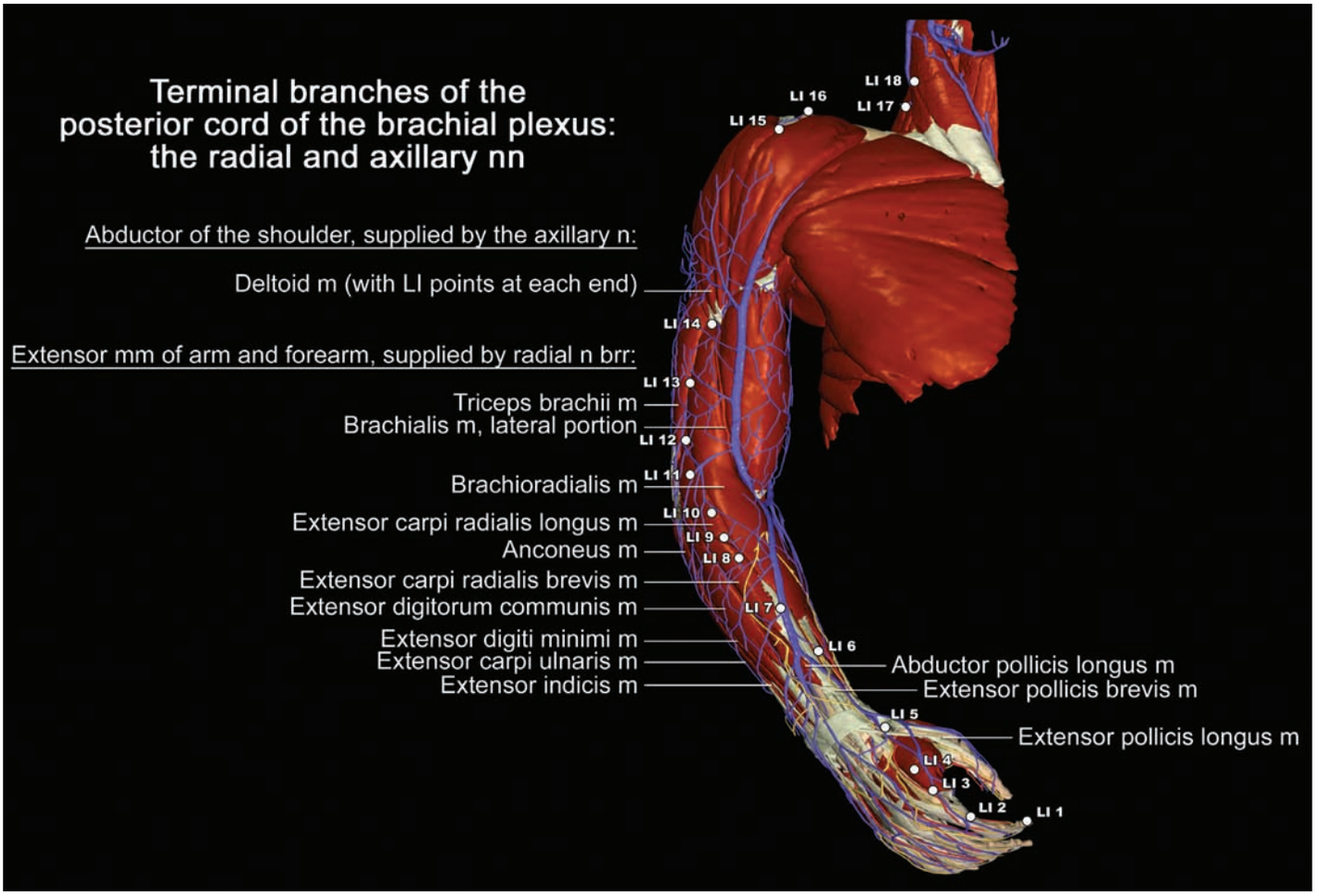

Figure 2-24. LI 14, "Muscle of the Arm," tucks into the anterior margin of the deltoid muscle insertion. The deltoid attachment incorporates three tendons that form an arch. Fascia investing the deltoid blends with the brachial fascia by way of its confluence with the medial and lateral intermuscular septi. As such, this "delta" joins not only three muscle parts but also three fascial components. (Rispoli DM, Athwal GS, Sperling JW, et al. The anatomy of the deltoid insertion. *J Shoulder Elbow Surg.* 2009;18:386-390.)

LI 15

Jian Yu "Shoulder Bone"

Inferior to the acromion, on the anterior border of the acromial part of the deltoid muscle, in the anterior of two depressions appearing on either side of the acromion when the arm is abducted 90°.

Bursa

• **Subacromial bursa:** Lies between the coracoacromial arch, the supraspinatus tendon, and the greater tubercle of the humerus.

Clinical Relevance: Subacromial impingement syndrome (a spectrum of pathology that includes subacromial bursitis, rotator cuff tendinopathy, and full-thickness tears of the rotator cuff; may involve features of extrinsic compression and intrinsic degeneration);[3] consider acupuncture and laser therapy for rotator cuff lesions with shoulder stiffness that may arise from local alterations in inflammatory cytokines, leading to myofibroblast recruitment in the subacromial bursa.[4]

Muscles and Tendons

• **Deltoid muscle:** Anterior part medially rotates and flexes the arm; middle part abducts the arm; posterior part laterally rotates the arm and extends it.

• **Supraspinatus tendon:** A rotator cuff muscle, the supraspinatus assists the infraspinatus, teres minor, and subscapularis muscles to hold the head of the humerus in the glenoid cavity of the scapula. Also, assists the deltoid muscle in arm abduction.

Clinical Relevance: Shoulder pain and dysfunction; shoulder joint pathology. Consider acupuncture and related techniques (laser therapy, most notably) for tendon pathology, in light of evidence maintaining the importance of nitric oxide in tendon health and recovery from injury.[5]

Nerves

• **Supraclavicular nerves (C3, C4):** Supply portions of the skin of the neck and shoulder.

• **Superior lateral brachial cutaneous nerve (from the axillary nerve):** Supplies the skin over the inferior portion of the deltoid muscle.

• **Axillary nerve (C5, C6):** Supplies the teres minor and deltoid muscles, the skin over the inferior portion of the deltoid (via the superior lateral brachial cutaneous nerve), and the shoulder joint.

Clinical Relevance: Supraclavicular or other nerve entrapment, whether by fibrous bands, muscles, or tendons.[6] Painful musculoskeletal conditions lead to central sensitization; this includes patients with shoulder impingement syndrome.[7]

Vessels

• **Thoracoacromial artery:** A short arterial trunk that divides into four branches: the acromial, deltoid, pectoral, and clavicular arteries.

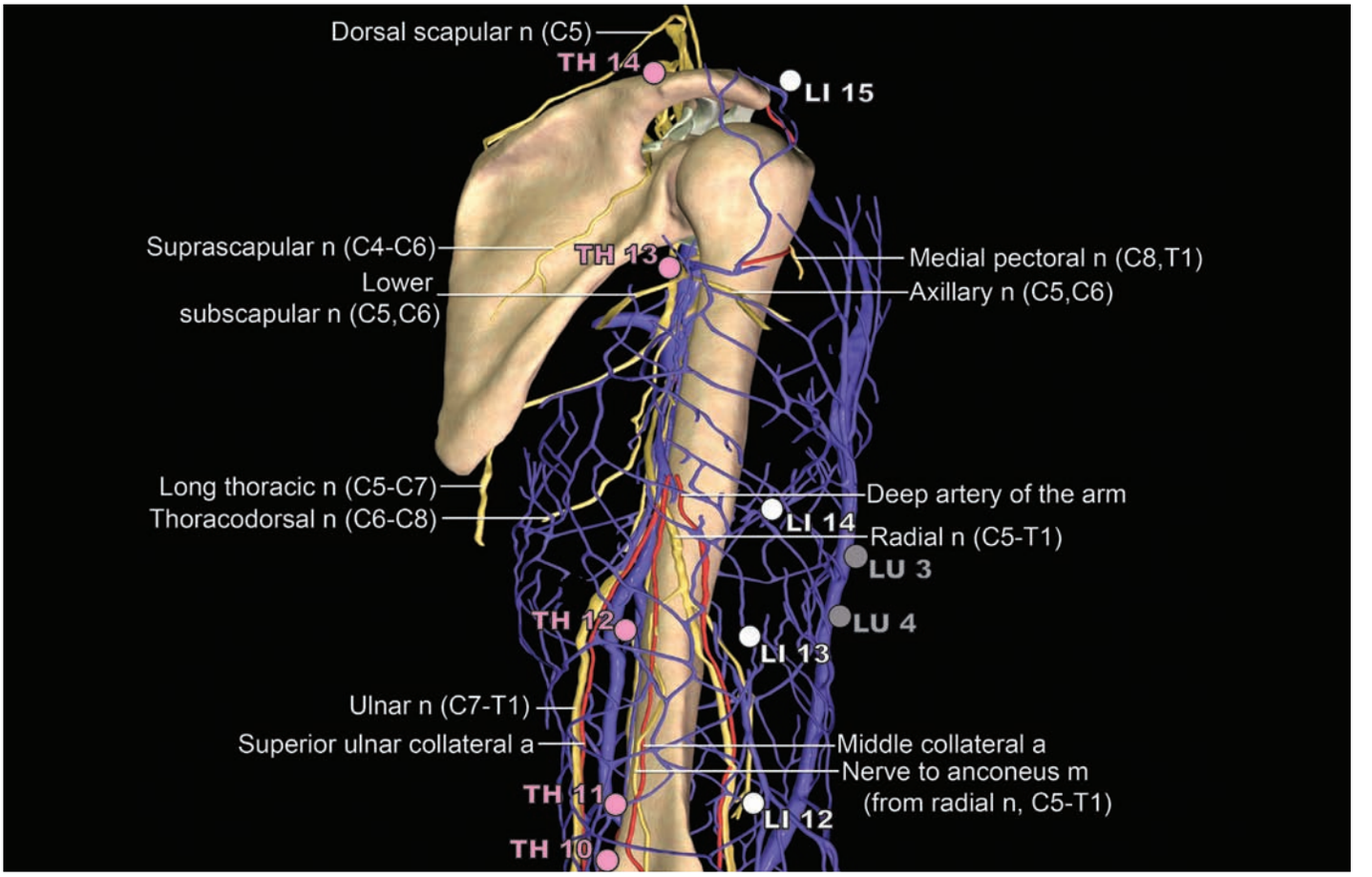

Figure 2-25. LI 15, "Shoulder Bone" often appears with TH 14, "Shoulder Bone Hole" in treatment protocols addressing shoulder joint pain.

Clinical Relevance: Hypovascular zones may promote susceptibility to rupture in tendons such as that belonging to the long head of the biceps muscle.[8] Possibly, by supporting circulation through medical acupuncture and related techniques, improved blood flow to tendons will support tissue integrity and strength.

Indications and Potential Point Combinations

- **Anterior shoulder pain:** LI 15 trigger point in the anterior deltoid region. Palpate for other local trigger points; including the infraspinatus muscle, at or around SI 11 and supraspinatus muscle (SI 12, SI 13) that may refer pain to the anterior shoulder. Coracobrachialis restriction should also be considered and palpated.
- **Shoulder joint pain:** LI 15, TH 14, contributing trigger points.
- **Torticollis:** LI 15, LI 16, LI 18, GB 12, GB 20, SI 17.

Evidence-Based Applications

- Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis (tennis elbow)**.[1]
- Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/ LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[2]

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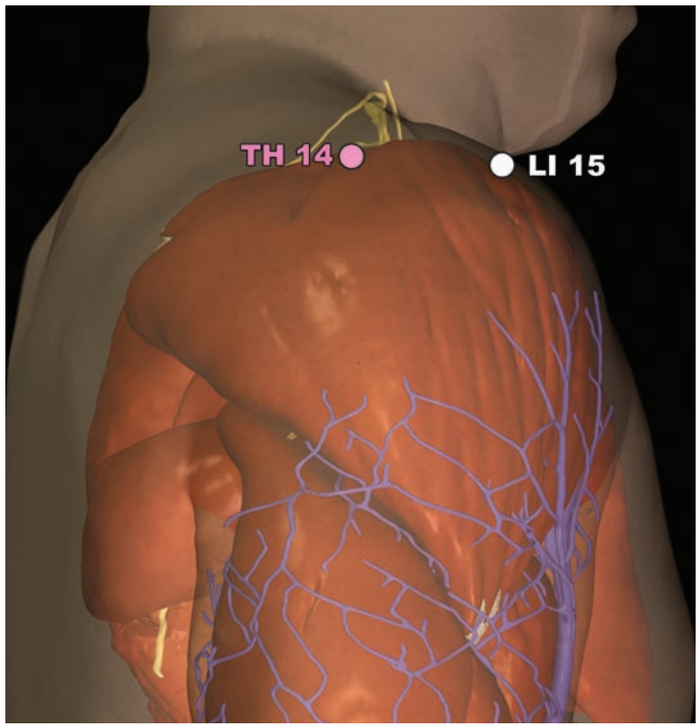

Figure 2-26. LI 15, "Shoulder Bone" and TH 14, "Shoulder Bone Hole" both inhabit depressions on either side of the acromion process. One can best visualize them with the thoracic limb abducted 90°. The depressions denote separations in the fiber bundles between the anterior, middle, and posterior portions of the deltoid muscle.

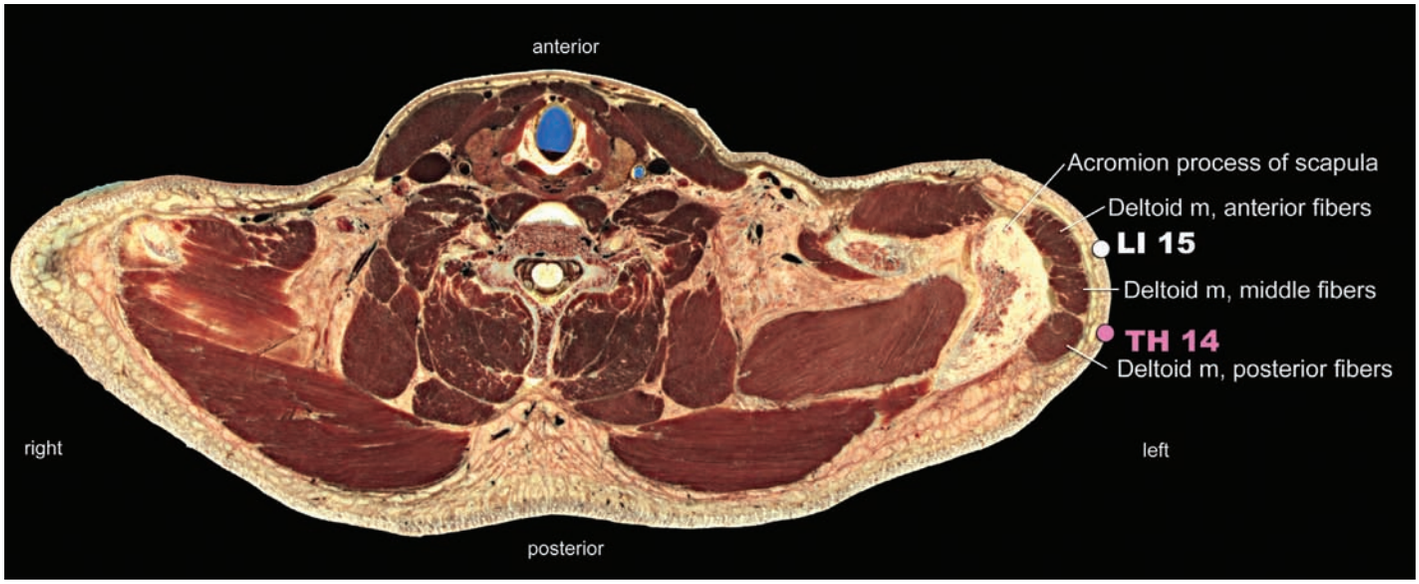

Figure 2-27. The crooks between the anterior, middle, and posterior fibers of the deltoid muscle appear here where they house LI 15 and TH 14.

LI 16

Ju Gu "Great Bone"

On the superior aspect of the shoulder, in the depression that appears between the acromial extremity of the clavicle and the spine of the scapula.

Muscles

• **Trapezius muscle:** The trapezius muscle's superior fibers elevate, middle fibers retract, and inferior fibers depress the scapula.

• **Supraspinatus muscle:** As a rotator cuff muscle, the supraspinatus assists the infraspinatus, teres minor, and subscapularis muscles to hold the head of the humerus in the glenoid cavity of the scapula. Also, assists the deltoid muscle in arm abduction.

Clinical Relevance: Shoulder pain and dysfunction; shoulder joint pathology. Consider acupuncture and related techniques (laser therapy, most notably) for tendon pathology, in light of evidence maintaining the importance of nitric oxide in tendon health and recovery from injury.[1]

Nerves

• **Supraclavicular nerves (C3, C4):** Supply portions of the skin of the neck and shoulder.

• **Spinal accessory nerve (CN XI):** Motor fibers innervate the sternocleidomastoid and trapezius muscles as well as the soft palate and pharynx.

• **Suprascapular nerve (C4, C5, C6):** Arises from the brachial (not the cervical) plexus to supply the supraspinatus and infraspinatus muscles. It also sends branches to the shoulder, or glenohumeral joint.

Clinical Relevance: Supraclavicular or other nerve entrapment, whether by fibrous bands, muscles, or tendons.[2] Painful musculoskeletal conditions lead to central sensitization; this includes patients with shoulder impingement syndrome.[3]

Vessels

• **Suprascapular artery:** Branches off of the thyrocervical trunk to supply the muscles on the posterior aspect of the scapula.

Clinical Relevance: Hypovascular zones may promote suscep-

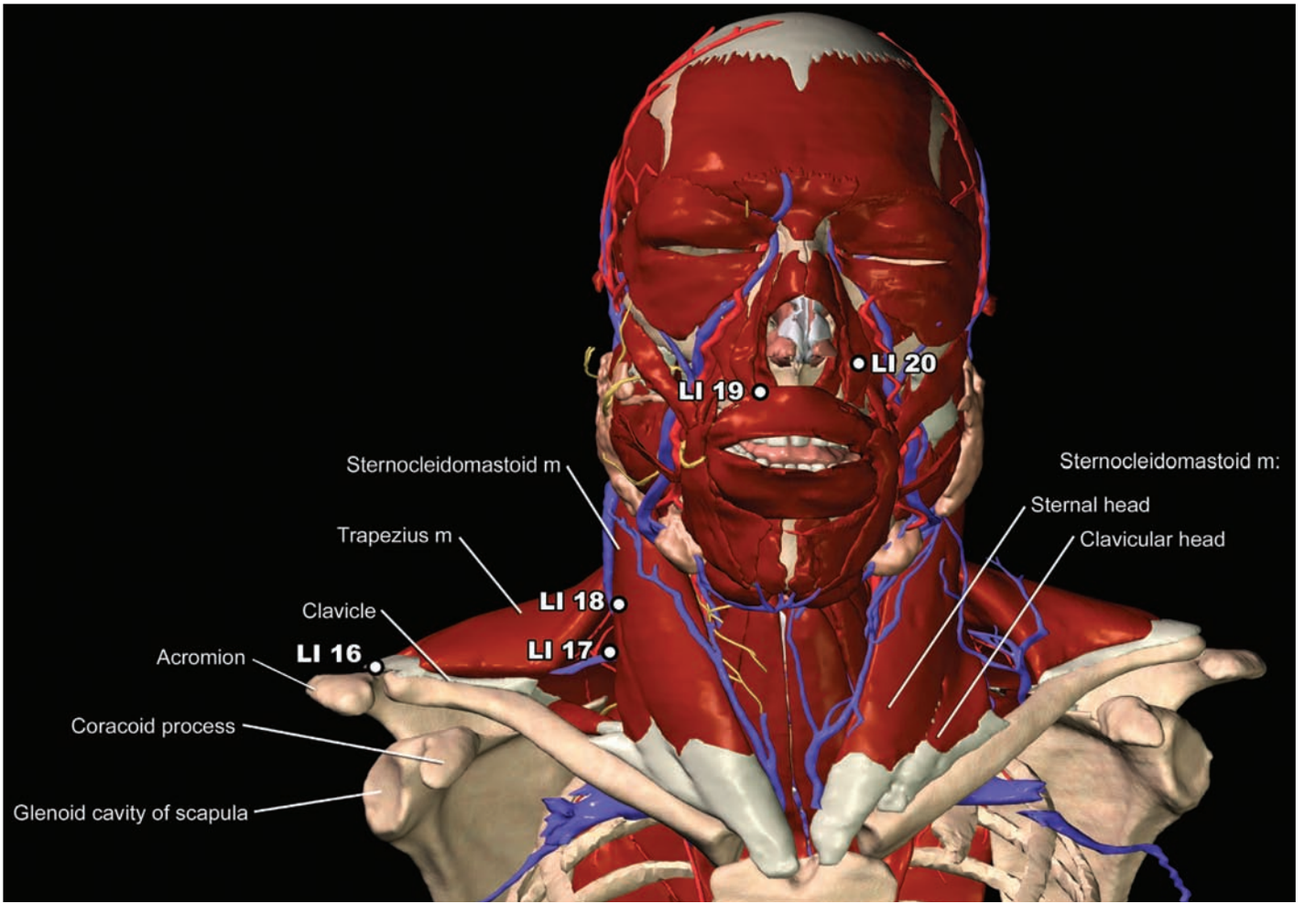

Figure 2-28. The Chinese term for LI 16, "Great Bone" alludes to the acromioclavicular joint as well as the clavicle itself. LI 16 resides in the nook created at the acromial end of the clavicle and the scapular spine, as shown in this image. LI 16 overlooks the supraspinatus outlet, denoted by a space surrounded by the acromioclavicular joint and the acromion along with the coracoacromial arch serving as the roof while the humeral head and glenoid become the floor. Narrowing of the supraspinatus outlet or dysfunction resulting from bearing increased loads can lead to impingement of the supraspinatus tendon. Tendinopathy or tendinitis may ensue.

tibility to rupture in tendons such as that belonging to the long head of the biceps muscle.[4] Possibly, by supporting circulation through medical acupuncture and related techniques, improved blood flow to tendons will support tissue integrity and strength.

Indications and Potential Point Combinations

• **Shoulder pain:** LI 16, isolate trigger points in nearby muscles contributing to the pain (deltoid, trapezius, pectoralis, etc.). Also palpate more distal potential sources of referred pain, including the subscapularis and teres major muscles for trigger points near HT 1. Check latissimus dorsi for trigger points referring to the shoulder.

• **Supraspinatus tendinitis:** LI 16, LI 15, LI 14, SI 12.

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LI 17

Tian Ding "Celestial Tripod"

On the anterior margin of the posterior triangle of the neck, on the posterior margin of the sternocleidomastoid muscle, at the midpoint of the line connecting LI 18 to ST 12.

Muscles

• **Platysma muscle:** The platysma muscle moves the corners of the mouth inferiorly, as in expressions of sadness or fright.

• **Sternocleidomastoid (SCM) muscle:** Tilts the head to one side.

• Flexes and rotates the neck to turn the face superiorly to the opposite side.

• **Anterior scalene muscle:** The anterior scalene muscle rotates the neck and flexes it laterally; it also elevates the first rib.

• **Middle scalene muscle:** The middle scalene flexes the neck laterally and raises the first rib during forced inspiration.

Clinical Relevance: Neck pain, restriction, torticollis, vestibular dysfunction, whiplash-associated disorders following motor vehicle accidents.[2]

Nerves

• **Transverse cervical nerve (C2, C3):** Provides sensation to the skin over the anterior triangle of the neck.

• **Cervical branch of the facial nerve (CN VII):** Provides motor innervation to the platysma muscle.

• **Phrenic nerve (C4, with C3 and C5):** Provides sensation to the central part of the diaphragm, as well as the mediastinal pleura and pericardium. Also receives communicating branches from the cervical sympathetic ganglia. Provides sole motor supply to the diaphragm.

• **Brachial plexus (C5-T1):** Superior trunk of the brachial plexus formed by the union of the C5 and C6 roots.

• **Supraclavicular nerves (C3, C4):** Supply portions of the skin of the neck and shoulder.

• **Spinal accessory nerve (CN XI):** Motor fibers innervate the sternocleidomastoid and trapezius muscles as well as the soft palate and pharynx.

• **C2, C3 spinal nerves:** Provides pain sensation and proprioceptive function to the SCM.

• **C5-C8 spinal nerves:** Innervate the middle scalene muscle.

• **Great auricular nerve (C2, C3):** Supplies the skin over the parotid gland, the posterior aspect of the pinna, and a patch of skin spanning from the angle of the mandible to the mastoid process.

Clinical Relevance: Pain, motor disturbances, sensory loss, myofascial restriction, autonomic dysfunction, phrenic nerve injury.

Vessels

• **External jugular vein (EJV):** Most of the blood drained by the EJV arises from the scalp and face.

• **Ascending cervical artery:** Supplies the lateral muscles of the upper neck; is one of the two terminal branches of the thyrocervical trunk (with the inferior thyroid artery).

Clinical Relevance: Caution needling in this highly vascularized zone, rich with autonomic investment. Note the proximity of this point to the external jugular vein.

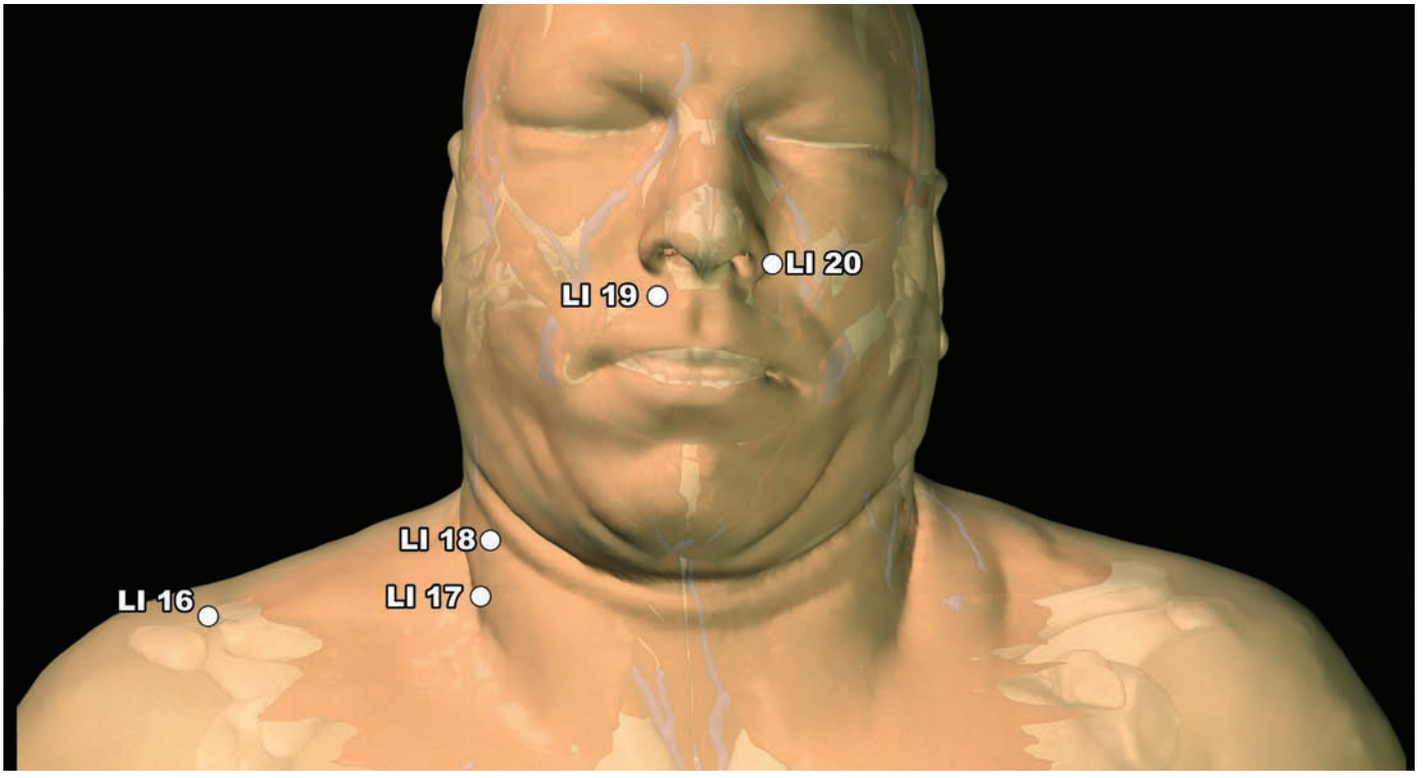

Figure 2-29. The "Celestial Tripod," LI 17, alludes to the location of LI 17 at the base of a cervical triangle that, like the feet of a tripod, support the head, a heavenly structure in Chinese allegory.

Indications and Potential Point Combinations

• Neck pain related to trigger points in the scalene and sternocleidomastoid muscles: LI 17.

Evidence-Based Applications

• Point injection of LI 17 was shown in a case series to effectively relieve "obstinate hiccup."[1]

References

1. Ju L. Twenty-five cases of obstinate hiccup treated by point injection at Tianding. *Journal of Traditional Chinese Medicine.* 2003;23(2):117-118.
2. Bexander CS, Hodges PW. Cervico-ocular coordination during neck rotation is distorted in people with whiplash-associated disorders. *Exp Brain Re.* 2012;217(1):67-77.

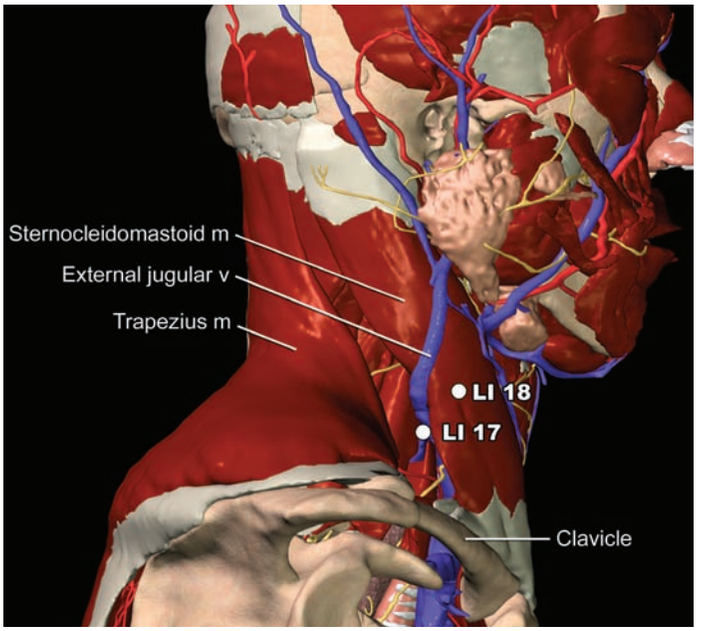

Figure 2-30. This image depicts the close association between LI 17 and the external jugular vein (EJV). The EJV crosses the SCM obliquely to dive into the anteroinferior part of the posterior triangle of the neck to ultimately empty into the subclavian vein. Prior to terminating at the subclavian, the EJV receives the transverse cervical, the anterior jugular, and the suprascapular veins. Although not visible in this view, the great auricular nerve (from C2, C3 ventral rami) ascends diagonally over the SCM as the EJV descends.

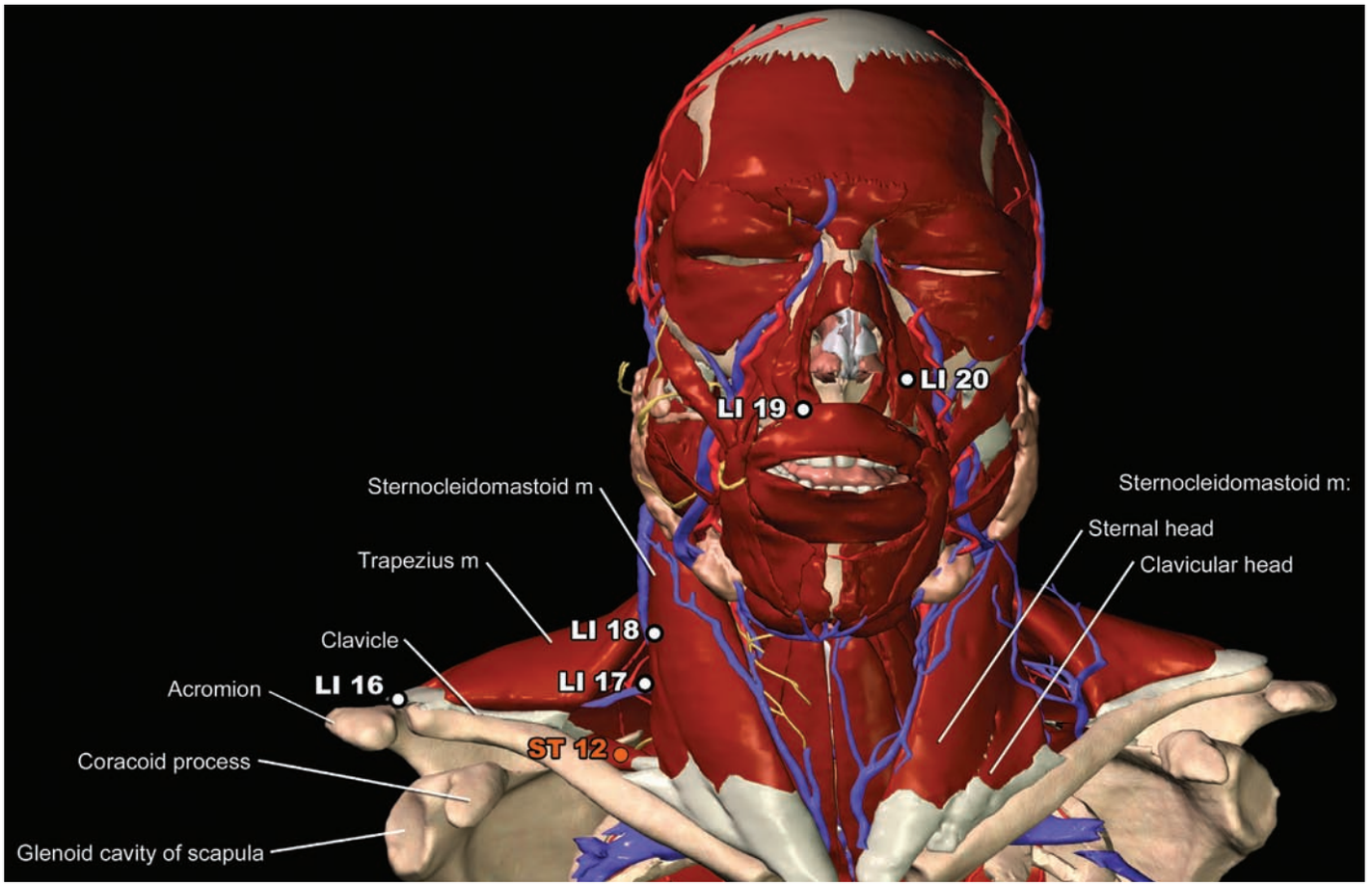

Figure 2-31. This image provides perspective on the relationship between LI 17 and the two points on either side, LI 18 and ST 12. LI 17 occupies the location halfway between the two. Here, too, the anatomic boundaries of the posterior triangle of the neck appear clearly, defined by the sternocleidomastoid (SCM) muscle, the trapezius muscle, and the clavicle.

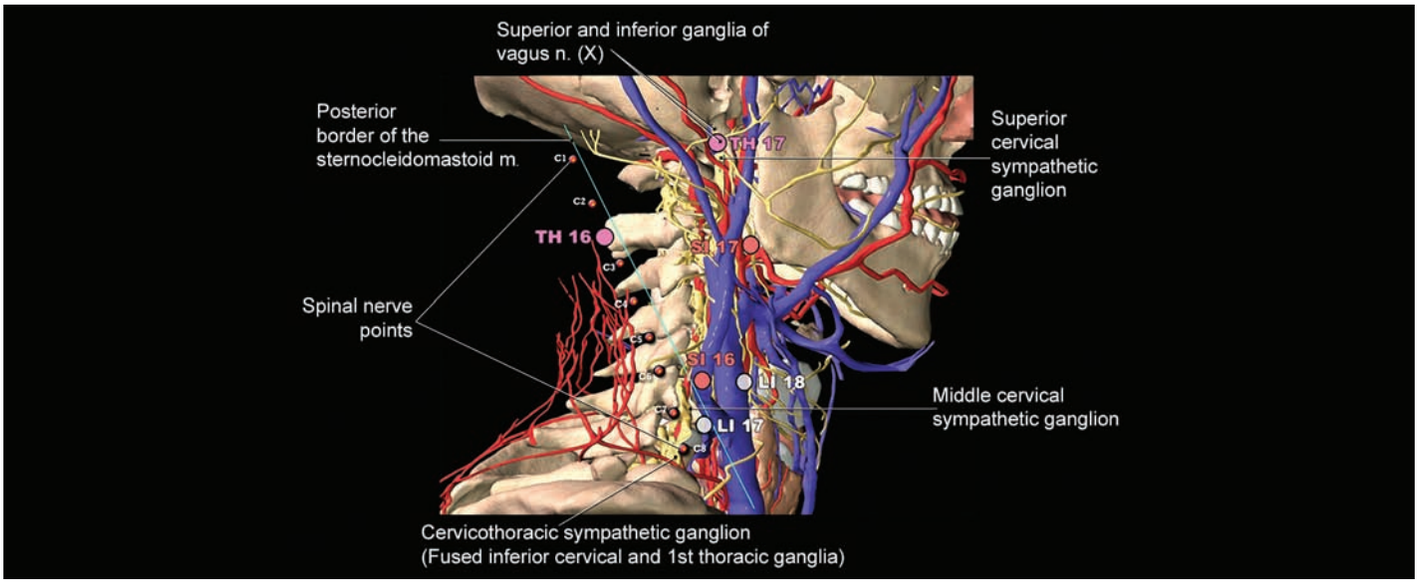

Figure 2-32. Acupuncture points on the lateral neck often occur adjacent to autonomic locales capable of widespread physiologic effects. This view illustrates the proximity of LI 17 to the middle cervical and cervicothoracic sympathetic ganglia.

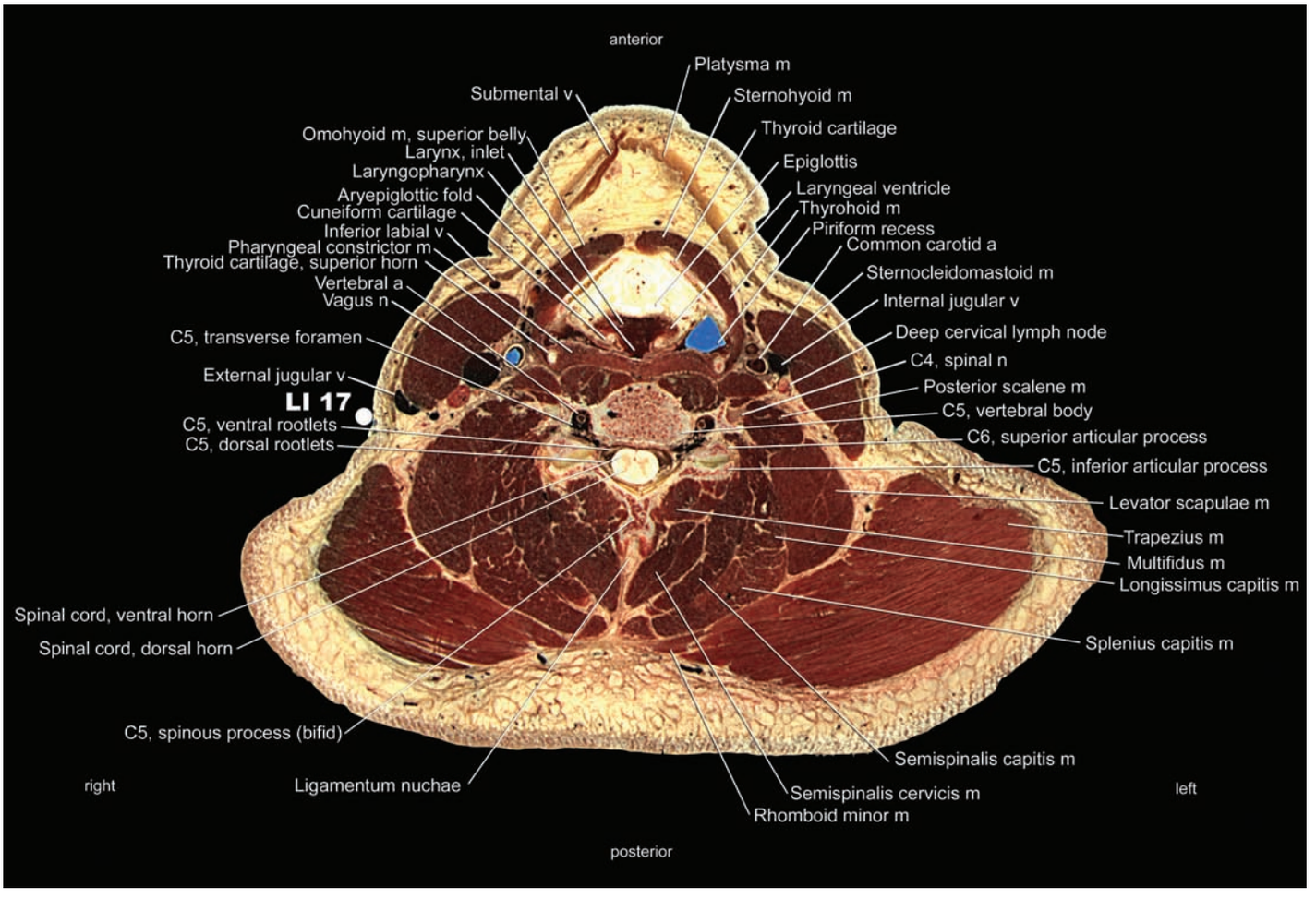

Figure 2-33. The cross-section at LI 17 exposes the densely packed neural, vascular, and myofascial structures within reach of an acupuncture needle. While acupuncture needling can influence nociceptive transmission as well as glandular, circulatory, and/or neural control of the head and neck, injudicious needling can cause serious injury.