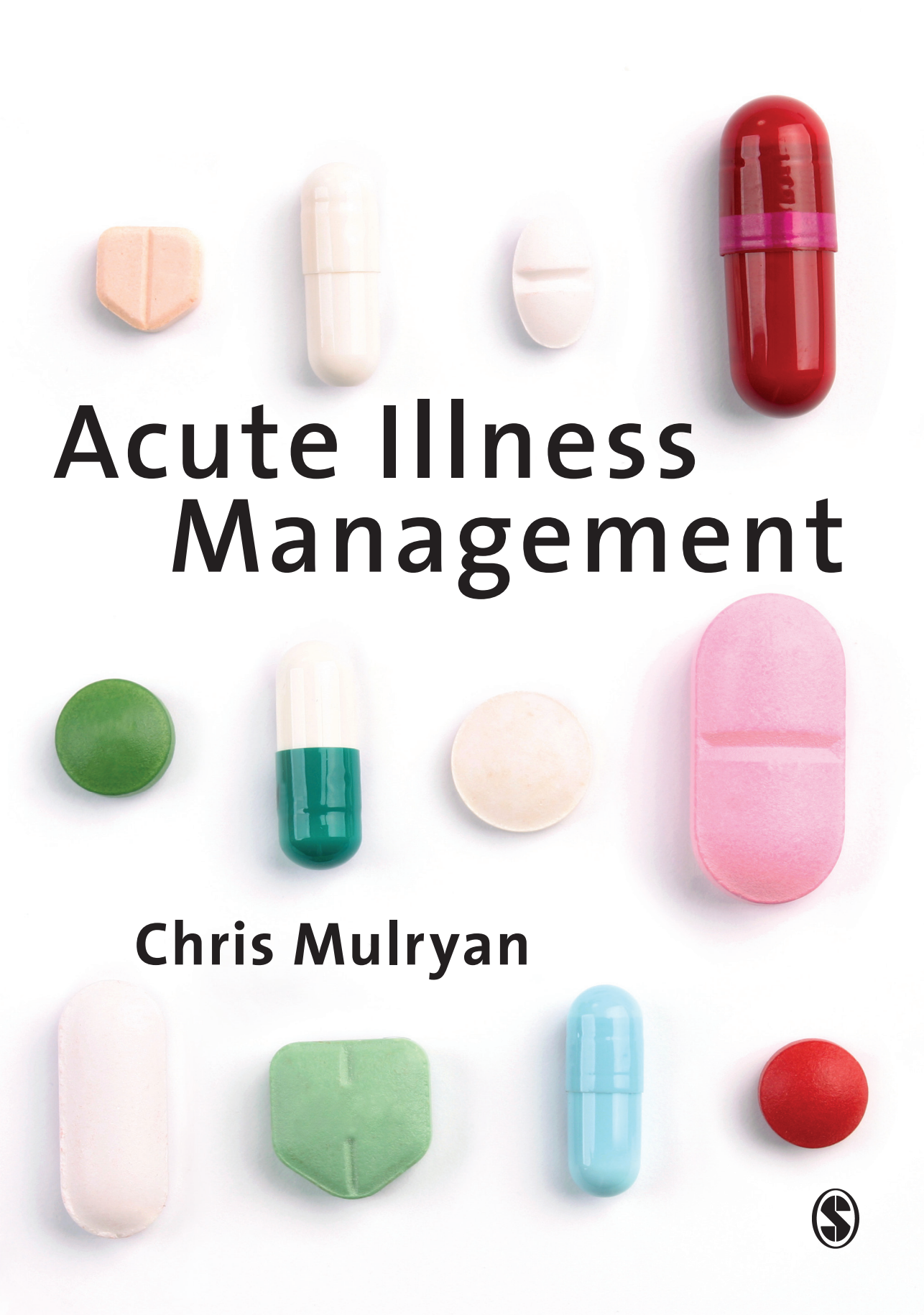

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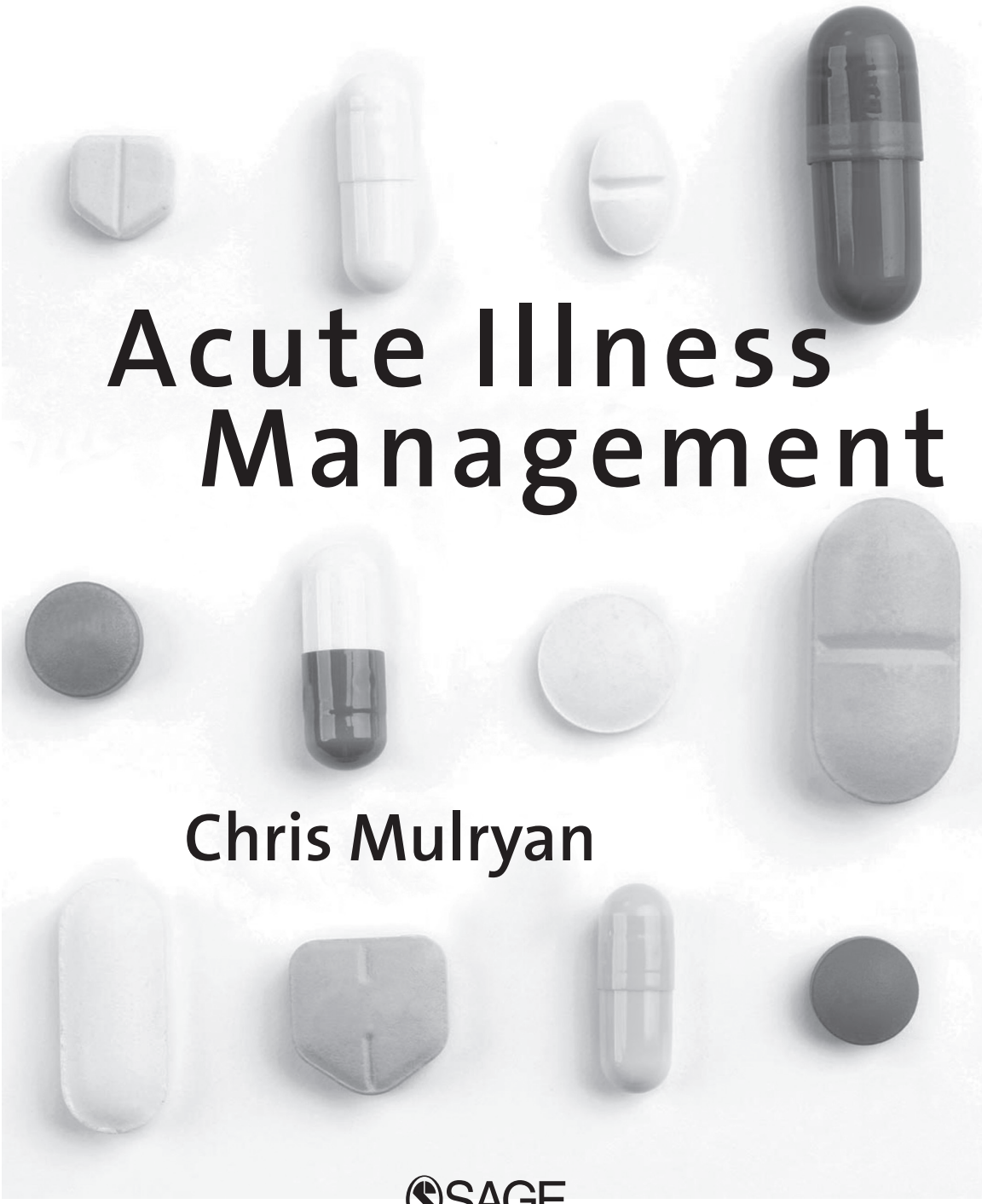

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Contents

Dedication and thanks

To
Marc Alexander Mulryan RIP 1979-1996
(Mr Tartleaf, as it is a special occasion)
and
those who have suffered harm needlessly for the want of better acute care

Special thanks
Many people have helped to bring this text to fruition. Special thanks are due to Zoe Elliot-Fawcet for commissioning the book. Dr Clive Taylor for his amazing support, encouragement and his critical eye. He read countless drafts and without him this book would not have made the press. Dr Lavinia Norton for teaching me so well. Lara Mulryan for the images that she has contributed. Alison Poyner, Emma Paterson and Emma Milman for their patience and support throughout this project. Katie Forsythe for guiding me effortlessly through the production process. Others at SAGE who have worked to bring this text to the shelf.

About the author

Chris Mulryan is senior lecturer at the University of Bolton where he teaches on a variety of programmes including the MSc in Advanced Practice, BSc in Health and Social Care and the Diploma in Paramedic Practice. In addition to this he also contributes the popular multidisciplinary continuing professional development framework provided by the university. Chris's academic interests are mainly concerned with patient safety and how expert clinical care contributes to this. To this end he is keen to teach about the body in a rigorous yet accessible way so that health professional have a developed understanding of how diseases affect the body and how medical therapies work to better or restore health.

List of abbreviations

°C	Degree Celsius
ABCDE	Airway, Breathing, Circulation, Disability, Exposure
ABG	Arterial Blood Gas
ACE	Angiotensin Converting Enzyme
ACS	Acute Coronary Syndrome
AED	Automated External Defibrillator
AF	Atrial Fibrillation
ALTE	Acute Life Threatening Event
ARDS	Acute (Adult) Respiratory Distress Syndrome
ATP	Adenosine Triphosphate
AV	Atrioventricular
AVPU	Alert, Voice, Pain, Unresponsive
BiPAP	Bi-level Positive Airway Pressure
BMA	British Medical Association
BP	Blood Pressure
bpm	Beats per Minute
CAD	Coronary Artery Disease
CCOT	Critical Care Outreach Team
CPAP	Continuous Positive Airway Pressure
CPR	Cardiopulmonary Resuscitation
DIC	Disseminated Intravascular Coagulopathy
DNAR	Do Not Attempt Resuscitation
ECG	Electrocardiograph
EWS	Early Warning Score
FiO2%	Fraction Inspired Oxygen
GTN	Glyceryl Trinitrate
HONK	Hyperosmolar Non-Ketotic State
ID	Internal Diameter
IO	Intraosseous
IPPV	Intermittent Positive Pressure Ventilation
ITU	Intensive Therapy Unit
IV	Intra Venous

K	Potassium
kPa	Kilopascal
LEP	Legal, Ethical, Professional
LMA	Laryngeal Mask Airway
LPM	Litres per Minute
LT	Laryngeal Tube
MAP	Mean Arterial Pressure
MET	Medical Emergency Team
MI	Myocardial infarction
mℓ	Millilitres
mmHg	Millimetres of mercury
mmol/L	Millimole per litre
Na	Sodium
NPA	Nasopharyngeal Airway
NSR	Normal Sinus Rhythm
NSTEMI	Non-S-T Elevation Myocardial Infarction
OPA	Oropharyngeal Airway
PAC	Premature Atrial Contraction
$PaCO_2$	Partial Pressure of Carbon Dioxide in Arterial Blood
PaO_2	Partial Pressure of Oxygen in Arterial Blood
PEA	Pulseless Electrical Activity
PEFR	Peak Expiratory Flow Rate
pH	(*potenz* Hydrogen) Measure of Acidity
PJC	Premature Junctional Contraction
PSA	Patient Stability Assessment
PVC	Premature Ventricular Contraction
RCB	Red Blood Cell
ROSC	Return of Spontaneous Circulation
SA	Sinoatrial
SaO_2	Saturation of Oxygen in Arterial Blood
SIRS	Systemic Inflammatory Response Syndrome
STEMI	S-T Elevation Myocardial Infarction
SVT	Supraventricular Tachycardia
UAP	Unstable Angina Pectoris
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia
WBC	White Blood Cell

Introduction

> 'To live through an impossible situation, you don't need the reflexes of a grand prix driver, the muscles of a Hercules or the mind of an Einstein. You simply need to know what to do.' (Greenbank, 2003)

Nowhere is this statement truer than in the care of those who become acutely ill. Unfortunately, however, health professionals often report feeling poorly prepared for the role that they may be called on to play should a patient become acutely ill. In response to these common concerns, this book attempts to demystify the topic of acute illness management in order to provide health professionals with a more developed understanding of the key topics that underpin the safe care of those who are at risk of becoming or who actually become acutely ill.

Specifically this book aims to provide an accessible yet authoritative account of the main reasons why and how patients become acutely ill and how to recognise deterioration in a patient's condition early in the course of the disease process, and finally an explanation of the key strategies used in the management of patients who are acutely ill. Underpinning this are chapters that address the legal, ethical and professional issues and the more psycho-social aspects of care.

The intention of this book is not to drill you in following protocols, but to develop your understanding of what occurs physiologically during an episode of acute illness so that this basic knowledge can inform a problem-solving approach to care. This in turn will assist you in understanding acute illness so that you can both avert deterioration and respond to it when it occurs.

The direction this book takes is to first explain what acute illness is and the various ways through which it can develop. This then leads on to a description of the physiological mechanisms that maintain homeostasis and how these are challenged at times of acute illness, which helps in understanding the changes that occur in the body during an episode of acute illness. Next, this foundation is related to the care that is provided to individual patients at the varying stages of acute illness by considering the

rationale for the different assessment and treatment options that are utilised in the care of the acutely ill person. The book aims to make you think in an investigative way when assessing patients so that you can not only recognise abnormal clinical signs, but also explain those findings and what their implications are for the patient and their care. Finally, you are encouraged to instigate appropriate management of the acutely ill patient, again while being able to justify why this care is needed and what it hopes to achieve. Whereas this approach will bring benefits for patients, it is also hoped that this text will help to make the care of the acutely ill less of something that brings about anxiety and more of something that you are confident about and find rewarding to provide.

In short this book aims to provide an introductory guide to the key components of caring for those who are at risk of becoming acutely ill. It intends to be a kind of survival guide for health professionals who may become involved in the care of acutely ill patients, which in reality is any patient in any clinical setting.

How to use this book

This book has been designed to introduce the reader to the principles of caring for the acutely ill. As such it is intended that the book is read in its entirety as each section deals with a different aspect of the assessment and management of the acutely ill patient. This book takes a generic approach to the subject of caring for the acutely ill without trying to link findings to a specific diagnosis. It focuses on recognising and correcting abnormalities of physiology that are common to all medical and surgical specialities involving adults. This approach enables you to deduce what is occurring within a patient physiologically and then be able to react to this without investing time in working out a specific diagnosis.

To help you learn about acute illness this book has been organised in a way that helps to integrate theory into your practice. Each chapter commences with a set of chapter aims. These are points that you should know after reading the chapter and completing the exercises within it. When you start reading each chapter be clear about what it is you are expected to achieve from reading the chapter and then at the end of the chapter go back to the chapter aims and consider whether you think that you have achieved them.

Throughout this book you will find various activities that you are encouraged to undertake if you are to generate the most learning from this book. Some of these exercises will be reflective and others will require you to

do things in your practice setting. Both are equally important to developing your acute care skills. Each chapter also concludes with some self-assessment questions. These are designed to help you judge whether you have developed a good grasp of the topic or if there are gaps in your knowledge that you should try to address.

After reading this book you may wish to enhance your knowledge in a way that is more specific in terms of the conditions that people in your area of practice present with. This is a sensible step and one that is to be encouraged. That said, it is important to recognise that in the initial stages of managing those who become acutely ill the process of management is largely generic and the systematic approach that is proposed in this book should still be followed.

It is sincerely hoped that you find this book both enjoyable and informative. Probably more importantly it is hoped that you find this book useful in improving the care that you provide to patients who suffer the misfortune of becoming acutely ill.

Chris Mulryan

1

Acute illness management: an overview

Chapter aims

By the end of this chapter you should be able to:

- Define what acute illness is
- Explain how acute illness typically develops in patients
- Identify some deficiencies in how acutely ill patients are recognised and managed
- Describe some potential ways through which acute care can be enhanced
- Review your own practice with regard to acute illness management and identify any learning needs that you may have

Acutely ill individuals can present in all healthcare settings and thus every health professional needs to have the knowledge and skills necessary to respond to this group of patients. In practice, this means that all health professionals must be able to recognise those who are at risk of becoming acutely ill and take early action to stabilise them in order to avert further deterioration.

Defining acute illness

Before going any further with the discussion of acute illness, it is important establish what exactly acute illness is. On reviewing the literature, it is difficult to find one definition of acute illness that would suitably cover all

patients in all specialities. What is easy to locate is a definition of the term 'acute', which is synonymous with illness that is rapid in onset, severe and short lived. The term 'acute illness' therefore describes patients who have rapidly become ill with a severe condition that may be life-threatening, with a degree of reversibility to it.

The inclusion of the term 'rapid' can be a little confusing as it conjures images of sudden collapse and as such requires further clarification. There is evidence that patients who suffer cardiac arrest have significant changes in their clinical observations for up to 24 hours before the cardiac arrest occurs (Hodgetts et al., 2002). This suggests that for many patients there is a period of acute illness that precedes the cardiac arrest. In this context, the term rapid therefore encompasses a gradual and insidious decline that occurs progressively over hours as opposed to weeks. While cardiac arrest, defined by the cessation of breathing and absence of cardiac output, represents an end point in this decline, there is a significant window of opportunity to intervene prior to arriving at this critical end point, which potentially allows cardiac arrest to be averted in some patients and morbidity reduced in others.

It should then be possible to define this time period of acute illness that precedes many cardiac arrests. To describe this phase of illness, where the patient is maximally physiologically disarranged, I shall use the term acute life-threatening event (ALTE). While ALTE is more difficult to define than cardiac arrest, it represents a period of time prior to cardiac arrest when a patient requires emergency resuscitation to avert cardiac arrest or other serious complications of an ALTE. The aim of acute illness management is then to detect those who are en route to, or have arrived at, an ALTE and to treat them rapidly and effectively before complications can occur.

Acute illness: a physiological disarrangement

Illness is something that spans a continuum of different clinical states that a patient may find themselves in; Figure 1.1 illustrates the regions of this spectrum. For most patients who become ill, the self-limiting nature of the illness and ability to self-repair confines the illness to the minor illness bracket. For others where the cause of the illness is more serious or the person's ability to self-repair is limited, they will progress on to the serious illness bracket. When this occurs the body will attempt to compensate for the illness state that has been encountered in an effort to maintain homeostasis. However, the body's ability to compensate for illness is limited, and illnesses,

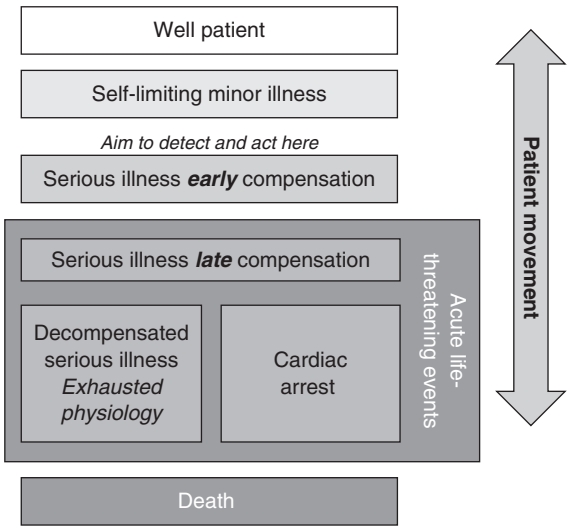

FIGURE 1.1 *The spectrum of acute illness.*

if severe, can exhaust the compensatory mechanisms of the body and bring about a massive physiological disarrangement. At the same time the activation of the compensatory mechanism places additional demands on an already diseased body and this in itself can further worsen the physiological disarrangement experienced by the patient. In some cases of acute illness it is in fact the body's own healing mechanism that bring about the illness state.

As the patient moves along the spectrum, from a point of wellness to a point where they are at risk of death, they will experience mounting physiological disarrangement. The further a patient moves along the spectrum of acute illness, the more difficult it is to correct their ailing physiology and the more likely it is that they will endure heightened morbidity and mortality. The speed at which a patient will progress along this spectrum is dependent on the actual cause of the disease; for some the progression will be quite slow but for others the progression may occur in quick succession with a small minority experiencing a sudden shift from a well patient state to cardiac arrest.

Acute illness is in simple terms a problem with a person's physiology that interrupts or hinders the factors that would normally regulate homeostasis (Chapter 2). There are many factors that can interfere with homeostasis, and while it is beyond the scope of this text to explore each and every one of the disease processes that can result in acute illness, Chapter 2 will endeavour to explain some most important physiological concepts that underpin the

development and management of acute illness. Example causes of acute illness are provided in Box 1.1.

BOX 1.1 Examples of acute illnesses

Airway obstruction, resulting in difficulty in breathing and ultimately hypoxia

- Loss of muscle tone/gag reflex
- Vomit
- Foreign body
- Swelling of the airway

Breathing problems, resulting in hypoxia and possibly acidic blood

- Acute asthma
- Exacerbation of chronic obstructive pulmonary disease
- Pneumonia
- Carbon monoxide poisoning
- Pneumothorax/plural effusion

Circulatory problems, resulting in shock and possibly acidic blood

- Myocardial infarction
- Heart failure
- Vomiting and diarrhoea causing dehydration, blood loss, other fluid loss
- A problem with the heart's rhythm (arrhythmia)

Kidney problems (renal failure)

- Too much fluid in the body (hypervolaemia/fluid overload)
- Too little fluid in the body (hypovolaemia)
- Altered electrolyte balance, particularly of sodium, potassium and calcium
- Problems with the regulation of acid in the blood
- Problems with blood pressure (hypertension/hypotension)
- Problems with red blood cell production (anaemia)

Problems with how acute illness is managed

It is now well recognised that acutely ill patients are not always well managed. Indeed a study by McQuillan et al. (1998) demonstrated that poor quality acute care not only occurred, but also that where patients were subjected to poor quality care either by not being recognised as acutely ill soon enough or not being managed correctly that there was a dramatic worsening in a patient's chances of surviving the episode. McQuillan et al. (1998) discovered that patients were approximately 20% more likely to die when they were the recipients of poor quality care prior to intensive care

unit (ITU) admission. Hodgetts et al. (2002) also demonstrated that an estimated 23,000 otherwise preventable in-hospital cardiac arrests occur in the UK each year as a result of poor quality acute care. These both shocking and saddening statistics are made worse when one considers that most of the variables that lead to poor patient outcomes relate to basic facets of care such as appropriately interpreting nursing observations, maintaining an adequate fluid balance, providing tailored oxygen therapy and maintaining a patient's airway and breathing (National Confidential Enquiry into Patient Outcome and Death, 2005).

While the picture that has thus far been painted of the state of acute illness management is quite a dismal one, a positive point to bear in mind is that many of the failings are readily reversible. This sets forth a challenge for health professionals to identify areas of poor practice and put in place plans to correct it.

Improving the response to the acutely ill

Several strategies have been proposed to improve the response to the acutely ill. These have included the use of early warning scores (EWS), early goal-directed therapies and improved education for those charged with responsibility for detecting acute illness and managing it. Following the development of EWS systems (Morgan et al., 1997; Stubbe et al., 2001) the National Institute for Health and Clinical Excellence issued guidelines on how to monitor people who are acutely ill and how to act once deterioration has been detected (NICE, 2007). These guidelines advocate the use of EWS systems for patients cared for in hospital.

EWS systems are essentially decision support tools which allow the identification of those who are at risk of deterioration. Most do this by setting reference ranges for physiological observations that are usually taken in the clinical environment. When these observations deviate from the reference range, a score is applied. When the score reaches a certain threshold, a specific action is required as dictated by local protocols. The 2007 NICE guidance on the acutely ill in hospital recommends that the scores generated by EWS are classified as either low, medium or high and the clinical response that a patient receives is directed by this classification. These classifications are set locally and will vary according to the EWS tool used, of which there are many, with different thresholds for action set by local advisors. This potentially introduces an inequality, as patients seen in different hospitals may be classified differently even when they present with clinically identical observations. To combat this situation, the Royal

College of Physicians proposed the development of an NHS early warning score, to be known as the NEW score (RCP, 2007). Indeed Prytherch et al. (2010) have recently developed and validated a scoring system that holds significant promise to standardise EWS.

While EWS systems play an important role and act as an enhancement to previous practice, their use is only a small part of the answer to the problems surrounding the care of the acutely ill. As with all protocols, they are designed to be used by thinking people. To illustrate the importance of thought, consider the observations listed and try to answer the questions in Box 1.2.

BOX 1.2 Observations to consider

- Respiratory rate: 18 breaths per min
- Pulse: 82 beats per min in normal sinus rhythm
- Blood pressure: 112/84 mmHg
- SaO_2: 96%

Questions

1 Look at the observations and map them against an EWS that you use locally.
2 Would you be concerned about a patient with these observations?
3 What, if anything, would lead you to have concerns about a patient with these observations?

On most of the currently available EWS systems the values in Box 1.2 would score zero, indicating that the patient was well and no trigger would be raised to command a clinical response to this patient. Now, if your patient is James Anderson, a 19-year-old man presenting to you after sustaining an ankle injury during a game of football, no loss of consciousness (LOC), no past medical history (PMH), who takes no medications – prescribed, over the counter or illicit – and has no allergies, then there is probably little to worry about physiologically based on the limited observations given. If, however, it was his grandfather Andrew Anderson, a 78-year-old, who was taking beta-blockers and angiotensin-converting enzyme (ACE) inhibitors and had had a myocardial infarction in 1997, a positive history for transient ischaemic attacks with type 2 diabetes, microalbuminurea and was normally hypertensive with a blood pressure of 188/96 mmHg who presented to you with ripping chest pain, then the clinical circumstances would be quite different. Although Andrew has a EWS of zero he is likely to be profoundly haemodynamically unstable. The

effects of beta-blockade and ACE inhibition have reduced his ability to compensate and hence he shows no signs of compensation in the observations given. The drop in his blood pressure is significant and worrisome, and taken with his history and presenting symptoms warrants immediate resuscitation and further investigation, ideally in a critical care area. From this simple case illustration, it can be seen that more than a tick-box system is needed if the acutely ill are to be reliably identified and managed.

Coupled with the ability to recognise the acutely ill patient is the need to manage them once detected. One strategy that can assist with doing this in an organised and responsive manner is early goal-directed resuscitation. Resuscitation is something that many solely associate with the response to a person who has had either a cardiac or respiratory arrest. Cardiopulmonary resuscitation or CPR is only one type of resuscitation, and resuscitation is a term with much wider utility. Simply put, resuscitation refers to restoring something to a normal state. Resuscitation can therefore be used to describe many other interventions that are designed to restore a person to a normal state. As such, resuscitative efforts can take place long before a person has a cardiac arrest and in many circumstances before the person has become acutely ill and experiences an ALTE. Terms such as fluid resuscitation and homeostatic resuscitation are examples of this, where the goal of resuscitation is not to restart a person's arrested heart, but to restore either a normal fluid balance or some other collection of physiological parameters that have become disarranged by the development of an illness state. The ultimate aim of this type of resuscitation is to prevent the development of an ALTE, averting the possibility of cardiac arrest and ultimately attempting to restore health.

Traditionally, care of the acutely ill individual was escalated at the point of gross abnormality in a person's physiology or where cardiac arrest had occurred; this is a critical oversight as any resuscitative efforts are much less likely to succeed at this late stage. Having established that cardiac arrest is often a preventable condition, it is important that resuscitation is started early and long before any gross abnormality occurs in a person's physiology if the best possible outcome is to be achieved.

The term 'goal-directed' resuscitation involves tailoring treatments given to achieve specific outcomes. For example consider how oxygen and intravenous fluid is administered to the acutely ill patient. It would theoretically be possible to provide the same treatment to all patients, as indeed most patients who become acutely ill will require both oxygen and intravenous fluid; however, this approach would result in some patients being overtreated while others were undertreated. The concept of goal-directed resuscitation sees that treatment is given in a sufficient quantity to achieve

a specific aim; for oxygen therapy this could be maintenance of the saturation of arterial oxygen between 94% and 98% or for intravenous fluid to keep the systolic blood pressure at 90 mmHg. Treatment in a goal-directed approach is given in an escalating pattern until the desired goal is achieved. Using this approach ensures that each patient receives the minimum yet most appropriate level of treatment needed to provide optimal support to their failing physiology. Goal-directed therapy has been a feature of intensive care medicine for many years now and its expansion to the non-ITU setting is timely and wholly appropriate for the initial management and stabilisation of the acutely ill patient (Rivers, 2001). When employing goal-directed therapy it is important though not to underestimate the severity of a patient's illness. The use of medical therapies to artificially support homeostasis in a person with failing physiology can restore blood pressure, oxygen saturations, etc., to a normal or near normal range. Where this is the case it is important to recognise that while homeostasis is being maintained, it is being achieved artificially and the person while more stable is dependent on the medical interventions that are stabilising them; however, the patient remains seriously unwell despite normal or near normal vital signs. This point not only illustrates the ability of goal-directed therapies to temporarily repair abnormal physiology but also shows the importance of factoring in the impact of any therapies that a patient might be in receipt of when making decisions about their stability.

Reflecting on your own acute illness management practice

While providing good quality care for a person who has become acutely ill is one of the most rewarding jobs that any health professional can undertake, it is also an activity that can provoke much anxiety for the caregiver. Some health professionals have even gone so far as to report overt fear at the mere thought of having to perform CPR (O'Donnell, 1990). While the exact reasons for this are likely to be multifactorial, a perceived lack of adequate preparation for the roles that health professionals are called upon to play has been cited as a problem (O'Donnell, 1990; Hamilton, 2005). This is an important observation, as improving the education of health professionals in the discipline of acute illness management could ultimately be a fundamental part of the solution to the problems with acute care that have been cited previously. This is particularly true when one considers that even if the acutely ill are identified using a scoring system, staff must be prepared and equipped to respond to the physiological changes that have been detected. An education that enhances the ability of health professionals to both