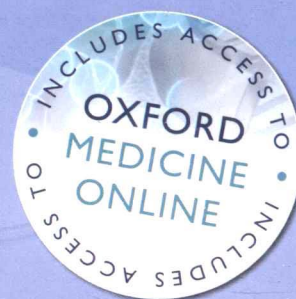


Oxford Textbook of **Anaesthesia** for the Elderly Patient

Edited by
Chris Dodds
Chandra M. Kumar
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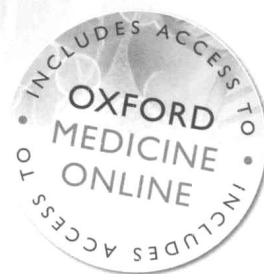
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Anaesthesia for the Elderly Patient

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Oxford Textbook of Anaesthesia for the Elderly Patient

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We would like to dedicate this book to those who have personally given us so much support over the years:

Chris: to my wife Ann for all her help and support

Chandra: to my wife Suchitra Kumar

Bernadette: to my special friends Caroline and Rozemarijn

Foreword

It is a pleasure to be invited to write a foreword for this book which is comprehensive, needed, and above all else, timely.

The growth in the elderly population across the world, in both the developed and also in the developing countries, has been unprecedented over the last two decades. National bodies tasked in providing health, welfare, infrastructure, and pensions have all been caught unawares by the shift in population demographics. Nowhere, however, is the impact felt as much as by the health services that have to meet the exponential demand for greater volumes of high quality care. The problems are experienced both financially and as an uncontrollable operational delivery exercise.

At present in the UK there are nearly 15,000 people over the age of 100 years and half a million over the age of 90 years: world wide, the number of people over 65 years will exceed those aged under 5 years in two years' time—the fastest growing age group is those aged 65 and over. The chronological age at which people develop degenerative diseases is increasing and this population,

when it requires anaesthesia, is presenting with more and more co-morbidities.

There is no doubt in my mind that the immediate future need of the health services is to meet the challenge of the ever-increasing elderly population with health solutions that provide high-quality care whilst simultaneously meeting the constraints of volume demand and cost-effectiveness. This book provides the way forward in anaesthesia to do just that. It is publishing at just the right time to make a maximal contribution to the problems of the immediate future. I congratulate the editors and authors and wish it every success.

Peter Hutton

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Preface

The balance of ages across populations throughout the world is changing. There are far more elderly people alive today than ever and they will profoundly alter the way we deliver healthcare. We will have to research, develop, and deliver appropriate anaesthesia, pain management, and intensive care to these increasingly frail and vulnerable patients. We have to recognize the fact that each elderly person is an individual whose needs vary to a far greater extent, one from another, than in other age groups. The prevention of complications and the associated loss of independence are vital in this age group and demand that we provide the highest standard of care.

The evidence base for our practice in the very old is woeful but improving and the contributors to this book have used the latest

information in their chapters. There are still many unanswered questions. Our understanding of the specific problems of the elderly, and therefore our practice, must evolve year on year as new information comes to hand. Just as each elderly cohort differs from the previous one because of the variation in exposure to infection, nutritional problems, smoking, poor social services, and access to therapeutic advances, so too must our practice reflect this. It is this challenge that makes caring for an elderly patient so rewarding at an intellectual and practical level.

We hope this book will inform and enthuse those who read it to provide better care for the elderly patient and to increase the evidence base on which we inform our practice.

List of Abbreviations

AAA	abdominal aortic aneurysm	CPP	cerebral perfusion pressure
ABA	American Board of Anesthesiology	CRP	C-reactive protein
ABI	ankle-brachial index	CSF	cerebrospinal fluid
ACE	angiotensin-converting enzyme	CT	computed tomography
ACEI	angiotensin-converting enzyme inhibitor	CVA	cerebrovascular attack
ACGME	Accreditation Council for Graduate Medical Education	CYP	cytochrome P450
ADL	activities of daily living	DBA	dobutamine stress echo
ADP	adenosine diphosphate	DBP	diastolic blood pressure
AED	antiepileptic drug	DLB	dementia with Lewy bodies
AF	atrial fibrillation	DLCO	diffusing capacity of the lung for carbon monoxide
AGE	advanced glycation end-product	DNAR	do not attempt resuscitation
AHA	American Heart Association	DNIC	diffuse noxious inhibitory controls
AHI	apnoea/hypopnoea index	ECG	Electrocardiogram
AKI	acute kidney injury	ECMO	extracorporeal membrane oxygenation
AMT	abbreviated mental test	ED	emergency department
ANH	artificial nutrition and hydration	EEG	electroencephalogram
AQP	aquaporin	EN	enteral nutrition
ARB	angiotensin receptor blocker	eNOS	endothelium derived nitric oxide synthase
ARMDS	age-related medial degeneration and sclerosis	EPO	erythropoietin
ART	assisted reproductive technology	ESWL	extracorporeal shock-wave lithotripsy
AS	aortic stenosis	ET	Endothelin
ASA	American Society of Anesthesiologists	EtCO ₂	end-tidal carbon dioxide
ASIC	acid-sensing ion channel (receptor)	EVAR	endovascular aneurysm repair
ATP	adenosine triphosphate	FEV ₁	forced expiratory volume in 1 second
AVR	aortic valve surgery	FRC	functional residual capacity
BMI	body mass index	FTD	frontotemporal dementia
BNP	brain natriuretic peptide	FVC	forced vital capacity
CABG	coronary artery bypass grafting	GABA	gamma-aminobutyric acid
CAD	coronary artery disease	GFR	glomerular filtration rate
CBD	case-based discussion	GMC	General Medical Council
CBF	cerebral blood flow	HCC	hepatocellular carcinoma
CEA	carotid endarterectomy	hESC	human embryonic stem cells
cfPWV	carotid-femoral pulse wave velocity	IABP	intra-aortic balloon pump
CGA	comprehensive geriatric assessment	IASP	International Association for the Study of Pain
CJD	Creutzfeldt-Jakob disease	ICH	intracerebral haemorrhage
CKI	cyclin-dependent kinase inhibitor	ICU	intensive care unit
CNS	central nervous system	IIS	insulin/insulin-like growth factor-like signalling
COPD	chronic obstructive pulmonary disease	IL	Interleukin
COX	cyclo-oxygenase	iNOS	inducible nitric oxide synthase
CPAP	continuous positive airway pressure	IOP	intraocular pressure
CPB	cardiopulmonary bypass	LA	left atrial
CPE	cardiopulmonary exercise	LIMA	left internal mammary artery
		LMA	laryngeal mask airway

LV	left ventricle	PSP	progressive supranuclear palsy
MAC	minimum alveolar concentration or mitral annular calcification	PWV	pulse wave velocity
MDT	multidisciplinary team	RAAS	renin-angiotensin-aldosterone system
MEF	maximal expiratory flow	RAS	renin-angiotensin system
MEP	maximal expiratory pressure	RNS	reactive nitrogen species
MET	metabolic equivalent	ROS	reactive oxygen species
MIF	maximal inspiratory flow	RSI	rapid sequence intubation
MIP	maximal inspiratory pressure	RV	residual volume
MMP	matrix metalloproteases	SAH	subarachnoid haemorrhage
MMSE	Mini Mental State Examination	SBI	silent brain injury
MR	mitral regurgitation	SBP	systolic blood pressure
MRA	magnetic resonance angiography	SDH	subdural haematoma
MRI	magnetic resonance imaging	SOAR	systolic blood pressure, oxygenation, age, and respiratory rate
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>	SOD	superoxide dismutase
MS	mitral stenosis	SpO ₂	haemoglobin oxygen saturation
MVR	mitral valve repair	SSI	surgical site infection
NADPH	nicotinamide adenine dinucleotide phosphate	STEMI	ST-elevation myocardial infarction
NAFLD	non-alcoholic fatty liver disease	STS	Society of Thoracic Surgeons
NF-κB	nuclear factor kappa B	SVG	saphenous vein graft
NHS	National Health Service (UK)	SVR	systemic vascular resistance
NICE	National Institute for Health and Clinical Excellence	TAP	transversus abdominis plane
NIRS	near-infrared spectroscopy	TAVI	transcatheter aortic valve implantation
NMDA	N-methyl-D-aspartate	TBI	traumatic brain injury
NO	nitric oxide	TCD	transcranial Doppler
NP	natriuretic peptide	TGF	transforming growth factor
NSAID	non-steroidal anti-inflammatory drug	TIA	transient ischaemic attack
OPCAB	off-pump coronary artery bypass	TLC	total lung capacity
PaCO ₂	partial pressure of carbon dioxide in arterial blood	TNF	tumour necrosis factor
PACU	post-anesthesia care unit	TOE	transoesophageal echocardiography
PAD	peripheral arterial disease	TOR	target of rapamycin pathway
PaO ₂	partial pressure of oxygen in the arterial blood	TRUS	transrectal ultrasound
PCNL	percutaneous nephrolithotomy	TTE	transthoracic echocardiography
PCT	procalcitonin	TURBT	transurethral resection of bladder tumour
PD	Parkinson's disease	TURP	transurethral resection of prostate
PDD	Parkinson's disease dementia	UTI	urinary tract infection
PN	parenteral nutrition	VaD	vascular dementia
POCD	postoperative cognitive dysfunction	VSMC	vascular smooth muscle cell
POD	postoperative delirium	WDR	wide dynamic range
POSSUM	Physiological and Operative Severity Score for Enumeration of Mortality and Morbidity		

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Introduction

Chris Dodds

We face an unprecedented challenge across the world as the balance of populations tip towards ever larger proportions of older members. This trend is not likely to begin to reverse for the next 40 years and will affect every one of us both professionally and personally. This change will alter the manner in which we live as independent adults, the age at which couples start their families, and the age at which we are able to afford to stop working.

The burden of caring for dependents will increase, whether these are children, parents, or grandparents. Increasingly families require both partners to work and their ability to maintain financial stability is undermined if one of them has to restrict their hours of work to care for a previously independent family member. This comes into sharp focus when an elderly family member has a serious illness or requires surgery. Not only is there a need for immediate support to get them back to their normal level of independence but the very prolonged nature of their convalescence means that support, of a degree, may need to be provided for many months.

Complications, following all medical interventions irrespective of the procedure, are far more common in older patients, and these are likely to have the greatest impact on their independence. Some are more to be expected as predictable side effects of the necessary clinical care whereas others are unexpected serious events. We, as a profession, continue to have a duty of care to determine what may cause these complications and try whenever possible to avoid precipitating them.

Anaesthesia because of its central role in hospital medicine has the ability to influence the outcome for patients from surgery, interventional radiology, intensive care, trauma, and pain medicine amongst others. As the majority of anaesthetists will spend most of their clinical years caring for elderly patients, it is imperative to understand why they differ from younger patients, and in what ways. The increasingly unacceptable response of 'we do lots of them anyway so what is so special?' has to be replaced by an attitude of providing individually tailored care based on the latest scientific data available. This evidence base is, perhaps, the most telling insight into medical and anaesthetic research into the elderly over the years. Until very recently almost all clinical trials excluded patients over the age of 65. Exclusion criteria also included mild cognitive dysfunction and pre-existing cardiac or respiratory disease—conditions present in many elderly patients. This means that for the majority of agents used during anaesthesia, the physiological parameters which are regarded as normal and the expectations of recovery are extrapolations from data gathered on younger patients. This is simply foolhardy.

The younger, healthier, adults enrolled into trials have minimal physiological variability. It is easy to look at the data gathered and visually identify relationships even if statistical packages are used to precisely define these. The contrast to the usual elderly distribution could not be more marked. Identifying a meaningful relationship may not be visually possible at all and reliance has then to be placed on the statistical analysis. What this means is that unlike caring for a fit American Society of Anesthesiologists (ASA) grade 1 adult where the responses to induction, surgical challenges, and recovery are largely predictable, each elderly patient is an individual and their responses unpredictable and so has to be managed with a far higher level of vigilance and skill to ensure a safe outcome. The precise parameters of blood pressure, heart rate, and fluid status will vary and one patient's hypertension will be another's hypotension. Simple techniques such as spraying the larynx and vocal cords with lignocaine to ameliorate the response to laryngoscopy and intubation may cause enough lidocaine to be absorbed to cause myocardial depression and hypotension in the frail elderly patient.

Although there has been much progress since the first specialist anaesthetic society was created over 20 years ago there is still no 'normative' data published on the responses of patients over 90 years of age to routine surgery. The information that is being published at present usually refers to small studies on patients with specific problems, for instance, fractured neck of femur. Large surveys and national audits do provide an idea of scale and outcomes but their retrospective nature limits their ability to differentiate between specific anaesthetic techniques in all but the broadest manner. We are no closer to clearly understanding what causes the devastating cognitive dysfunction that occurs so commonly, affecting nearly one in four of the elderly after major surgery.

Research in the field of geriatrics is helping to provide some guidance, especially with regard to the emerging concepts about frailty as a complex entity in its own right. Genetics and stem cell biology are proving fertile fields in the quest to understand the ageing process and potential means to slow, stop, or even reverse the process. Nanotechnology and bioengineering are exploring novel solutions to help with protecting vulnerable or isolated elderly people and the almost universal access to the Internet is allowing interactive monitoring and tailored clinical advice for those with long-term medical conditions.

At a clinical and training level, awareness of the communication problems in the elderly, related to vision, hearing, and language, is improving but is still rarely taught formally across anaesthetic training schemes. Simple tests of cognition such as the abbreviated

mental test (AMT) and mini-mental state evaluation (MMSE) are seldom part of routine preoperative assessment. There remains a great deal of mythology about the elderly patient's need for analgesia and what is safe and effective across nursing and medical staff.

It is for these reasons that we have embarked on creating this textbook. We have sought leading authoritative and acknowledged world experts to write the chapters in the book. There is, inevitably, a variation in both style and detail that reflects both the nature of that specialist area and also the volume of data available on that area. The sections are ordered to provide a view of the fundamental principles underlying ageing at the most basic levels, the population changes occurring and possible social consequences of those changes, the responses to drugs that change with ageing, and the potential that modern technology may hold for us. The next section covers ageing within specific organ systems, the nervous system including cognition, the cardiovascular, renal, respiratory, and hepatic systems. The third section summarizes

the common areas of practice some of which are related to the surgical speciality involved. These include pre-assessment, intensive care, pain management, obesity, frailty, and palliative care as well as covering other areas such as trauma, vascular, neurosurgery, cardiovascular surgery, urological, gynaecological, and ophthalmic surgery.

Finally there are areas where the elderly demand a greater focus than currently occurs, such as training, managing infection, maintaining heat balance, and anaesthesia beyond the operating suite. There is a review of the current medicolegal system. This is primarily from a UK perspective and we assume that it reflects practice worldwide. This emphasizes the need to seek informed consent, to identify the presence of any advanced directives or legal advocates, and to assess and support competence in decision-making.

Finally we have our view of what should happen in the future as well as a possible glimpse into where practice may evolve in the not so near future.

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