# GYNECOLOGIC AND OBSTETRIC SURGERY

## CHALLENGES AND MANAGEMENT OPTIONS

EDITED BY
ARRI COOMARASAMY
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WILEY Blackwell

# Gynecologic and Obstetric Surgery

## Challenges and Management Options

The Editors donate the royalties of this book to Ammalife (UK Registered Charity 1120236: www.ammalife.org) for the advancement of non-physician clinicians (clinical officers) in Africa.

This book is dedicated to my inspirational teachers in Valalai, Idaikkadu, Paththamani, Paruthithurai, Chennai and Forest Gate, for opening the doors of curiosity, knowledge and discernment.

Arri Coomarasamy

I would like to dedicate this book to my family: Naseem, Imran, Omar and Mohsin Shafi.

Mahmood I. Shafi

My contributions to this book are dedicated to the many clinical fellows, residents, researchers and observers who have given me the impetus to continue to acquire and, more importantly, share knowledge. Otherwise, life would be rather boring.

G. Willy Davila

# Gynecologic and Obstetric Surgery

## Challenges and Management Options


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# Preface

Our book has the aim of stimulating resourceful thinking and offering insightful management options to many challenges a gynecologic or obstetric surgeon may face before, during and after an operation. This book addresses two primary issues of concern at the coalface of practice: how to avoid getting into trouble, and if you are already in trouble, how to get out of it. It is thus a highly practical manual, with very little in the way of fine print.

We, the editors, are under no delusion that a book alone will make one an effective and safe surgeon. Competence in surgery is acquired by diligent and intelligent training under expert guidance. This book is designed to complement that process.

The book is divided into two parts, the first covering general preoperative, intraoperative, and postoperative challenges, and the second covering challenges specific to various gynecologic and obstetric operations within the subspecialty areas. Chapters are brief, starting with (i) a case history that presents the challenge, then (ii) a discussion about the challenge, and finally (iii) the management options that are available, with reasoning and available evidence. A summary Key points box is provided with each chapter, and is ideal for "elevator reading," i.e., speedy checking up of facts on the way to facing a challenge in an operating room or elsewhere.

How will you get the most out of this book? We suggest you read the case history, and work out some management solutions yourself before reading the rest of the chapter. Compare and contrast your solutions with the options in the book. Discuss with your seniors and juniors. And if you have a better option than that outlined in the book, please let us know; if we agree with you, we will acknowledge your contribution in the next edition.

A.C., M.I.S., G.W.D., K.K.C.

# List of Abbreviations

| | |
|---|---|
| **AAE** | arterial air embolism |
| **AAGL** | American Association of Gynecologic Laparoscopists |
| **ABC** | airway, breathing, circulation |
| **ABCDE** | airway, breathing, circulation, disability, exposure/examination |
| **ABG** | arterial blood gases |
| **ABPI** | ankle-brachial pressure index |
| **ACC/AHA** | American College of Cardiology/American Heart Association |
| **ACCP** | American College of Chest Physicians |
| **ACE** | angiotensin-converting enzyme |
| **ACHD** | adult congenital heart disease |
| **ACOG** | American College of Obstetricians and Gynecologists |
| **ACTH** | adrenocorticotropic hormone |
| **AED** | antiepileptic drug |
| **AF** | atrial fibrillation |
| **AFP** | α-fetoprotein |
| **AIS** | anti-incontinence surgery |
| **AKI** | acute kidney injury |
| **ALP** | alkaline phophatase |
| **ALS** | advanced life support |
| **ALSO** | advanced life support in obstetrics |
| **ALT** | alanine aminotransferase |
| **anti-HBs** | hepatitis B surface antibody |
| **anti-HBc** | total hepatitis B core antibody |
| **anti-HBe** | hepatitis B e antibody |
| **AOC** | advanced ovarian cancer |
| **AP** | anteroposterior |
| **APS** | antiphospholipid syndrome |
| **aPTT** | activated partial thromboplastin time |
| **ARDS** | acute respiratory distress syndrome |
| **ART** | assisted reproductive technology |
| **ASA** | American Society of Anesthesiologists |
| **AST** | aspartate aminotransferase |
| **ATP** | anti-tachycardia pacing |
| **BCSH** | British Committee for Standards in Haematology |
| **b.d.** | twice daily |
| **bHCG** | β-human chorionic gonadotropin |
| **BM** | Boehringer Mannheim (test to measure blood glucose levels) |
| **BMI** | body mass index |
| **BMS** | bare metal stent |
| **BP** | blood pressure |
| **bpm** | beats per minute |
| **BPI** | brachial plexus injury |
| **BSO** | bilateral salpingo-oophorectomy |
| **BSUG** | British Society of Urogynecology |
| **CABG** | coronary artery bypass grafting |
| **CAD** | coronary artery disease |
| **CAIS** | congenital androgen insensitivity syndrome |
| **CARP** | Coronary Artery Revascularization Prophylaxis |
| **CDC** | Centers for Disease Control and Prevention |
| **CE** | Conformité Européenne |
| **CEA** | carcinoembryonic antigen |
| **CEMACH** | Confidential Enquiry into Maternal and Child Health |
| **$CHA_2DS_2$-VASc** | **c**ongestive heart failure, **h**ypertension, **a**ge, **d**iabetes mellitus, **s**troke, **v**ascular disease, **a**ge, **s**ex **c**ategory |
| **CI** | confidence interval |
| **CIC** | clean intermittent catheterization |
| **CIN** | cervical intraepithelial neoplasia |
| **CISC** | clean intermittent self-catheterization |
| **CIWA-Ar** | Clinical Institute Withdrawal Assessment of Alcohol Scale, Revised |
| **CKC** | cold-knife cone |
| **CKD** | chronic kidney disease |
| **CME** | continuing medical education |
| **COPD** | chronic obstructive pulmonary disease |
| **CPAP** | continuous positive airway pressure |
| **CPR** | cardiopulmonary resuscitation |
| **CRH** | corticotropin releasing hormone |
| **CRP** | C-reactive protein |
| **CRT** | cardiac resynchronization therapy |
| **CS** | cesarean section |
| **CSF** | cerebrospinal fluid |
| **CSP** | cesarean scar pregnancy |
| **CT** | computed tomography |
| **CTG** | cardiotocography |
| **CTP** | Child-Turcotte-Pugh (scoring system) |
| **CTS** | category, time, site |
| **Cu-IUD** | copper intrauterine device |
| **CVP** | central venous pressure |
| **D&C** | dilatation and curettage |
| **DAP** | dose-area product |
| **DDAVP** | desmopressin acetate (1-desamino-8-D-arginine vasopressin, a synthetic analog of the pituitary hormone 8-arginine vasopressin) |
| **DDD** | dual chamber (dual pacing, dual activity sensing, dual response) |
| **DES** | drug-eluting stent |
| **DIC** | disseminated intravascular coagulation |
| **DIEP** | deep inferior epigastric perforator |
| **DKA** | diabetic ketoacidosis |
| **DMARDs** | disease-modifying antirheumatic drugs |
| **DNAR** | do not attempt resuscitation |
| **DO** | detrusor overactivity |
| **DSD** | disorders of sex development |
| **DSM** | Diagnostic and Statistical Manual of Mental Disorders |
| **DVT** | deep vein thrombosis |
| **EAS** | external anal sphincter |
| **EAU** | endoanal ultrasound |
| **ECF** | extracellular fluid |
| **ECG** | electrocardiography, electrocardiogram |
| **EHRA** | European Heart Rhythm Association |
| **ELISA** | enzyme-linked immunosorbent assay |
| **EMG** | electromyography |

| | |
|---|---|
| **EmOC** | emergency obstetric care |
| **ENT** | ear, nose and throat |
| **EPO** | erythropoietin |
| **ER** | enhanced recovery |
| **ERAS** | enhanced recovery after surgery |
| **ERPC** | evacuation of retained products of conception |
| **ESA** | erythropoiesis-stimulating agent |
| **ESBL** | extended spectrum β-lactamase |
| **ESC** | European Society of Cardiology |
| **ESR** | erythrocyte sedimentation rate |
| **ESTReP** | Enhanced Surgical Treatment and Recovery Programme |
| **$ETCO_2$** | end-tidal carbon dioxide |
| **EUA** | examination under anesthesia |
| **EWS** | early warning score |
| **FBC** | full blood count |
| **FDA** | Food and Drug Administration |
| **FDG** | fluorodeoxyglucose |
| **FFP** | fresh frozen plasma |
| **$FEV_1$** | forced expiratory volume in 1 s |
| **FGM** | female genital mutilation |
| **FIGO** | International Federation of Gynecology and Obstetrics |
| **FNA** | fine needle aspiration |
| **FRC** | functional residual capacity |
| **FSH** | follicle-stimulating hormone |
| **FVC** | functional vital capacity |
| **G&S** | group and save |
| **GABA** | γ-aminobutyric acid |
| **GDC** | Gartner's duct cyst |
| **GECS** | graduated elastic compression stockings |
| **GFR** | glomerular filtration rate |
| **GIFTASUP** | Guideline on Intravenous Fluid Therapy for Adult Surgical Patients |
| **GIST** | gastrointestinal stromal tumor |
| **GMC** | General Medical Council |
| **GnRH** | gonadotropin-releasing hormone |
| **GP** | general practitioner |
| **GTN** | glyceryl trinitrate |
| **HAART** | highly active antiretroviral therapy |
| **HAS-BLED** | **h**ypertension, **a**bnormal renal or liver function, **s**troke, **b**leeding, **l**abile INRs, **e**lderly, **d**rugs and/or alcohol |
| **Hb** | hemoglobin |
| **HBeAg** | hepatitis B e antigen |
| **HBIG** | hepatitis B immunoglobulin |
| **HBsAg** | hepatitis B surface antigen |
| **HBV** | hepatitis B virus |
| **HCAI** | healthcare-associated infection |
| **HCG** | human chorionic gonadotropin |
| **HCV** | hepatitis C virus |
| **HCW** | healthcare worker |
| **HDU** | high-dependency unit |
| **HGCIN** | high-grade cervical intraepithelial neoplasia |
| **HIV/AIDS** | human immunodeficiency virus/acquired immunodeficiency syndrome |
| **HMB** | heavy menstrual bleeding |
| **HNPCC** | hereditary non-polyposis colorectal cancer |
| **HPA** | hypothalamic-pituitary-adrenal |
| **HPV** | human papillomavirus |
| **HrHPV** | high-risk human papillomavirus |
| **HRT** | hormone replacement therapy |
| **HSG** | hysterosalpingography |
| **IAP** | intra-abdominal pressure |
| **IAS** | internal anal sphincter |
| **ICD** | implantable cardioverter defibrillator |
| **ICF** | intracellular fluid |
| **ICI** | International Consultation on Incontinence |
| **ICIQ-VS** | International Consultation on Incontinence Questionnaire on Vaginal Symptoms |
| **ICS** | International Continence Society |
| **ICSI** | intracytoplasmic sperm injection |
| **IDDM** | insulin-dependent diabetes mellitus |
| **IEA** | inferior epigastric artery |
| **IgM anti-HBc** | IgM antibody to hepatitis B core antigen |
| **i.m.** | intramuscular (injection) |
| **IMCA** | independent mental capacity advocate |
| **INR** | International Normalized Ratio |
| **IOTA** | International Ovarian Tumor Analysis |
| **IPC** | intermittent pneumatic compression |
| **IPL** | infundibulopelvic ligament |
| **ISD** | intrinsic urethral sphincter deficiency |
| **ITA-IEA** | internal thoracic artery/inferior epigastric artery |
| **ITC** | isolated tumor cell |
| **ITP** | immune-mediated thrombocytopenic purpura |
| **ITU** | intensive therapy unit |
| **IU** | international unit(s) |
| **IU(C)D** | intrauterine (contraceptive) device |
| **IUGA** | International Urogynecology Association |
| **IUS** | intrauterine system |
| **i.v.** | intravenous (injection) |
| **IVC** | inferior vena cava |
| **IVF** | *in vitro* fertilization |
| **IVIG** | intravenous immunoglobulin |
| **IVP** | intravenous pyelography |
| **IVU** | intravenous urography |
| **KCl** | potassium chloride |
| **LAVH** | laparoscopic-assisted vaginal hysterectomy |
| **LDH** | lactate dehydrogenase |
| **LDUH** | low-dose unfractionated heparin |
| **LEEP** | loop electrosurgical excision procedure |
| **LEER** | laterally extended endopelvic resection |
| **LFT** | liver function test |
| **LH** | luteinizing hormone |
| **LLETZ** | large loop excision of the transformation zone |
| **LM** | laparoscopic myomectomy |
| **LMA** | laryngeal mask airway |
| **LMWH** | low-molecular-weight heparin |
| **LNG-IUS** | levonorgestrel intrauterine system |
| **LRH** | laparoscopic radical hysterectomy |
| **LRINEC** | laboratory risk indicator for necrotizing fasciitis |
| **LUTS** | lower urinary tract symptoms |
| **LVH** | left ventricular hypertrophy |
| **LVSI** | lymphovascular space invasion |
| **MAOIs** | monoamine oxidase inhibitors |
| **MAP** | mean arterial pressure |
| **MCA** | Mental Capacity Act |
| **MCV** | mean cell volume |
| **MDCT** | multirow detector helical computed tomography |
| **MELD** | Model for End-stage Liver Disease (score) |
| **MEWS** | Modified Early Warning Score |
| **MHRA** | Medicines and Healthcare products Regulatory Agency |
| **MI** | myocardial infarction |
| **micro-TESE** | microdissection testicular sperm extraction |

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|---|---|
| **MMSE** | Mini Mental State Examination |
| **MR** | magnetic resonance |
| **MRgFUS** | magnetic resonance-guided focused ultrasound |
| **MRI** | magnetic resonance imaging |
| **MRKH** | Mayer-Rokitansky-Kuster-Hauser (syndrome) |
| **MROP** | manual removal of placenta |
| **MRSA** | methicillin-resistant *Staphylococcus aureus* |
| **MSU** | midstream specimen of urine |
| **MUCP** | maximal urethral closure pressure |
| **MUS** | mid-urethral sling |
| **MVA** | manual vacuum aspiration |
| **NACT** | neoadjuvant chemotherapy |
| **NGT** | nasogastric tube |
| **NHS** | National Health Service |
| **NHSLA** | NHS Litigation Authority |
| **NICE** | National Institute for Health and Care Excellence |
| **NIDDM** | non-insulin-dependent diabetes mellitus |
| **NOAC** | novel anticoagulant |
| **NPO/NBM** | nothing by mouth |
| **NPSA** | National Patient Safety Agency |
| **NPWT** | negative pressure wound therapy |
| **NSAIDs** | non-steroidal anti-inflammatory drugs |
| **OAB** | overactive bladder |
| **OASIS** | obstetric anal sphincter injuries |
| **OR** | odds ratio |
| **ORS** | ovarian remnant syndrome |
| **OT** | operating theater |
| **PA** | posteroanterior |
| **PAE** | paradoxical air embolism |
| **PAF** | paroxysmal atrial fibrillation |
| **PALS** | Patient Advice and Liaison Service |
| **PCA** | patient-controlled analgesia |
| **PCI** | percutaneous coronary intervention |
| **PDS** | poly(p-dioxanone) |
| **PE** | pulmonary embolism |
| **PEA** | pulseless electrical activity |
| **PEEP** | positive end-expiratory pressure |
| **PEP** | post-exposure prophylaxis |
| **PESA** | percutaneous epididymal sperm aspiration |
| **PET** | positron emission tomography |
| **PFMT** | pelvic floor muscle training |
| **PID** | pelvic inflammatory disease |
| **POD** | pouch of Douglas |
| **PONV** | postoperative nausea and vomiting |
| **POP** | pelvic organ prolapse |
| **POP-Q** | pelvic organ prolapse quantification |
| **PPH** | postpartum hemorrhage |
| **PRBC** | packed red blood cells |
| **PSH** | port-site herniation |
| **PT** | prothrombin time |
| **PTFE** | polytetrafluoroethylene |
| **PVR** | post-void residual |
| **q.d.s.** | four times daily |
| **RA** | rheumatoid arthritis |
| **RBC** | red blood cell |
| **RCOG** | Royal College of Obstetricians and Gynaecologists |
| **RCT** | randomized controlled clinical trial |
| **RLS** | reporting and learning system |
| **RMI** | risk of malignancy index |
| **RR** | relative risk |
| **RVE** | rectovaginal endometriosis |
| **RVF** | rectovaginal fistula |
| **RVT** | radical vaginal trachelectomy |
| **SCJ** | squamocolumnar junction |
| **SCr** | serum creatinine |
| **SFT** | solitary fibrous tumor |
| **SIADH** | syndrome of inappropriate antidiuretic hormone secretion |
| **SIRS** | systemic inflammatory response syndrome |
| **SLE** | systemic lupus erythematosus |
| **SLN** | sentinel lymph node |
| **SLNB** | sentinel lymph node biopsy |
| **SN** | sentinel node |
| **SNAPP** | **s**epsis, **n**utrition, **a**ssess anatomy, **p**rotect skin, **p**lanned surgery |
| **SOCRATES** | **s**ite, **o**nset, **c**haracter, **r**adiation, **a**ssociations, **t**iming, **e**xacerbating factors, **s**everity |
| **SPRM** | selective progesterone receptor modulator |
| **SSF** | sacrospinous fixation |
| **SSI** | surgical site infection |
| **SSL** | sacrospinous ligament |
| **SSLF** | sacrospinous ligament fixation |
| **SSRI** | selective serotonin reuptake inhibitor |
| **SST** | short Synacthen test |
| **STARR** | stapled transanal rectal resection |
| **STI** | sexually transmitted infection |
| **SUI** | stress urinary incontinence |
| **$T_4$** | thyroxine |
| **$T_3$** | triiodothyronine |
| **TAH** | total abdominal hysterectomy |
| **TAP** | transversus abdominis plane |
| **TCAs** | tricyclic antidepressants |
| **TCRE** | transcervical resection of the endometrium |
| **t.d.s.** | three times daily |
| **TEE** | transesophageal echocardiography |
| **TESA** | testicular sperm aspiration |
| **TESE** | testicular sperm extraction |
| **TFT** | thyroid function test |
| **TH** | thyroid hormone |
| **TIA** | transient ischemic attack |
| **TIBC** | total iron-binding capacity |
| **TIVA** | total intravenous anesthesia |
| **TLH** | total laparoscopic hysterectomy |
| **TME** | total mesorectal excision |
| **TMET** | transmyometrial transfer |
| **TNF** | tumor necrosis factor |
| **TOT** | transobturator tape |
| **TPN** | total parenteral nutrition |
| **TPP** | tubal perfusion pressure |
| **TPU** | transperineal ultrasound |
| **TRALI** | transfusion-related acute lung injury |
| **TRAM** | transversus rectus abdominis muscle |
| **TSH** | thyroid-stimulating hormone |
| **TTE** | transthoracic echocardiography |
| **TVH** | total vaginal hysterectomy |
| **TVS** | transvaginal ultrasonography |
| **TVT** | tension-free vaginal tape |
| **TVTO** | tension-free vaginal tape obturator |
| **TWOC** | trial without catheter |
| **U&E** | urea and electrolytes |
| **UC** | ulcerative colitis |
| **UFE** | uterine fibroid embolization |

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|---|---|
| **UFH** | unfractionated heparin |
| **UNFPA** | United Nations Population Fund |
| **UNICEF** | United Nations Children's Fund |
| **US-FNAC** | ultrasound-guided fine needle aspiration cytology |
| **USI** | urodynamic stress incontinence |
| **USS** | ultrasound scan |
| **UTI** | urinary tract infection |
| **UVF** | urethrovaginal fistula |
| **VAC** | vacuum-assisted closure |
| **VAE** | venous air embolism |
| **VAIN** | vaginal intraepithelial neoplasia |
| **VCUG** | voiding cystourethrography |
| **VF** | ventricular fibrillation |
| **VLPP** | Valsalva leak point pressure |
| **VT** | ventricular tachycardia |
| **VTE** | venous thromboembolism |
| **VVF** | vesicovaginal fistula |
| **VVP** | vaginal vault prolapse |
| **vWF** | von Willebrand factor |
| **WBC** | white blood cell |
| **WHO** | World Health Organization |

# PART I

# General Preoperative, Intraoperative, and Postoperative Challenges

## Section 1
## Preoperative Care
**Editors: Phil Moore and Arri Coomarasamy**

CHAPTER 1

# Patient with Poor ASA Score

**Phil Moore**
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***Case history:*** *An obese 79-year-old woman with chronic obstructive pulmonary disease, angina, hypertension and insulin-dependent diabetes requires abdominal hysterectomy for endometrial cancer.*

## Background

The idea of a physical status classification system was originally suggested by the American Society of Anesthetists in 1940, and three physicians – Saklad, Rovenstine and Taylor – produced a six-point scale. In 1963 this was published with two modifications by Dripps *et al.* as the current five-point scale, which was subsequently amended to become the American Society of Anesthesiologists physical status system for assessing the fitness of patients before surgery. This eponymous system consists of five grades (Table 1.1). The system was later modified to include a sixth grade for brain-dead patients whose organs are being removed for donation. In cases of emergency surgery, the grade is modified by the addition of an 'E' (e.g., 5E).

**Table 1.1** American Society of Anesthesiologists (ASA) physical status system.

| ASA grade | Physical status |
|---|---|
| 1 | A normal healthy patient |
| 2 | A patient with mild systemic disease |
| 3 | A patient with severe systemic disease |
| 4 | A patient with severe systemic disease that is a constant threat to life |
| 5 | A moribund patient who is not expected to survive without the operation |

The score has been criticized for being subjective and prone to inter-observer variability. Additionally, it takes no account of the nature of the surgical procedure being carried out. Nevertheless, it is simple and quick to administer, rapidly communicated, and has been shown to be broadly correlated with adverse outcomes from surgery (Table 1.2).

**Table 1.2** Percentage perioperative mortality categorized by ASA status.

| ASA physical status class | Vacanti *et al.* [1] | Marx *et al.* [2] |
|---|---|---|
| 1 | 0.08% | 0.06% |
| 2 | 0.27% | 0.47% |
| 3 | 1.8% | 4.4% |
| 4 | 7.8% | 23.5% |
| 5 | 9.4% | 50.8% |

In view of the increased morbidity and mortality rate, patients with high ASA scores undergoing major surgery need appropriate preoperative investigations and preparation and, in order to optimize their outcome, require the involvement of senior surgical and anesthetic staff at all stages of their management.

## Management

The management of patients with a poor ASA score is based on three important principles.

1 A multidisciplinary assessment of the risks and benefits of the proposed procedure, and a frank discussion of these issues with the patient, and her relatives if appropriate.

In the case described, surgery may be necessary to save the woman's life; nevertheless, the severity of the underlying diseases must be taken into account, to ensure that surgery will result in not only prolonged life, but also a return to a quality of life deemed acceptable to the patient. However, it can be very difficult to quantify the risks and benefits associated with the proposed surgical procedure, and the decision to proceed is often based on a consensus opinion of the specialists involved. It is sometimes appropriate, especially in cases of disagreement among the healthcare professionals, to obtain opinions from clinicians not directly involved in the case. Discussions with the patient should include provision of published risk data if available, although this may be difficult to apply to an individual patient's clinical situation. The General Medical Council (UK) has stressed the importance of providing adequate information to enable patients to make a decision about their care. The patient may ask for the clinician's opinion about whether to proceed, and while it is appropriate to provide this, it should be made clear that this decision ultimately lies with the patient. It is almost always mandatory to seek the consent of patients before involving their relatives in discussions about their care. All discussions should be documented, in addition to obtaining signed written consent.

Sometimes the risks of surgery and anesthesia may dictate that a decision not to operate is the most appropriate course of action, with symptomatic, supportive or palliative care provided instead, with the patient's consent.

2 Preoperative optimization of physiology and pre-existing morbidity, including the involvement of other medical specialists as appropriate.

*Gynecologic and Obstetric Surgery: Challenges and Management Options,* First Edition. Edited by Arri Coomarasamy, Mahmood I. Shafi, G. Willy Davila and Kiong K. Chan.

In the case described, the woman should be reviewed by the cardiologists, diabetologists, respiratory or general physicians, and geriatricians as necessary. The aim of preoperative preparation is to optimize management of the patient's pre-existing comorbidities, and it may be appropriate to perform this either in the outpatient department or after hospital admission. This process may involve changing the patient's medication, or optimizing the dose and frequency of the drugs already in use. In the case described, review will include the patient's inhaled bronchodilators (Chapter 8), insulin (Chapter 9), and antihypertensive drug therapy (Chapter 7). It might be necessary to carry out further investigations or even interventional procedures, for example coronary angiography and stenting if her angina is inadequately controlled (Chapter 3). Arrangements should also be made for the postoperative management of these conditions. Although other specialists will likely make a valuable contribution to the patient's management, the final decision to proceed with anesthesia and surgery lies with the consultant surgeon and anesthetist caring for the patient. After listing for surgery, the patient should be reviewed by an anesthetist at the earliest possible opportunity, to allow planning of the perioperative management of her comorbidities. Physiological variables such as intravascular volume and plasma electrolyte levels should be optimized as far as possible. Some patients will benefit from preoperative admission to a critical care area where oxygen delivery to body tissues can be optimized with goal-directed therapy utilizing intravenous fluids and inotropes, and with invasive cardiovascular monitoring. Arrangements should also be made for higher-level care postoperatively, if required, and good communication with the nursing staff who will care for the patient will allow any special equipment or arrangements to be organized; for example, in this case, the patient is obese and may require specialist equipment for manual handling. It is important that discharge planning also commences at this stage, as non-standard care or equipment may also be needed in the community, and early assessment of these will avoid a prolonged and inappropriate stay in hospital.

3 The involvement of consultant-level surgical and anesthetic personnel and senior nursing staff in the planning and implementation of intraoperative and postoperative care. It may be important to also involve other healthcare and allied professionals, such as physiotherapists, dietitians, and social workers.

It may be appropriate for very senior surgical and anesthetic trainees to manage high-risk cases; however, close supervision and involvement of consultant staff is mandatory for high-risk patients at all stages of their hospital stay. This is particularly true intraoperatively, as minimizing time under anesthesia may reduce complications and enhance recovery. The World Health Organization (WHO) surgical checklist provides an opportunity for all the staff involved with the procedure to highlight issues or potential problems, and to ensure everyone understands the procedure being undertaken, and the particular risks associated with the patient's pre-existing conditions.

Although avoidance of general anesthesia by using spinal or epidural anesthesia may be advantageous from the point of view of this patient's lung disease, it may be associated with increased cardiovascular risk, requiring careful risk–benefit consideration by an experienced anesthetist. Depending on the planned incision, regional techniques may not provide adequate anesthesia.

Arrangements for recovery and high-level postoperative care (in a high-dependency or intensive therapy unit) should be in place in advance of surgery, and these should be confirmed on the day. It is sometimes necessary to review and clarify the patient's resuscitation status before surgery. High-risk patients may have 'Do not attempt resuscitation' (DNAR) orders in place, and as a number of the activities involved in general anesthesia may be interpreted as being resuscitative in nature (e.g., lung ventilation), DNAR orders may have to be withdrawn or suspended intraoperatively, dependent on local policy. Alternatively, it may be appropriate to agree limits on the interventions which may be used, for example stipulating that cardiac compressions in the event of cardiac arrest would be inappropriate. These issues should be fully discussed with the patient and/or relatives as appropriate.

## Prevention of complications

All discussions and plans should be carefully documented in the medical records, and good lines of communication should be established to ensure that all staff involved in the patient's care are aware of these.

Most medication should be continued up to the time of surgery, although this may require discussion with the anesthetist and appropriate medical specialists (Chapter 2). It may be necessary to repeat investigations such as blood tests after admission to hospital, to provide up-to-date baseline data in advance of surgery. The patient should be closely monitored postoperatively to allow early identification and treatment of complications arising from anesthesia or surgery. Regular review by senior medical staff is mandatory during the early postoperative period.

Scheduling the patient for surgery early in the day allows early postoperative complications to be detected and dealt with during daylight hours. It may be inadvisable to operate on these patients just before a weekend, as weekend medical cover is often reduced.

### KEY POINTS

**Challenge:** Surgery for the patient with a poor ASA score.

**Background**
- The ASA physical status scale correlates with perioperative morbidity and mortality.
- Patients' physical condition should be optimized before surgery.
- Senior surgical and anesthetic staff must be involved in all stages of patient management.

**Prevention**
- Careful planning of all stages of perioperative care.
- Multidisciplinary involvement.
- Scheduling of operation early in the day.

**Management**

***Preoperative***
- Multidisciplinary assessment of risks and benefits of surgery, and discussion of these with the patient and her relatives.
- Optimization of pre-existing medical conditions by medical specialists.
- Optimization of physiological variables: goal-directed therapy.
- Multidisciplinary advance planning of perioperative management.

***Intraoperative***
- Direct involvement of consultant surgical and anesthetic staff.
- Minimization of operative time.

***Postoperative***
- Close monitoring to identify complications early.
- Consideration for transfer to HDU or ITU for postoperative care.
- Regular senior surgical and anesthetic or critical care review of patient during postoperative period.

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CHAPTER 2

# Patient on Medication

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***Case history:*** *An elderly woman taking phenytoin for epilepsy and prednisolone 20 mg daily for COPD is scheduled to have laparotomy for ovarian cancer.*

## Background

Medications may affect, or be affected by, surgery. For instance, drugs can interact with anesthetic agents, impair clotting, or affect wound healing; conversely, surgery can wreak havoc on established treatment regimens, for example insulin or steroid therapy. A common preoperative challenge is deciding whether a drug should be stopped, continued as normal, or continued with a modified regimen. Another challenge is what should be done with oral medications during the preoperative fasting period and the postoperative period until oral feeding is re-established. This chapter focuses on medications and surgery; however, medications are often prescribed for specific chronic illnesses, and the management of patients with common chronic illnesses is addressed elsewhere in the book.

### Medication and anesthesia interactions

Several drugs can result in a hazardous interaction [1,2]. Some key drugs that may interact with anesthetic agents include aminoglycosides, beta-blockers, ACE inhibitors, clindamycin, cyclophosphamide, erythromycin, monoamine oxidase inhibitors, droperidol, haloperidol, magnesium, ritonavir, procainamide, quinidine, lithium, and tricyclic antidepressants. To reduce the risk of interactions, a full history of drugs and allergies should be taken during preoperative assessment and drug interactions should be carefully considered.

### Stress hormones

Operations associated with minimal stress (many minor operations) do not result in the release of stress hormones; however, operations associated with moderate or severe stress result in the release of cortisol and catecholamines [3]. The stress hormone response is of importance in women with adrenocortical suppression or diabetes.

### Poor gastrointestinal function

After major abdominal surgery, the patient may suffer with nausea, vomiting and ileus, preventing oral intake of medicines or resulting in poor absorption. Alternative routes of administration (e.g. intravenous, rectal or transdermal) will need to be considered.

### Clotting complications

Venous thromboembolism may occur following major surgery, particularly if the surgery is prolonged and associated with immobility and other risk factors. Oral contraceptives and hormone replacement therapy will increase the risk of venous thromboembolism (VTE). Women on anticoagulant or antiplatelet therapy are at risk of intraoperative and postoperative bleeding.

## Management

### Medications on the day of the operation

To avoid the risk of aspiration of stomach contents, food needs to be avoided for at least 6 hours before general anesthesia. However, water can be taken in small quantities for up to 2 hours before surgery. This will allow patients to take oral medications with sips of water until a few hours before an operation.

### Drugs that need to be continued and discontinued

Unless there is a contraindication, medicines should be continued through the perioperative period to avoid relapse of the condition being treated and to prevent the effects of drug withdrawal. Continuation may require administration via a route other than oral; however, a change of route may alter the bioavailability of a drug and thus may also necessitate a change of dose. Involvement of pharmacy information services and drug level monitoring may be necessary to ensure an effective therapeutic regimen is achieved. Categories of common drugs and whether they should be continued or discontinued is provided in Table 2.1. For detailed discussion of management of patients on anticoagulant/antiplatelet therapy and steroid therapy, see Chapters 16 and 17, respectively.

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**Table 2.1** Perioperative use of medications.

| Medication class | Perioperative recommendation | Alternatives for prolonged "nil by mouth" |
|---|---|---|
| **Cardiovascular medications** (Chapters 3–7) | | |
| Antihypertensives | Continue most antihypertensives, including a dose on the morning of surgery<br>*Withhold diuretics on the morning of surgery to reduce the risk of volume depletion and hypokalemia*<br>*Withhold ACE inhibitors on the night before and the morning of surgery*<br>Consider prophylactic beta-blockers in patients at high risk of perioperative cardiac morbidity (controversial) | Consider transdermal alternatives to $\alpha_2$-agonists<br>Consider intravenous alternatives to beta-blockers (e.g., esmolol)<br>Nitropaste is an alternative to oral nitrates |
| Antiarrhythmics (digoxin, sotalol, amiodarone) | Continue; consider serum levels | Amiodarone i.v. |
| Lipid-lowering drugs | Continue statins, including on the morning of surgery<br>*Discontinue bile acid sequestrants (cholestyramine, colestipol) and fibric acid derivatives (gemfibrozil) and other agents* | |
| **Pulmonary medications** (Chapters 8 and 53) | Continue inhaled agents (beta-agonists, ipratropium and steroids)<br>Continue chronic corticosteroids and increase dosage to account for surgical stress<br>Continue leukotriene inhibitors<br>Theophylline: no clear advice | Consider nebulized therapy<br>Consider intravenous steroids |
| **Medications affecting hemostasis** (Chapters 14–16) | Antiplatelet agents can be continued in patients having minor surgery | Consider bridging anticoagulation with LMWH for patients at high risk of thrombosis |
| Aspirin, clopidogrel (irreversible platelet function) | *Stop 5 days before surgery* | |
| Dipyridamole | No clear advice | |
| NSAIDs (reversible platelet dysfunction) | *Stop 3 days before surgery* | |
| Cox-2 inhibitors (little or no platelet effect) | Continue | |
| Warfarin | *Stop 4 days before surgery, and check INR the night before surgery. Most operations are safe when INR <1.5*. For emergency surgery, warfarin effect can be reversed by 2 units of FFP over 30 min (recheck INR after 1 hour) or 10 mg of intramuscular vitamin K (recheck INR after 6 hours) | |
| Unfractionated heparin (UFH) | *Discontinue full-dose anticoagulation 4–6 hours before surgery* | |
| Low-molecular-weight heparin (LMWH) | *Discontinue full-dose anticoagulation 24 hours before surgery* | |
| **Endocrine medications** (Chapters 9, 10 and 17) | *Withhold oral hypoglycemics on the day of surgery and resume when patient starts eating. If the half-life of the agent is >24 hours, stop 2 days before surgery* | Use intermediate and long-acting insulin for "basal coverage" with sliding scale insulin |
| Diabetic agents | *Discontinue metformin for 2 days before surgery*<br>Insulin: individualized regimens are required. For intermediate and long-acting insulin, half the usual dose is normally given on the night before and the morning of the operation, with dextrose infusion and sliding scale insulin | |
| Thyroid agents | Continue thyroxine<br>Continue antithyroid medications | |
| Steroid therapy | If the patient is on >10 mg of prednisolone (or equivalent) per day, use the following:<br>• For minor surgery: hydrocortisone 25 mg i.v. at induction<br>• For moderate surgery: hydrocortisone 50 mg i.v. at induction, and 25 mg every 8 hours for 48 hours, and then resume usual oral dose<br>• For major surgery: hydrocortisone 100 mg i.v. at induction and 50 mg every 8 hours for 48–72 hours and resume usual oral dose | Use intravenous hydrocortisone therapy<br>Discuss with endocrinologist |
| Oral contraceptives and hormone replacement therapy | *Stop combined estrogen/progesterone preparations 4 weeks before major surgery*<br>Continue progesterone-only preparations | |
| **Gastrointestinal medications** | Continue $H_2$ blockers<br>Continue proton pump inhibitors | Consider intravenous therapy |
| **Neurologic and psychotropic medications** (Chapters 18 and 19) | Continue anti-seizure medications<br>Hold anti-Parkinsonian agents briefly<br>Continue agents for myasthenia gravis<br>Continue SSRIs<br>Continue tricyclic antidepressants, benzodiazepines, lithium, and antipsychotics<br>*Discontinue MAOIs 10–14 days before surgery* | Benzodiazepines can be used parenterally<br>The antipsychotic agents haloperidol and olanzapine can be given parenterally |
| **Herbal medications** | Discontinue 1 week before surgery | |

### Restarting medications

Most drugs that are discontinued preoperatively can be restarted as soon as the patient is able to tolerate oral intake. For anticoagulants and for drugs that predispose to VTE, the time of recommencement will need to be individualized. If a patient is unable to take oral medications for more than 1 or 2 days, then alternative routes should be considered, in consultation with the medical and pharmacy teams as appropriate.

## Resolution of the case

The patient will need to be reviewed by an anesthetist and medical specialists to optimize her condition preoperatively. Necessary tests, including blood count, biochemistry, chest X-ray, ECG, lung function, and possibly cardiac function, will need to be performed. Phenytoin will need to be continued perioperatively, including on the morning of surgery. This can be taken with a small sip of water up to 2 hours before surgery.

It is very likely that this woman's adrenal axis will have been suppressed and normal steroid response to stress will have been blunted with 20 mg/day of regular prednisolone. As this is major surgery, hydrocortisone 100 mg i.v. should be given at induction, followed by 50 mg i.v. every 8 hours for 48–72 hours; after this period, the usual oral dose of steroid can be resumed.

## Prevention

A full drug and allergy history is essential to identify and avoid potentially serious drug and anesthetic interaction. When reviewing the medications, consider the indication for the medication, the effects of stopping the drug, absorption, half-life, metabolism, and elimination. Involvement of anesthetists, physicians, and pharmacists may be necessary for patients on complex medical regimens. Even if patients are "nil by mouth," they may still take oral medications with a sip of water until 2 hours before the operation; postoperatively, the aim should be to restart the medicine on day 1.

### KEY POINTS

**Challenge:** Patient on medication.

**Background**
- Medications may affect or be affected by surgery.
- For each drug, a decision needs to be made to stop, continue as normal, or modify the regimen.
- Major surgery is associated with release of the stress hormones cortisol and catecholamines; this has implications for patients with adrenocortical suppression and diabetes.
- Abdominal surgery can be associated with nausea, vomiting, and ileus; this may necessitate a non-oral route of drug administration.

**Prevention**
- A full drug and allergy history should be taken preoperatively.
- When reviewing medications, consider indication, effect of withdrawal, absorption, half-life, metabolism, and elimination.
- Involve physicians, anesthetists, and pharmacists for women with complex medical regimens.

**Management**
- Patients may take oral medications with a sip of water until 2 hours before surgery.
- Postoperatively, aim to start oral medications on day 1. If oral medication is not tolerated, consider alternative routes temporarily.
- For specific recommendations about perioperative use of commonly used medicines, see Table 2.1.

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## Further reading

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CHAPTER 3

# Patient with Ischemic Heart Disease

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***Case history:*** *A 75-year-old woman with an ovarian mass is scheduled to have surgery under general anesthesia. During the course of history-taking, it became apparent that she had symptoms of chest pain on minimal exertion and on two occasions had been woken at night with typical ischemic chest pain necessitating the use of her GTN spray. Her cardiac biomarkers were within the normal range.*

## Background

Coronary artery disease (CAD) is common and affects around 12% of the female population over 70. In patients with stable or asymptomatic CAD undergoing non-cardiac surgery, trials have shown no benefit from prophylactic coronary revascularization at reducing subsequent operative risk [1]. However, chest pain *at rest* is a symptom of unstable angina, a form of acute coronary syndrome which if untreated carries a high risk of adverse events including myocardial infarction (MI) and mortality. Thus, further investigation with coronary angiography is warranted as there is a significantly increased risk of postoperative MI, cardiac arrest and death to the patient. Even if treated by percutaneous coronary intervention (PCI) with coronary stents, a delay in performing surgery is mandated. It has been shown that patients undergoing non-cardiac surgery within 6 weeks of a PCI procedure have a higher risk of mortality when compared with patients undergoing surgery after 6 weeks [2]. Published guidelines are available for risk assessment and management of patients with CAD who need to undergo non-cardiac surgery [3].

If coronary revascularization is undertaken by PCI, there are concerns related to the need for dual antiplatelet therapy and operative bleeding. This, on the other hand, has to be balanced with the risk of stent thrombosis associated with early discontinuation of dual antiplatelet drugs in patients who have had recent deployment of a stent.

### Coronary revascularization prior to non-cardiac surgery

The Coronary Artery Revascularization Prophylaxis (CARP) trial [1] investigated the value of medical therapy versus revascularization in stable patients undergoing non-cardiac surgery. The revascularization strategy included both PCI and coronary artery bypass grafting (CABG). There was no difference in perioperative MI or long-term mortality when medical therapy was compared with coronary revascularization. Outside the perioperative setting, when non-invasive ischemia testing is employed, patients with evidence of moderate to severe ischemia (defined as >10% myocardium at risk) seem to benefit prognostically from PCI compared with medical therapy alone [4]. This strategy reduces the risk of death or MI especially if the ischemic burden is reduced to less than 5%. No trial, however, has specifically addressed the role of prophylactic coronary revascularization in patients with unstable angina symptoms requiring non-cardiac surgery.

### PCI with BMS versus DES

Coronary artery stents broadly comprise two categories: the bare metal stent (BMS) and the drug-eluting stent (DES). The latter were introduced in the early 1990s as a result of the high rate of restenosis seen with the deployment of BMS in the early (3–6 months) postoperative phase. Minor restenosis caused by neointimal hyperplasia (also called late luminal loss) is universal and occurs as part of the normal healing process within the vascular wall, and leads to scar tissue formation within the lumen of the stent. In about 30% of cases when a BMS is used, the degree of restenosis is severe leading to recurrent flow limitation. This can cause symptoms of recurrent angina and on occasion result in occlusion of the vessel and subsequent MI [5]. Risk factors for the development of restenosis with implantation of a BMS have been identified and include the presence of diabetes, current smoking, a reference vessel diameter of less than 3.25 mm, and lesion length of more than 30 mm [6].

A DES differs from a BMS in that it has an antiproliferative drug coating that inhibits smooth muscle proliferation and neointimal hyperplasia. The use of drug-eluting compared with bare metal stents results in a significant reduction in the subsequent need for target vessel revascularization, with no difference in rates of death or MI [7]. The use of DES modulates vascular inflammation preventing restenosis but also leads to delayed re-endothelialization and impairment of endothelial function, which increases the requirements for duration of dual antiplatelet therapy.

### Coronary stents and antiplatelet therapy

Stent thrombosis is a feared outcome, with reported mortality rates up to 45% [8]. Stent thrombosis can be categorized as early (0–30 days), late (>30 days), and very late (>12 months). The presence of metal within the coronary tree creates a thrombogenic area; fortunately

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there are antiplatelet drugs available which reduce the risk of stent thrombosis to less than 1%. Aspirin and clopidogrel have long been considered mandatory. Recently, however, there have been newer antiplatelet drugs (ticagrelor, prasugrel) which further reduce the risk of stent thrombosis but with an increased risk of bleeding [9,10].

After implantation of a BMS it is recommended that the patient remains on a dual antiplatelet regimen for 4 weeks. For a DES, the recommendation is 6–12 months to allow adequate endothelialization of the stent [11]. Early discontinuation of antiplatelet drugs is considered the most potent risk factor for stent thrombosis [8]. Surgery also induces a state of hypercoagulability with reduced fibrinolysis and increased platelet reactivity, thus conferring an increased risk of stent thrombosis [12].

There were initial concerns that the presence of a DES may confer an increased risk of stent thrombosis, but recent studies do not suggest this [13]. It is also becoming evident that although early discontinuation of dual antiplatelet therapy carries a substantially increased relative risk of stent thrombosis, absolute risks are low and shorter durations of treatment (as little as 3 months) may be adequate when necessary [14].

### Bleeding risk with dual antiplatelet therapy

Some types of surgery increase the risk of bleeding and ideally should be undertaken with single or no antiplatelet therapy (e.g., prostatectomy, intracranial surgery, and myomectomy). However, patients who have had recent stent implantation should continue on aspirin when undergoing surgery. The decision to continue with clopidogrel will depend on the type of surgery and the type of coronary stent inserted. In certain surgical procedures, continuing with clopidogrel has been shown to increase the risk of bleeding, the need for blood transfusion, and hospital stay. The risk of bleeding will therefore need to be carefully balanced against the risk of developing stent thrombosis if clopidogrel is discontinued.

## Management

A cardiologist and an anesthetist will need to be involved in the management of a patient with CAD. The first step is to assess the extent and stability of CAD as well as the presence of any comorbidities (e.g., hypertension, diabetes, renal disease). Appropriate investigations may include ECG, echocardiography, exercise stress test, and coronary angiography.

Preoperative optimization of medical conditions should include cessation of smoking, good control of hypertension and cholesterol, and management of comorbidities such as diabetes.

The key decisions are best made in a multidisciplinary setting, and should include consideration of whether warfarin, aspirin or clopidogrel need to be stopped, and whether preoperative revascularization (e.g., with PCI) is needed.

A systematic review of randomized trials found that regional (spinal or epidural) anesthesia is safer than general anesthesia, with a reduction in overall mortality with regional anesthesia (OR 0.7; 95% CI 0.5–0.9) [15]. Although research evidence supports a more widespread use of regional anesthesia, it is recognized that an individualized approach will need to be taken with each patient.

Postoperatively, vigilance is required; if myocardial ischemia is suspected, an ECG and measurement of cardiac troponins, as well as review by a cardiologist, should be arranged.

## Resolution of the case

The management involved close discussion with surgeons and cardiologists. In view of the history of chest pain, the patient in the case history underwent a cardiac perfusion scan which confirmed significant ischemia in the left anterior descending artery territory (>10%). In light of this finding, she underwent urgent coronary angiography. There were concerns about the possible malignant nature of the ovarian mass and the indication for urgent surgery was clear. However, the high risks of dangerous cardiac complications when performing surgery on patients with unstable angina are well known and prominent in all relevant guidelines, so surgery was delayed. Angiography revealed a critical stenosis in the proximal left anterior descending artery (Figure 3.1). In view of this and the large amount of myocardium in jeopardy, she proceeded to PCI (Figures 3.2 and 3.3). It was clear that the patient would need

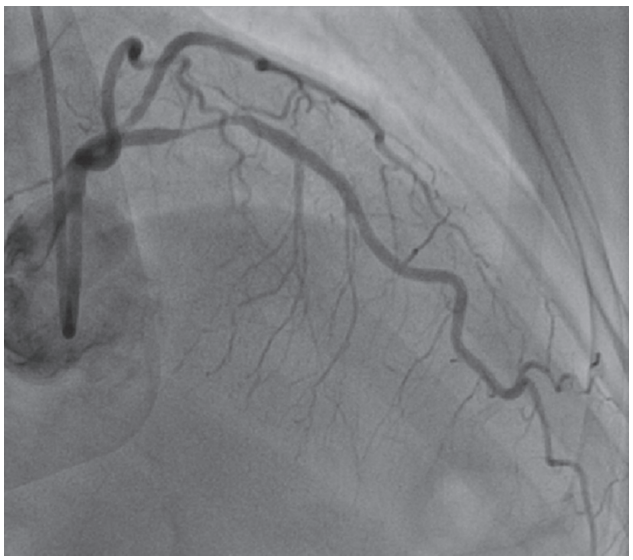

**Figure 3.1** Coronary angiogram showing significant proximal left anterior descending (LAD) artery stenosis.

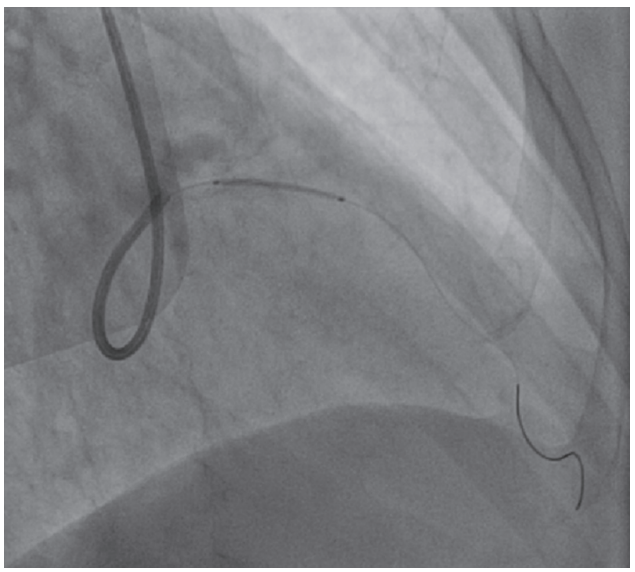

**Figure 3.2** Successful positioning of 3.0 × 18 mm bare metal stent in proximal LAD.

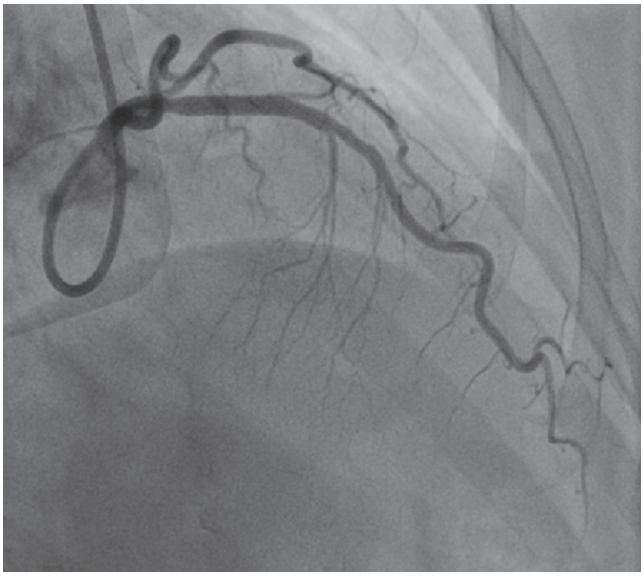

**Figure 3.3** Successful stent deployment and final angiographic result after expansion of stent with a 3.5 mm non-compliant balloon.

to go to surgery in the near future and so a bare metal stent was successfully deployed. Dual antiplatelet therapy was given for only 4 weeks post PCI. At 6 weeks the patient remained on aspirin therapy together with statins and underwent a successful general anesthetic procedure and surgical exploration.

In patients with stable angina there is no clear role for prophylactic revascularization prior to non-cardiac surgery but it is believed that optimal medical therapy including aspirin and statins reduces the risk of adverse cardiac events. However, in this patient, because of the unstable nature of symptoms and large burden of myocardium at risk, it was important for her to undergo undertake coronary angiography and revascularization by PCI.

## Prevention

A key goal of preoperative assessment is to identify hitherto undiagnosed heart disease. A cardiovascular condition may be suspected if the patient has unexplained chest pain, shortness of breath, claudication, lower extremity edema, erectile dysfunction, or past history of cerebrovascular events. All patients over the age of 60 years should have routine preoperative ECG.

If screening suggests a cardiovascular condition, appropriate investigations (e.g., ECG, exercise treadmill ECG, 24-hour ECG, and echocardiogram) should be arranged, and management planned with the help of a cardiologist and consultant anesthetist.

Preoperatively, the patient's condition should be optimized, with cessation of smoking and good control of blood pressure, cholesterol and body weight. There is conflicting evidence on the use of preoperative beta-blocker therapy, although it is suggested that it can be considered in patients who have known ischemic heart disease or myocardial ischemia [16]. The use of preoperative statins also has a IIa recommendation. Meta-analysis has shown that statins can reduce postoperative MI [17]; this is most likely a class effect and if statin treatment is considered, it should be initiated 4 weeks before non-cardiac surgical procedures.

### KEY POINTS

**Challenge:** Patient with ischemic heart disease.

**Background**

- CAD is common in those over 70 years of age.
- In stable or asymptomatic CAD, it is believed that optimal medical therapy including aspirin and statins reduces the risk of adverse cardiac events.
- Unstable angina carries a high risk of adverse events including MI and death, warranting further investigation with coronary angiography.
- If PCI is indicated, surgery should be delayed for 6 weeks if possible.
- Elective surgery should be delayed for 3–6 months after MI.

**Prevention (of complications)**

- Perform a thorough preoperative assessment to identify undiagnosed heart disease.
- Perform ECG on all patients over 60 years of age.
- Optimize preoperative condition: cessation of smoking, good control of hypertension and cholesterol, and management of comorbidities such as diabetes.
- Refer patients with unstable cardiac symptoms to a cardiologist for evaluation of symptoms as they are at increased risk of cardiac complications.
- Patients with unstable cardiac symptoms and/or substantial myocardium at risk should undergo revascularization and deployment of a BMS.
- There are conflicting data on the use of preoperative beta-blocker therapy, and routine use is not recommended for the purpose of postoperative risk reduction.
- There are promising data on the use of preoperative statins to reduce postoperative cardiovascular complications.

**Management**

- Involve a cardiologist and an anesthetist.
- Assess the extent and stability of CAD.
- Assess the presence of comorbidities, particularly hypertension, high cholesterol, diabetes, and renal disease.
- Arrange necessary investigations (e.g., ECG, echocardiography, exercise stress test, and coronary angiography).
- Take key decisions in a multidisciplinary setting:
  - When to stop and restart warfarin.
  - Whether and when to stop and restart aspirin and clopidogrel.
  - Whether to organize preoperative revascularization (e.g., stent) and delay the operation.
  - Whether to use regional (spinal or epidural) or general anesthesia.
- Postoperatively, if myocardial ischemia is suspected, arrange an ECG and measurement of cardiac troponins, as well as review by a cardiologist.

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CHAPTER 4

# Patient with Arrhythmias

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***Case history:*** *A 76-year-old woman attended for preoperative assessment, as she was awaiting hysterectomy. She was known to have had hypertension for 10 years and was diagnosed to be in atrial fibrillation (AF) 1 month previously on ECG. She had a DDD pacemaker implanted 3 years ago for an episode of collapse and asystole and had remained stable since then with satisfactory pacemaker check annually. Her medications included warfarin, amlodipine 10 mg once daily, and digoxin 125 μg once daily. On assessment she was asymptomatic, BP 130/80 mmHg, pulse 80–90/min irregularly irregular, but physical examination was otherwise unremarkable. Her 12-lead ECG confirmed rate-controlled AF, and echocardiography showed mild concentric LVH, good left ventricular systolic function, normal cardiac dimensions, and no significant valvular lesion; 24-hour tape showed rate-controlled AF.*

## Background

Atrial fibrillation (AF) is the most common cardiac arrhythmia, occurring in 1–2% of the general population. The prevalence of AF increases with advancing age, from less than 0.5% at 40–50 years to 5–15% at 80 years. About one-third of the patients with AF are asymptomatic, which aggravates the problem of timely detection and early management. The Framingham Heart Study showed that AF was associated with increased morbidity and mortality in both men and women. The adverse consequences of AF are related to reduced cardiac output and to thromboembolic manifestations. The arrhythmia is associated with a fivefold increase in stroke, and anticoagulation has been shown to reduce mortality by approximately two-thirds.

### Definition and classifications

AF is a cardiac arrhythmia characterized by surface ECG showing irregular RR intervals with no distinct P waves. The hemodynamic consequence is a result of loss of coordinated atrial contraction, irregular ventricular response, and decrease in myocardial blood flow.

AF is broadly divided into valvular and non-valvular AF and the term "valvular AF" is used to imply that AF is associated with rheumatic valvular disease or prosthetic heart valves. Depending on the nature of the arrhythmia, AF can be characterized as follows.

- New-onset AF: first diagnosed AF, regardless of the duration, presence or absence of symptoms.
- Paroxysmal AF (PAF): PAF is intermittent and self-terminating AF, with two or more episodes in less than 7 days.
- Persistent AF: this is when AF fails to terminate spontaneously within 7 days and continues until reverted chemically or electrically.
- Permanent AF: this term is used to identify patients with persistent AF in whom the chances of restoring sinus rhythm are unlikely; therefore a rate control strategy is adopted.
- Lone AF: no underlying structural heart disease.

## Management

Management of AF is aimed not only at reducing the risks of death, stroke and other thromboembolic consequences, but also at reducing hospitalization and improving quality of life.

When a patient presents with new-onset AF, a rapid assessment of her symptoms (palpitations, breathlessness, fatigue, dizziness), hemodynamic status (ventricular rate, hypotension, hypoxia), and underlying causes (structural heart disease, heart failure, ischemia, electrolyte abnormalities, thyroid dysfunction, pulmonary disease, chronic renal disease) is important. A focused assessment and relevant investigations are crucial for an initial work-up. Initial investigations include full blood count, renal profile, thyroid function, inflammatory markers, chest X-ray, ECG, and echocardiography.

### Risk stratification

All patients need to be assessed for anticoagulation therapy. Unless a patient is under 65 with no risk factors or has a major contraindication, she should be anticoagulated with warfarin or a novel anticoagulant (NOAC). The thromboembolic risk is similar in individuals with paroxysmal, persistent, or permanent AF and the risk stratification can be performed using clinical and echocardiographic variables. All patients with valvular AF need anticoagulation. In non-valvular AF, the modified $CHA_2DS_2$-VASc score (Table 4.1) can be used to assess for thromboembolic risk. The risk of major bleeding, in particular intracranial bleed, is the most feared complication of anticoagulation therapy. Hence the decision to consider anticoagulation must be carefully balanced against the risk of bleeding. While there are several bleeding risk assessment tools, the widely recommended HAS-BLED tool (Table 4.2) offers simple and reliable bleeding risk prediction. For patients with

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