

D. A. Buxton Hopkin

# Hazards and Errors in Anaesthesia

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**D. A. Buxton Hopkin, MD, FFARCS**

**Honorary Consultant Anaesthetist**

**Charing Cross and St. Thomas' Hospitals and Medical  
Schools**

**University of London**

**11 Chelsea Embankment**

**London SW3 4LE England**

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# Preface

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This book has a twofold purpose, first to provide information for beginners about the pitfalls and hazards of anaesthesia and second to help the occasional anaesthetist in remote areas when confronted with requests to anaesthetise for unfamiliar surgical operations.

The book is not intended to replace any standard text for anaesthetic examinations, and indeed, its lack of information about basic sciences makes it unsuitable for such a purpose.

The contents can be regarded as a distillate of 45 years of practical anaesthesia, in both primitive and sophisticated conditions, from the ether and chloroform rag and bottle days onwards through cyclopropane, trichloroethylene, relaxants and lytic cocktails to halothane. The only operation mentioned of which I have no practical experience is thymectomy and removal of an argentaffinoma. I have never knowingly encountered malignant hyperpyrexia, but had one experience of what we called ether convulsions with hyperpyrexia, which could have been, and probably was, the same thing.

An attempt has been made to arrange the book in four logical sections. It begins with the hazards of preparation—assessment of risks to patients particularly, but Part I also includes chapters on medicolegal and occupational hazards to anaesthetists.

Part II deals with the performance of anaesthesia and related matters that are relevant to all surgical procedures. As many anaesthetic accidents arise from faulty connections or from disconnections, a chapter is devoted to the care and preparation of anaesthetic apparatus and the need for systematic checking before use. Intensive care receives attention only insofar as concerns treatment of the respiratory distress syndrome and the ethics of organ transplantation, with which beginners and anaesthetists in isolated areas may find themselves involved.

Part III deals with anaesthesia for emergency surgery. This short section includes a chapter on shock states which is an attempt to simplify a subject which has become unnecessarily complicated over the years. Application of the views put forward could be very rewarding.

Part IV contains thumbnail sketches of operations by specialities and the anaesthetic problems to which they give rise and how they can be dealt with. It is by no means comprehensive and only intends to cover the conditions commonly encountered in everyday hospital practice. It does, however, include chapters on anaesthesia for day surgery and in radiological and cardiological departments.

Detailed references have been intentionally left out of the text,

but at the end of the book a certain number of bibliographical references on selected subjects are listed, for those seeking further details. I hope they will be useful.

The suggestion that there was a need for a book such as this came from the late Paul B. Mayer, the London representative of Springer-Verlag, who himself experienced anaesthesia on more than one occasion during his last illness. Although seldom free from pain and progressively disabled he took an active interest in the project and his enthusiasm was a great stimulus. During his last days he continued to carry out his normal daily routine. His courage and fortitude evoked the admiration of everyone and I much regret he was unable to see the completed manuscript.

The onerous task of typing and retyping the manuscript was undertaken by Miss Elizabeth Mitchell, Secretary of the Anaesthetic Department at Charing Cross Hospital; by Miss Mary McRedmond, Miss Vanessa Rose and Miss Jane Fraser, members of Mrs Van Aernsbergen's Department of Secretarial Services, also at Charing Cross Hospital; and by Mrs Hettie Jones and Miss Clover Bygraves of West London Hospital. Each devoted many hours of spare time to typing and I thank them all.

The Department of Medical Illustration at Charing Cross Hospital Medical School undertook the redrawing and preparation for reproduction of Figs. 1, 2 and 5, and Mrs S. Godbolt and her staff at the Medical School Library checked the details of the bibliography. I am much indebted to all concerned.

Finally, it is a pleasure to acknowledge the help received from Mr Michael Jackson, Medical Editor of Springer-Verlag, and Mr Bruce Cameron, Copy Editor, whose advice and expertise have proved invaluable in deciding the final arrangement of the material, which Mr Roger Dobbing, Production Editor, and The Lavenham Press have produced so elegantly.

London, July 1980

D. A. Buxton Hopkin

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# Part I

## *Pre-operative Assessment, Medicolegal and Occupational Hazards*



# 1 General Considerations

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Pre-operative assessment of patients for elective surgery, although acknowledged to be essential for planning safe anaesthesia and successful surgery, is too often perfunctory and carried out too late to be of any practical value. There are many reasons for this, including an excessively rapid turnover of patients in the interest of high bed occupancy, combined with a shortage of trained anaesthetists. Surgeons also carry some responsibility as improved safety of anaesthesia has encouraged concentration on the technical aspects of surgery without equal concern for the physical state of patients. Anaesthetists should never be hurried into anaesthetising badly prepared or unassessed patients in response to a request by surgical colleagues for a short anaesthetic. Too often the operation develops into a major procedure accompanied by complications due to lack of preparation and causes considerable anxiety to the anaesthetist.

It has often been said (referring to heavy smokers and drinkers) that the day before a major surgical operation is a poor time to change the habits of a lifetime. The same thought applies to pre-operative assessment: the night before a major operation is not the best time to carry it out. It is true that constant efforts are being made to ensure that anaesthetists have time to examine and assess their patients some days before the actual surgery, and the idea of anaesthetic assessment clinics where patients can be seen well in advance of their operation has much support. Although the proposal is excellent in theory, there are administrative problems and it is unlikely to be adopted widely until there are more anaesthetists available. Nevertheless, much can be achieved by close co-operation in hospitals between the surgical and anaesthetic residents. Surgical residents who know the schedules can often pass on advance information to their anaesthetic colleagues through the nursing staff. Whatever system is being followed, anaesthetists should have a planned procedure aimed at eliminating unforeseen complications, anticipating difficulties and allowing a reasonable assessment of risk, which may have to be set against the degree of seriousness or urgency of the proposed operation. Apart from their clinical value, recording these facts and findings is of increasing medicolegal importance and provides often the best protection against litigation to do with the anaesthetic which may arise after the operation. Many anaesthetists in the United States, where litigation has reached serious proportions, besides recording the pre-operative findings of all patients, include the technique they propose to use, with the reasons for

their choice, as a protection against any subsequent medicolegal problems.

As in any other branch of medicine, the patient's history is of prime importance and a few moments spent on it can be rewarding. Apart from details of social habits, e.g. smoking and alcohol, and details of past and present operations, references to previous history of medical treatment, particularly of cardiovascular and respiratory ailments, and of any drug treatment prescribed either in the past or currently are very relevant. Increasing awareness of potential anaesthetic hazards of drug therapy has resulted in several hospitals issuing patients with a routine enquiry form about past and present drug therapy for their personal physician to complete and send to the hospital before their admission. All patients undergoing major surgery—or, in the opinion of many, any surgery—should have the following examination carried out in advance: (1) weight in kilograms, blood pressure, pulse and respiration rate; (2) chest X-ray; (3) if over 60, an ECG examination; (4) full blood count and, where appropriate, sickle test; (5) examination of urine for sugar, albumin and cellular deposits. Results of these investigations should be available at least 24 h before surgery. They should reveal any pathological conditions likely to constitute an added risk and allow time for their correction.

## 2 Cardiovascular Disease

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### 2.1 Valvular Disease

### 2.2 Hypertension and Cardiac Ischaemia

#### 2.2.1 *Management of Patients Receiving Antihypertensive Drugs*

#### 2.2.2 *Factors Increasing Myocardial Ischaemia*

### 2.3 Coronary Artery Disease, Angina and Myocardial Infarction

#### 2.3.1 *Operative Mortality*

#### 2.3.2 *Myocardial Infarction During Anaesthesia*

#### 2.3.3 *Anaesthetic Management*

#### 2.3.4 *Undiagnosed Myocardial Infarction*

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Abnormalities of the cardiovascular system are encountered more frequently than any other defect. Long-standing cardiovascular disease is usually evident from the history or physical examination of the patient. Signs of untreated cardiac failure (orthopnoea, pulmonary congestion, enlarged heart, tender liver, rapid and irregular pulse) are absolute contra-indications for elective or emergency surgery. The assistance of a cardiologist should be sought and surgery postponed until the cardiac failure is under control. Statistics have shown that in these circumstances delay does not increase the overall mortality and, if anything, will decrease it.

### 2.1 Valvular Disease

Treated valvular disease where there is no failure is not a great added risk. Patients who have had repeated attacks of congestive failure, suggesting progressive reduction of cardiac reserve, are poor risks and unsuitable for major radical surgery. Patients with mitral valve disease, even if auricular fibrillation is present, tolerate major surgery very well. On the other hand, those with aortic valve disease, whether stenosis or regurgitation, stand anaesthesia very badly. In aortic valve disease the coronary arteries are always affected and there is a reduction in the amount of blood which the heart muscle can receive. Therefore, any additional strain on the heart muscle is likely to result in failure, since output is limited and a small fall of blood pressure, which often accompanies induction with barbiturates, can reduce coronary perfusion and oxygen supply to the already hypertrophied heart muscle. On the

other hand, stimulation under light anaesthesia can lead to a rise in systolic blood pressure, increasing the work of the heart, for which adequate oxygen supplies are not available. Therefore, prognosis of aortic disease is poor at the best of times. The presence of cardiac asthma (nocturnal dyspnoea) implies a survival of less than 6 months and is always a contra-indication for anaesthesia, except for life-saving emergency operations.

## **2.2 Hypertension and Cardiac Ischaemia**

Advances in treatment of hypertension and associated cardiac ischaemia have greatly improved expectation of life and patients under treatment present for assessment of anaesthetic risk in ever increasing numbers.

Often routine blood pressure measurements before operation reveal unexpectedly high figures in newly admitted patients, in spite of there being no previous history. High readings can arise from apprehension, and measurements made a few hours later will usually be within normal limits.

### ***2.2.1 Management of Patients Receiving Antihypertensive Drugs***

Patients with established hypertensive disease are usually under treatment with a beta-adrenergic receptor blocker (propranolol); a blocker of adrenergic neuronal transmission (guanethidine); or agents which interfere with synthesis of noradrenaline, such as methyl dopa (Aldomet), whose inhibition of decarboxylase prevents conversion of naturally occurring L-dopa to dopamine, itself a precursor of noradrenaline.

When these drugs were first introduced for treatment of hypertension, many anaesthetists felt that the administration of anaesthetics (all of which lower blood pressure) to patients receiving them was unjustifiable, owing to the risk of inducing catastrophic falls in systolic blood pressure, which would endanger cerebral and coronary circulation. Many anaesthetists insisted on discontinuation of therapy for 14 days before elective surgery, during which the cardiac and cerebral symptoms which had led the patient to seek medical advice often returned.

This practice was unpopular with patients and their practitioners and it is now agreed there is no need to stop antihypertensive treatment before anaesthesia. Clinical observations have established that untreated patients and those whose therapy has been discontinued tolerate anaesthesia and surgery less well than those who are under treatment with antihypertensive agents.

### ***2.2.2 Factors Increasing Myocardial Ischaemia***

Electrocardiographic signs of myocardial ischaemia (flattened S-T

segment), often accompanied by marked increase in blood pressure brought about by an increase of adrenergic activity, have been observed in the course of:

- 1) Laryngoscopy and endotracheal intubation
- 2) Bronchoscopy or tracheal suction
- 3) Surgical incision
- 4) Traction on mesentery during routine laparotomy
- 5) Clamping of aorta during arterial surgery
- 6) Recovery, when pain sensation and central autonomic reflexes return and induce increase of adrenergic activity

In patients who are not receiving treatment these episodes of high blood pressure place an added burden on heart muscle. The greater tension of cardiac muscle required to overcome the enhanced peripheral resistance increases the demand for oxygen, which the impaired coronary circulation finds difficulty in meeting. On the other hand, patients whose antihypertensive therapy has not been interrupted show fewer signs of physiological disturbance during anaesthesia and surgery.

Practical experience confirms these findings. Patients with renal disease, although always receiving high dosage of beta blocking agents, tolerate general anaesthesia very well and no reports have appeared of severe reduction of blood pressure.

Cautious anaesthetists are warned against arriving at a compromise by reducing the dose of antihypertensive medication before anaesthesia. This will only create an unstable condition, and hypertensive episodes during surgery will increase in number and be comparable in severity to those encountered in untreated patients.

### **2.3 Coronary Artery Disease, Angina and Myocardial Infarction**

The presence of evidence of coronary artery disease increases the overall mortality during or following surgical procedures, but the time interval between infarction and surgery and the type of infarct, whether transmural or subendocardial, also have considerable influence on the prognosis.

#### **2.3.1 Operative Mortality**

When 4 months has passed since the infarction, the postoperative mortality is half that of patients who have suffered infarct recently (i.e. less than 3 months before operation), but it is about twice that of patients with no evidence of coronary artery disease. After 6 months, operative mortality falls to 5%, which is a little higher than the overall average. However, there is a strongly held view in Great Britain that the mortality after 6 months does not differ significantly from that of patients who have not had infarct.

The outlook for patients who have had a transmural infarction is much poorer than for those with subendocardial lesions, the mortality for patients with transmural lesions being ten times greater. It has often been suggested that older patients (aged 70 or more) are less liable to postoperative infarction than younger ones since sufferers from serious coronary disease seldom survive beyond 65 years. Figures published in the United States do not support this idea and indicate that the risk is nearly doubled.

### *2.3.2 Myocardial Infarction During Anaesthesia*

Infarction during anaesthesia must be extremely rare. It has occurred during procedures under local analgesia in an apprehensive and inadequately sedated patient and in a patient undergoing dental extraction under hypoxic nitrous oxide. Sedation for patients with a history of infarction who are to undergo procedures under local or regional anaesthesia should include strong tranquillising agents—droperidol, promazine or chlorpromazine—as well as opiates and beta-adrenergic blockers.

### *2.3.3 Anaesthetic Management*

When general anaesthesia is to be employed attention should be directed to choice of techniques that allow liberal supplies of oxygen whilst allowing maintenance of a depth of anaesthesia sufficient to subdue adrenergic response to surgical stimulation and ensure a gradual return to consciousness. Rapid recovery and inadequate postoperative control of pain are not in the best interest of patients with a history of infarction. Some workers recommend a small intravenous injection of an opiate (e.g. 25 mg pethidine) as the procedure is ending to ensure freedom from pain during the early recovery phase. Although the incidence of postoperative infarction is not high (5%), the mortality when infarction does occur is very high, averaging 54%. These considerations underline the importance of a pre-operative ECG in all patients over 60, as well as a careful enquiry into the history behind any positive finding. Although the patient may be symptom-free at the time of examination, a pre-operative ECG, whether normal or abnormal, serves as a baseline for comparison with any postoperative ECG taken in connection with the diagnosis of postoperative complications.

### *2.3.4 Undiagnosed Myocardial Infarction*

Although fatal infarction during anaesthesia is not widely reported, the author has on two occasions anaesthetised patients who suffered a fatal but silent infarction 24–48 h before anaesthesia and surgery. Absence of signs of cardiac failure or complaint of distress explains the failure to diagnose the condition. One patient died 12 h and the other 48 h after operation. At post-mortem in both cases necrosis of left ventricular

muscle was present. One of the patients had myocardial disease of several years standing and complained of transient angina pain 36 h before surgery; the pain responded to rest and analgesics. The other suffered a hypotensive episode 36-48 h before operation. This was thought by the intern to be a small gastric haemorrhage and was one of the reasons for advancing the time of surgery and for the failure to take an ECG before anaesthesia.

## 3 Respiratory Disease

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- 3.1 Common Cold
  - 3.2 Chronic Respiratory Disease
    - 3.2.1 *Vitalograph*
    - 3.2.2 *Peak Flow Meter*
    - 3.2.3 *Match and Breath-Holding Tests*
  - 3.3 Methods of Improving Lung Function
  - 3.4 Anaesthetic Management
    - 3.4.1 *Premedication*
    - 3.4.2 *Anaesthetic Techniques*
  - 3.5 Asthma
- 

### 3.1 Common Cold

Complications of the common cold, particularly tracheitis, are indications for postponement of elective major surgery. Infection can easily spread from the upper respiratory tract into the lungs after autonomic disturbance during surgery. Animal experimentation undertaken some years ago showed that irritation of autonomic nerve endings in the pharynx can induce hyperaemia of the lungs; this in its turn attracted pathogenic organisms previously placed in mediastinal lymph nodes and which hitherto had remained inactive.

### 3.2 Chronic Respiratory Disease

When pre-operative clinical examination shows evidence of respiratory disease, elective operations should be delayed to allow assessment of lung function and institution of measures to improve it. Sophisticated equipment is not necessary and tests can be made at the bedside.

#### 3.2.1 *Vitalograph*

Measurement of forced expiratory volume in 1 s ( $FEV_1$ ) and forced vital capacity (FVC) can be made with the Vitalograph, which consists of a bag attached to a device into which patients make maximum expiration. The required data is presented in graphic form which patients can see. In normal subjects the ratio between  $FEV_1$  and FVC should be around 80%. Figures of 60% or less indicate impaired function and treatment is