# OPEN ACCESS TEXTBOOK OF GENERAL SURGERY

## PRE-OPERATIVE ASSESSMENT AND POST-OPERATIVE CARE

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### INTRODUCTION

All but the most trivial surgical procedures result in a systemic response that may affect the patient's physiological homeostasis. In addition, certain procedures directly effect on the life-supporting organ systems of the body, particularly the cardiovascular and respiratory systems.

Successful surgery depends on assessing the whole patient's ability to withstand the procedure, preparing the patient preoperatively and providing postoperative care until recovery from surgery is complete.

Patients undergoing elective surgery must be as fit as possible and, if necessary, surgery should be postponed to allow time for adequate preoperative preparation. In the emergency situation however, while everything possible must be done to make the surgery safe, judicious timing is required to ensure that the deteriorating surgical condition does not outweigh the risk of taking the unprepared patient to the operating theatre.

### PRE-OPERATIVE ASSESSMENT

During pre-operative assessment particular attention should be paid to the two systems most involved with *oxygen delivery to the tissues* - the cardiovascular and respiratory systems.

The risk of surgery depends on the medical condition of the patient and the site, severity and duration of the proposed surgery. The experience and expertise of the surgical team and the availability of specialized facilities for investigation and post-operative care must also be taken into account.

The most widely accepted means of categorizing surgical risk is the ASA (American Society of

Anesthesiologists) Risk classification (see table)

**ASA Risk**

| | |
|---|---|
| I | Normal healthy patient |
| II | Minor systemic abnormality (e.g. mild essential hypertension) |
| III | Severe systemic disease, but not incapacitating (e.g. severe diabetes) |
| IV | Incapacitating systemic disease – life-threatening (e.g. cardiac failure) |
| V | Moribund – not expected to survive 24hrs with or without surgery |
| E | Emergency Surgery |

Categories III and IV are associated with a four to five times increase in surgical mortality. For emergency surgery the letter E is added to the classification and this increases the risk by one category.

Fundamental to the pre-operative assessment is a detailed history and clinical examination. All pre-operative patients should undergo this clinical assessment which should go beyond the immediately presenting surgical problem and actively seek chronic and underlying conditions that could increase the risk of surgery. In addition to merely diagnosing, the assessment should attempt to quantify the degree of impairment and the risk of morbidity associated with surgery.

The indiscriminate ordering of special investigations is no substitute for clinical assessment and the only "routine tests" required for surgery and general anaesthesia are a haemoglobin (or haematocrit) and

urine testing for glucose and protein. Chest X-rays, pulmonary function tests, serum electrolytes and ECG's may be requested on elderly patients and when indicated on clinical grounds.

## THE PATHOPHYSIOLOGICAL RESPONSE TO SURGERY

Surgery, and often the condition necessitating the surgery such as injury, infection or neoplasm, results in a generalised systemic response which has inflammatory and metabolic components. The combined effects of surgical trauma, hypovolaemia, anaesthesia and post-operative pain cause an endocrine response with stimulation of the sympathetic nervous system and increased levels of adrenaline and noradrenaline causing tachycardia and vasoconstriction. Increased secretion of Glucagon and Cortisol promotes gluconeogenesis, and the production of Aldosterone and ADH together with activation of the renin-angiotensin mechanism result in sodium and water retention. Insulin secretion is suppressed. There is also an increase in metabolic rate, muscle protein catabolism and hepatic synthesis of acute phase proteins such as coagulation factors.

Major surgery, trauma and sepsis also initiate an inflammatory response caused by the activation of a complex network of mediators including cytokines (such as TNF$\alpha$, Interleukin 1 & 2, and interferons), prostaglandins and the complement and coagulation cascades. This systemic inflammatory response is manifested by an pyrexia, tachycardia, tachypnoea and increased neutrophil production. It is important to note that this clinical syndrome can be part of the normal post-operative picture and does not necessarily imply the presence of infection. Although the inflammatory response is protective it can become overwhelming and lead to generalised activation of the vascular endothelium causing vasodilatation and permeability to plasma. This can lead to septic shock, multiple organ dysfunction and death. Paradoxically, a severe inflammatory response caused by a massive stimulus such as multiple trauma, can cause cellular immunity to be down-regulated leading to an increased risk of infection.

### *Respiratory system*

The most common postoperative complications relate to the respiratory system. General anaesthesia carries with it the intrinsic risk to the airway and the possibility of aspiration of gastric contents leading to Medelson's syndrome and aspiration pneumonia. Atelectasis of the lung bases can develop during anaesthesia and this can persist post-operatively aggravated by decreased tidal volumes and a rapid, shallow breathing pattern. The effects of anaesthesia on the respiratory system are generally short lived. More marked are the effects of thoracic and upper abdominal surgery. Pain and reflex interference with diaphragmatic function cause the progressive loss of the Functional Reserve Capacity (FRC) leading to hypoxia, atelectasis and respiratory infection. (see Fig i) After upper abdominal surgery the vital capacity (VC) is reduced by 50%. Residual volume and FRC continue to decrease postoperatively and are maximally depressed between 24 and 72 hours after surgery. Respiratory function only returns to normal 10 to 14 days later. Its is important to understand that adequate analgesia is essential to minimise these effects in the post-operative patient and adequate doses of opiates should not be withheld in the patient with preexisting respiratory disease.

When clinically assessing the surgical patient with pulmonary disease, particular attention should be paid to the patient's effort tolerance and evidence of bronchospasm, recurrent bronchitis and smoking. On examination, look for cyanosis, clubbing and abnormal breathing

patterns. In assessing the respiratory reserve it is useful to walk with the patient and assess his ability to climb stairs.

The chest X-ray may show evidence of active or previous infections, reduced lung volume due to restrictive lung disease or hyperinflation due to emphysema. Patients with pulmonary disease due to undergo thoracic or abdominal surgery should have at least simple spirometry to measure the VC and the forced expiratory volume in one second (FEV1). Reduction in these volumes to less than 60% of predicted value denotes severe pulmonary disease. A FEV1 of less than 1.2 liters (average sized patient) carries a very high risk of post-operative respiratory failure. More sophisticated tests of respiratory function include flow-volume loops to detect small airways disease and ventilation-perfusion scans for regional lung dysfunction. Arterial blood gases are a useful test especially in the emergency patient, but abnormality is a late sign of respiratory failure. A $PO_2$ of less than 8.0 kPa or a $PCO_2$ greater than 6.5 kPa defines respiratory failure and these patients will usually require post-operative ventilation.

Pre-operative preparation of the patient with pulmonary disease is extremely important. Chest infections need to be controlled with antibiotics and physiotherapy is required to reduce secretions and to teach the patient how to breathe and cough post-operatively. Patients with asthma should be optimally bronchodilated. Smoking should be stopped as long as possible prior to surgery. Six weeks is required for a significant respiratory effect but even stopping 12 to 24 hours before surgery will lower blood nicotine and carbon monoxide levels.

Postoperatively, patients with respiratory disease need particular attention to analgesia (see below). Respiratory function should be monitored by charting the respiratory rate, pulse oximetry and regular VC measurement. Postoperative physiotherapy is essential in these patients after abdominal or thoracic surgery and patients should sit upright in bed and be mobilised early.

***Cardiovascular system***

The cardiovascular system is affected by surgery in a number of ways. Painful stimuli under light anaesthesia cause tachycardia and an increase in blood pressure. This also occurs with intubation. The resultant increase in myocardial oxygen requirements is detrimental to the patient with ischaemic heart disease. Deeper anaesthesia, especially when there is little surgical stimulus, results in a loss of motor tone and myocardial depression. Epidural and spinal anaesthesia can have a similar effect with pooling and vasodilatation of the anaesthetised part of the body due to sympathetic paralysis. Intra-operative hypotension is more dangerous to the ischaemic heart than hypertension. In addition, blood loss and other extracellular fluid (ECF) losses decrease the cardiac filling pressure causing a decrease in cardiac output and hypotension.

Patients with ischaemic heart disease or cardiac failure are particularly at risk during and after surgery. The two main consequences of ischaemic heart disease are intra-operative or post-operative myocardial infarction (MI) and cardiac failure. The mortality of a peri-operative myocardial infarction is 50%. The risk of peri-operative MI is particularly high if surgery is carried out in a patient with unstable angina or who has had an MI within the previous three months. Hypoxia and hypotension can result in failure of the ischaemic heart leading to pulmonary oedema or further hypotension. This can cause other organs, such as the kidneys, to fail.

Hypertension, if untreated, is associated with a decreased intravascular volume, which may lead

to sudden hypotension during anaesthesia. Severe hypertension should be brought under control prior to elective surgery. It is important to continue anti-hypertensive medication, especially beta-blockers, through the peri-operative period.

Patients with pre-existing ischaemic heart disease or with cardiac failure from any cause are at very high risk when undergoing non-cardiac surgery. Patients with uncontrolled cardiac failure, unstable angina or who have had a myocardial infarction in the preceding three months should only have urgent, life-saving surgery.

In assessing patients with cardiac disease, particular attention must be paid to symptoms and signs of angina and failure. An erect PA chest X-ray is a valuable investigation for cardiac failure and an ECG may yield further evidence of hypertrophy and arrhythmias. If a major procedure is being planned in a patient with cardiac disease, an exercise stress ECG, echocardiography and coronary angiography may be required. The advisability of preoperative coronary artery bypass grafting or coronary angioplasty should be considered.

The management of these patients requires careful monitoring of the haemodynamic status, both intra-operatively and post-operatively, with the emphasis on maintaining haemodynamic stability.

***Other organ systems***

Patients with renal disease are at increased risk of going into complete renal failure and particular attention should be paid to fluid balance and avoiding a further renal insult during surgery. Electrolyte imbalances may cause life –threatening complications.

Patients with cirrhosis or chronic liver failure have a high risk of intra-operative bleeding and post-operative infection. Further liver damage can be precipitated by intra-operative hypotension. Problems with blood coagulation, hypoglycaemia, drug metabolism and associated renal failure may occur. Liver disease should be suspected in patients with a history of ethanol abuse and hepatitis or if jaundice, hepatomegaly or other stigmata of liver failure are present. Preoperatively the bilirubin, liver enzymes and prothrombin ratio (INR) should be measured. Preoperative preparation includes adequate hydration and correction of the INR with vitamin K or fresh frozen plasma.

Patients with diabetes require special consideration. They are at risk for ischeamic heart disease, renal failure and postoperative infection. Blood glucose control is usually maintained by conversion to short acting insulin and close monitoring. Adequate hydration must be ensured.

The nutritional status of the surgical patient is very important. Obesity carries a significant risk, particularly for surgical and respiratory complications. Early mobilisation in these patients is essential. Patients with significant malnutrition have an increased risk of mortality, infection and poor wound healing. If there is time to improve the nutritional status by supplementing the enteral intake of the patient this should be done, provided the underlying surgical condition is not the cause of the malnutrition. A patient with malignancy or infection will not be able to "catch up" nutritionally until the underlying condition is corrected.

In the postoperative patient enteral nutrition should be started as soon as possible and in patients who cannot swallow a nasogastric feeding tube may be used. Intravenous nutrition using special solutions of amino acids, glucose and lipid emulsions should only be considered if the patient is unable to take enteral nutrition for prolonged periods.

Other aspects of the preoperative assessment should include a careful

drug and allergy history, seeking evidence of an abnormal bleeding tendency and a history of any adverse events associated with previous surgery and anaesthesia.

**PSYCHOLOGICAL PREPARATION AND CONSENT**

For most patients the prospect of a major surgical procedure is a significant "life crises". The surgeon should use the opportunities presented during history taking and examination to explain procedures and reassure the patient, who should be allowed to express her own fears of death or disfigurement. These must be discussed honestly and compassionately. The immediate post-operative care should be explained as well as the risk associated with the surgery. The patient should be motivated to participate in her post-operative recovery by assisting with physiotherapy and mobilisation.

The surgeon who will be doing the operation should obtain consent. Common complications and even rare catastrophic complications of the procedure should be disclosed. A valid consent requires the patient to be given the information required to make an informed decision and the capacity to understand and make that decision without external duress.

**PERI-OPERATIVE INTRAVENOUS FLUID MANAGEMENT**

Intravenous fluid is administered to restore blood volume and replace other fluid losses, provide maintenance fluid to the patient unable to take enterally and as a conduit for intravenous drugs. Blood loss can be replaced by crystalloids, colloids or red blood cells. Resuscitation crystalloids are solutions of electrolytes and water with a composition to similar to ECF, i.e. a relatively high sodium and chloride, and low potassium content. They should not contain glucose. Colloids are also used for volume replacement. These contain a high molecular weight substance of a similar size to the albumin molecule to prevent the fluid from leaking out of the vascular compartment. Apart from the fact that approximately three times the volume lost must be given for resuscitation when using crystalloids there is no evidence that colloids produce a better outcome. Colloids are more expensive than crystalloids and occasionally cause allergic reactions. Albumin solutions are no longer used for resuscitation. Blood should only be given to maintain an acceptable haemoglobin of 8 to 10g/100ml, depending on the condition of the patient. Each unit given carries a risk of infection, allergic reaction, incompatibility and immune suppression.

Patients who are temporarily unable to take fluid enterally after surgery are given an infusion of one of the maintenance solutions. These contain 5 or 10% glucose, sodium, potassium and other electrolytes. Average requirements are about 30ml/kg/24hrs and these solutions should not be used for volume replacement.

**PAIN MANAGEMENT**

Adequate analgesia is of major concern for patients and inadequate pain relief increases respiratory complications because of poor coughing and immobilisation. In the past many patients have suffered because of the low priority given to analgesia by doctors and nurses and because of exaggerated fears of addiction and respiratory depression by the opiates. Education, pain teams and modern techniques are improving the situation. Opiate drugs like morphine need to be prescribed regularly and in adequate doses. One of the most effective methods is patient controlled analgesia (PCA) using a device, which delivers a dose of analgesic drug on demand, from the patient.

Other pain controlling techniques include the use of epidural catheters to administer local anaesthetics and opiates (which stimulate μ receptors on the pain relaying neurons in the spinal cord), the placement of local anaesthetic blocks, and the use of non-steroidal anti-inflammatory drugs.

In conclusions the success of surgery depends on the adequate preoperative assessment and preparation of the patient and meticulous attention to detail in the post-operative period.