

*Report*

# Anaesthetic management of laparoscopic surgery

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## Introduction

In recent years, laparoscopic surgery has become common clinical practice. Initially, the use of laparoscopic procedures was confined to the obstetric and gynaecological department where it was used for laparoscopic sterilization and short diagnostic procedures. Thus, it was usually carried out on young and healthy females.

New intra-abdominal laparoscopic surgical techniques have been developed, performed and advocated for older patients when they may have coexisting cardiac and pulmonary disease. These laparoscopic procedures may involve changes in patient position and require a longer period of intra-abdominal carbon dioxide insufflation.

The major problems during laparoscopic surgery are related to the cardiopulmonary effect of pneumoperitoneum, systemic carbon dioxide absorption, extraperitoneal gas insufflation, venous gas embolism, unintentional injuries to intra-abdominal structures and patient positioning.

An appraisal of the potential problems is essential for optimal anaesthetic care of patients undergoing laparoscopic surgery. Appropriate anaesthetic techniques and monitoring facilitate surgery and allow early detection and reduction of complications. The need for rapid recovery and a short hos-

pital stay impose additional demands on the anaesthetist for skilful practice.

## Anaesthesia

### Anaesthetic management

Anaesthetic management of patients undergoing laparoscopic surgery must accommodate surgical requirements and allow for physiological changes during surgery. Monitoring devices are available for the early detection of complications. Recovery from anaesthesia should be rapid with minimal residual effects. The possibility of the procedures being converted to open laparotomy needs to be considered.

### Pre-anaesthetic assessment

Medical contraindications to laparoscopic surgery are relative. Successful laparoscopic surgery has been performed on anticoagulated [1], pregnant [2] and morbidly obese patients [3].

Premedication is usually not necessary except in anxious patients for whom anxiolytics, such as the benzodiazepines, may be prescribed. Atropine can be used for premedication to prevent vagally mediated bradyarrhythmias but may cause undesirable mouth drying and increase the likelihood of tachyarrhythmias [4]. It is,

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therefore, more appropriate to give the drug intravenously only when necessary.

### Anaesthetic techniques

The choice of anaesthetic technique for upper abdominal laparoscopic surgery is mostly limited to general anaesthesia with muscle paralysis, tracheal intubation and intermittent positive pressure ventilation (IPPV) [5]. At induction of anaesthesia it is important to avoid stomach inflation during ventilation as this increases the risk of gastric injury during trocar insertion. Tracheal intubation and IPPV ensure airway protection and control of pulmonary ventilation to maintain normocarbica. Ventilation with a large tidal volume of 12–15 ml/kg prevents progressive alveolar atelectasis and hypoxaemia and allows for more effective alveolar ventilation and carbon dioxide elimination [6].

The use of nitrous oxide during laparoscopic surgery is controversial because of concerns about its ability to produce bowel distension during surgery and the increase in postoperative nausea. Nitrous oxide is about 30 times more soluble than nitrogen. Thus, a closed air-containing space may accumulate nitrous oxide more rapidly than it can eliminate nitrogen. Eger and Saidman [7] observed an increase of more than 200% in intestinal lumen size after 4 hours of breathing nitrous oxide. Lomie and Harper [8] reported a reduction in postoperative vomiting from 49% to 17% when nitrous oxide was omitted in a prospective randomized study of 87 patients undergoing gynaecological laparoscopic surgery. In contrast, in an extensive randomized and blinded prospective study, Muir et al. [9] found no association between the use of nitrous oxide and the subsequent development of postoperative nausea and vomiting. Halothane increases the incidence of arrhythmia during laparoscopic surgery, es-

pecially in the presence of hypercarbia [10]. Isoflurane is the preferred volatile anaesthetic agent as it has less arrhythmogenic and myocardial depressant effects.

### Regional anaesthesia

Epidural anaesthesia has been used for outpatient gynaecological laparoscopic procedures to reduce complications and shorten recovery time after anaesthesia [11]. Local or regional anaesthetic techniques have not been reported for laparoscopic cholecystectomy or other upper abdominal surgical procedures except in patients with cystic fibrosis [12]. A high epidural block (T2–T4 levels) is required to abolish the discomfort of surgical stimulation of the upper gastrointestinal structures. The high block produces myocardial depression and reduction in venous return, aggravating the haemodynamic effects of tension pneumoperitoneum.

### Monitoring

The electrocardiogram, noninvasive arterial pressure monitor, airway pressure monitor, pulse oximeter, end-tidal carbon dioxide concentration monitor, peripheral nerve stimulation and body temperature probe are routinely used. A urinary catheter is usually placed to minimize the risk of bladder injury and improve surgical exposure. The urine output should be monitored in patients with compromised cardiopulmonary function.

End-tidal carbon dioxide is most commonly used as a noninvasive substitute for PaCO<sub>2</sub> (tension of carbon dioxide in arterial blood) in evaluating the adequacy of ventilation during laparoscopic surgery because the gradient between PaCO<sub>2</sub> and P<sub>E</sub>CO<sub>2</sub> (tension of CO<sub>2</sub> in expired air) in healthy patients under general anaesthesia is between 2 mmHg and 9 mmHg [13].

However, for patients with compromised cardiopulmonary function, the gradient between  $\text{PaCO}_2$  and  $\text{P}_e\text{CO}_2$  may become large and unpredictable so direct estimation of  $\text{PaCO}_2$  by arterial blood gas analysis may be necessary to detect hypercarbia [14]. A  $\text{P}_e\text{CO}_2$  monitor is also valuable for early detection of venous gas embolism [15].

An airway pressure monitor is mandatory for anaesthetized patients receiving IPPV. A high airway pressure alarm can aid detection of excessive elevation in intra-abdominal pressure [16].

Nerve stimulation ensures adequate muscle paralysis which reduces the intra-abdominal pressure necessary for abdominal distension. This also prevents sudden patient movement during surgery that can lead to accidental injuries of intra-abdominal structures by laparoscopic instruments.

## Postoperative course

Laparoscopic surgery is a relatively new surgical technique, with the advantages of

shortening hospital stays, allowing a more rapid return to normal activities and lessening pain.

Nausea and vomiting are particularly troublesome after laparoscopic surgery; over 50% of patients require antiemetics, so prophylactic antiemetics may be given routinely. The use of non-steroidal anti-inflammatory drugs for postoperative analgesia has been described to minimize emesis after laparoscopic cholecystectomy [18]. Pain following laparoscopic surgery consists of early transient vagal abdominal and shoulder discomfort due to peritoneal irritation by residual carbon dioxide. Patients can also experience deep-seated pain related to trauma at the surgical site. Pain from the puncture wounds of the trocars is generally mild because the wounds are small and are produced without the cutting of muscle fibres.

Pulmonary function is better presented following laparoscopic surgery; forced vital capacity is reduced by 27% after laparoscopic surgery and by 48% after open surgery [19].

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