ANAESTHESIA FOR A PATIENT UNDERGOING TRANSTHORACIC ENDOSCOPIC VAGOTOMY

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SUMMARY
We describe the anaesthetic management of a patient who underwent transthoracic endoscopic vagotomy. One-lung ventilation was necessary to provide adequate surgical access. Potential intraoperative problems involved arterial oxygen saturation during one-lung ventilation, unequal intrathoracic pressures causing mediastinal displacement and inadvertent myocardial injury by surgical instruments and diathermy. The management of these problems and the benefits of endoscopic surgery to the patient are discussed.

KEY WORDS

Endoscopic surgery minimizes trauma in gaining access to surgical sites. Benefits include minimal postoperative pain, reduction in postoperative complications, avoidance of large surgical scars, shorter hospital stay and earlier resumption of normal activities for the patient [1]. In addition to gynaecological operations, endoscopic abdominal surgery includes appendicectomy and cholecystectomy [2, 3]. There is increasing acceptance of the technique and more widespread applications are likely to follow. This is the first report of anaesthesia for a patient who underwent vagotomy using the transthoracic endoscopic technique.

CASE REPORT
A 58-yr-old man (70 kg) had undergone gastrectomy 4 yr previously for bleeding gastric ulcer. He continued to have repeated episodes of gastrointestinal bleeding which required admission to hospital and multiple blood transfusions, despite treatment with ranitidine and omeprazole. Upper gastrointestinal endoscopy revealed an anastomotic ulcer. Revision vagotomy was considered necessary and the patient consented to have the procedure performed with the transthoracic endoscopic technique. His medical history was otherwise unremarkable and physical examination revealed no abnormal findings. Preoperative investigations revealed microcytic hypochromic anaemia with a haemoglobin concentration of 10.7 g dl⁻¹. Renal function tests, chest x-ray and ECG were normal. Diazepam 10 mg was given orally 1 h before operation.

Anaesthesia was induced with thiopentone 300 mg, fentanyl 100 μg and suxamethonium 100 mg i.v. The trachea was intubated with a left-sided Robertshaw double-lumen endobronchial tube. The right lung was selectively ventilated. Anaesthesia was maintained with 0.5–1.5% isoflurane in 100% oxygen and incremental doses of atracurium and fentanyl. A nasogastric tube was inserted. Monitoring included ECG, non-invasive arterial pressure, ventilation pressure, oxygen analyser, pulse oximetry, end-tidal carbon dioxide concentration and nasopharyngeal temperature.

Surgery was performed with the patient in the right lateral position. The first trocar and cannula was inserted at the eighth intercostal space in the posterior axillary line for attachment of the endoscope. Three accessory trocars and cannulae were inserted under endoscopic vision. The diaphragm and the left lung were retracted with endoscopic retractors and the oesophagus and vagi mobilized in

FIG. 1. Summary of the intraoperative course during transthoracic endoscopic vagotomy. OLV = one-lung ventilation; Ligno. = lignocaine 100 mg i.v.; $S_aO_2$ = arterial oxygen saturation; $E_{CO_2}$ = end-tidal carbon dioxide concentration; SAP, DAP = systolic, diastolic arterial pressure; HR = heart rate.


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the groove between the heart and the descending aorta. The patient developed ventricular ectopic beats when the heart was probed accidentally by the pointed surgical instruments. This was controlled temporarily with lignocaine 100 mg i.v. and the surgeons were informed of the problem. The operation was performed with the taps of the endoscope cannulae open to atmosphere, allowing air to move freely in and out of the left thoracic cavity. The duration of surgery was approximately 3.5 h, and blood loss was less than 100 ml. The intraoperative course was uneventful overall (fig. 1).

A 32-French gauge chest drain was inserted at the end of the procedure. The patient required one dose of parenteral pethidine for analgesia in the evening after surgery. He resumed normal oral diet and was ambulatory on the first day after operation. The chest drain was removed on the second day and the patient was discharged the next day.

**DISCUSSION**

Technological advances in micro-chip video cameras, high resolution monitors and optical systems with xenon light source, rod lens and fluid light cables have produced considerable progress in endoscopic surgery [4]. The operative field may be displayed on a video monitor, allowing two-handed dissection and performance of more complicated procedures.

Laparoscopic cholecystectomy has gained widespread acceptance [3]. The problems of anaesthesia for endoscopic abdominal procedures have been studied extensively with laparoscopic gynaecological procedures [6, 7]. These are associated mostly with effects of tension pneumoperitoneum, carbon dioxide absorption, extraperitoneal instillation of carbon dioxide, venous gas embolism and unintentional injuries to intra-abdominal structures [8]. Trans-thoracic procedures performed usually with rigid thoracoscopy are limited to diagnostic and simple therapeutic procedures such as pleurectomy [9]. Anaesthetic techniques include regional anaesthesia and general anaesthesia with double-lumen endobronchial tubes allowing one-lung ventilation (OLV) [10]. Anaesthesia for complex endoscopic thoracic surgery poses additional problems.

In the case report described here, video view of the operative field was restricted and surgical manipulation and dissection with endoscopic instruments were technically more demanding. The use of a double-lumen endobronchial tube was necessary to allow collapse of one lung to improve surgical access. The patient maintained satisfactory arterial oxygen saturation (\(S_{ao_2}\)) during OLV with 100% oxygen. Application of continuous positive airway pressure (CPAP) [11] and insufflation of the collapsed lung with oxygen [12] would have been used if necessary for improving \(S_{ao_2}\). However, CPAP and, to a lesser extent, oxygen insufflation would also have caused partial expansion of the collapsed lung, hindering surgical access. Other methods of improving \(S_{ao_2}\) would include careful patient positioning, adequate neuromuscular block to minimize intrathoracic pressure, optimization of cardiac output to reduce venous admixture, adjustment of tidal volumes and application of positive end-expiratory pressure to the ventilated lung [13, 14]. The use of low-dose dobutamine infusion also has been reported to be useful [15]. Surgery may have to be abandoned in patients who cannot maintain an adequate \(S_{ao_2}\), without application of CPAP or oxygen insufflation to the collapsed lung. This should be discussed with the surgeon and patient before operation.

Procedures performed with a rigid thoracoscope often require pressurized air to create an artificial pneumothorax to improve surgical exposure. This was shown to be tolerated well, even in spontaneously breathing patients [16, 17]. However, unequal pressures within the two thoracic cavities may cause mediastinal displacement with serious haemodynamic effects. Carbon dioxide insufflators designed to create a pneumoperitoneum may deliver gas at pressures greater than 40 mm Hg [18]. These should not be used for producing a pneumothorax. Within an enclosed space, suction used to clear blood, smoke and irrigation fluid from the surgical field may cause large negative intrathoracic pressures with the same risk of mediastinal displacement. Nitrous oxide diffusing into the enclosed cavity also could cause pressure changes. These problems are avoided by opening the taps of the endoscope cannulae to air, allowing the intrathoracic pressure to equilibrate with atmosphere at all times. Collapse of the lung under its own elastic recoil provided adequate surgical access in the present case.

With the proximity of the heart to the surgical site, accidental physical irritation of the heart was inevitable, especially as the video view was restricted and only two-dimensional. Ventricular ectopic beats precipitated in our patient were benign, and did not cause haemodynamic problems. However, the possibility of precipitating malignant ventricular arrhythmias needs to be considered [19]. It is also important to avoid factors that enhance myocardial arrhythmias, such as the use of halothane and hyperventilation. Unintentional application of surgical diathermy to the liver surface is common during laparoscopic cholecystectomy and this does not produce clinical consequences. Inadvertent application of diathermy to the heart, however, produces areas of myocardial damage that may become foci of arrhythmias. Diathermy to the epicardial blood vessels may provoke vasospasm and thrombosis, leading to myocardial ischaemia.

The major disadvantage of the procedure was the prolonged duration of surgery. This may be reduced with greater experience in the technique, as occurred with laparoscopic cholecystectomy [20]. In retrospect, an intra-arterial cannula would have been useful for monitoring haemodynamic changes and blood sampling for arterial blood-gas analysis.

The benefits of endoscopic surgery were illustrated well in this patient. In contrast with truncal vagotomy performed through an upper abdominal incision, our patient’s postoperative recovery was rapid and devoid of problems such as intestinal ileus and wound infection. Postoperative pain was minimal. The patient enjoyed early resumption of normal activities, with little risk of deep vein thrombosis and
pulmonary embolism. Hospital stay was short and medical costs less than those associated with standard surgery.

REFERENCES
