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Abdominal wall lift

Low-pressure pneumoperitoneum laparoscopic surgery

S. Banting, S. Shimi, G. Vander Velpen, and A. Cuschieri

Department of Surgery, Ninewells Hospital and Medical School, University of Dundee, Dundee DD1 9SY, Scotland

Summary. A method of abdominal wall lift has been developed and evaluated clinically in this unit during the past 18 months. It permits the conduct of laparoscopic procedures at an intraabdominal pressure of 6–8 mm Hg. The technique was introduced for laparoscopic surgery in patients with preexisting cardiac disease and chronic bronchitis. The procedure, by lifting both the abdominal wall and the falciform ligament together, also elevates the central portion of the liver (segments 3–5), thereby improving the surgical exposure. For this reason it is now also used in fit patients with ptotic livers or hypertrophied quadrate lobes undergoing laparoscopic cholecystectomy and common bile duct exploration, and to facilitate left subhepatic exposure in patients during laparoscopic antireflux surgery and vagotomy.

Key words: Abdominal wall – Falciform life – Low-pressure – Pneumoperitoneum laparoscopic surgery

The induction and maintenance of a pneumoperitoneum above 10 mm Hg is associated with adverse cardiovascular, respiratory, and metabolic changes [1, 3, 4, 6, 8]. The cardiovascular effects include arrythmias, rise in mean arterial pressure, and increase in central venous pressure and heart rate [4]. Earlier reports also indicated a fall in the cardiac output, but this effect varies from patient to patient. The respiratory changes are characterized by a hypercarbia with a consequent chloride shift into the RBCs and catecholamine release. The respiratory changes are minimized but not abolished by controlled ventilation and monitoring of end-tidal CO_2. More recently, significant elevation of the plasma arginine vasopressin concentration has been documented [7]. Although these changes are well tolerated by fit patients — especially those treated with endotracheal anesthesia and monitored for intraoperative end-tidal pCO_2, the cardiovascular effects can prove troublesome in patients with preexisiting cardiac disease and chronic bronchitis. In these patients, laparoscopic surgery undertaken at a low-pressure pneumoperitoneum (6–8 mm Hg) is desirable. These considerations have led to the introduction by Mouret of a metal abdominal-wall suspender [5] which is, however, difficult to introduce, and unless great care is taken, it may induce liver trauma during its insertion and removal. We describe a simple, safe, and effective technique which achieves the same objective and is a modification of our previously described falciform lift [2].

Materials, method, and patients

Instrument

The instrument used is a large, hand-held trocar—a pointed, 4-mm-diameter metal introducer with a distal spiral relief, onto which is lifted a flexible 80-cm polyethylene tube (Fig. 1). This is secured to the butt of the needle by a strong ligature. The other component of the system is a vertically adjustable screen consisting of two support

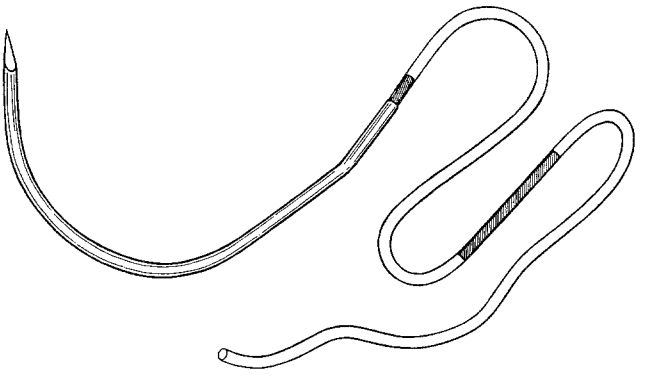

Fig. 1. Drawing of the needle and tube assembly

Offprint requests to: A. Cuschieri

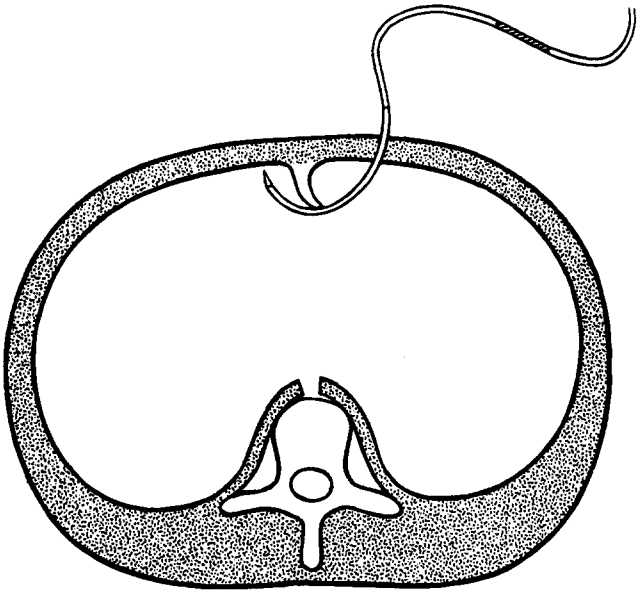

Fig. 2. Technique of insertion of sling

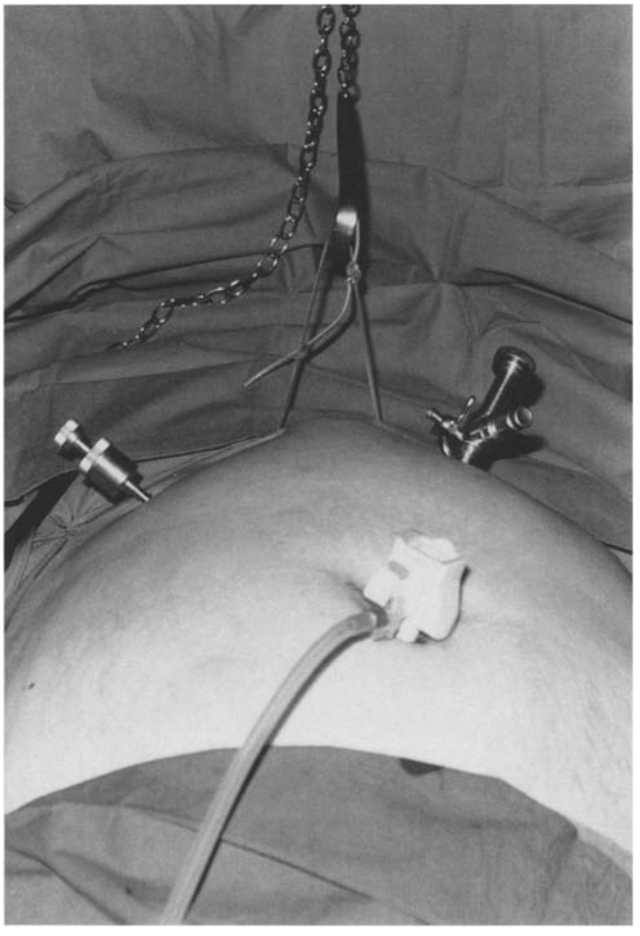

Fig. 3. Abdominal wall lift during laparoscopic cholecystectomy

Fig. 4. Endophotograph of the appearance of the upper abdomen after insertion of the lift device and reduction of the intraabdominal pressure to 6–8 mm Hg

rods (fixed to the operating table by standard chucks) on which fits a horizontal bar equipped with a sliding hook attachment.

Technique of insertion and use

The procedure entails the initial creation of a 10–12 mm Hg pneumoperitoneum using a Veress needle and electronic insufflator. The laparoscopic cannula is then inserted (usually in the subumbilical position), and a 30° forward oblique 10-mm telescope attached to a CCD camera is introduced for visualization of the peritoneal cavity. The telescope is then rotated to view the upper abdominal wall and falciform ligament just below the inferior margin of the liver. A site some 2 cm lateral to the falciform ligament on the right side is selected by finger depression. Once accurate location is achieved, a small stab wound is made in the skin and the trocar point introducer is inserted under vision. The end of the introducer is next negotiated around the proximal falciform ligament to the anterior abdominal wall on the left side, which is then penetrated by the trocar point. A small skin incision is made over the tented skin, which is stretched by the emerging point of the introducer (Fig. 2). As the introducer is exteriorized, it trails behind it the polyethylene tubing. After detachment of the introducer, the two ends of the U-tube are tied together, and the resultant loop is applied to a sterile hook-and-chain assembly, which is pulled forcibly up and attached to a horizontal bar at the head end of the operating table (Fig. 3). If leakage of CO_2 is encountered from the exit wounds, temporary pursestring sutures are in-

serted and tied. The intraabdominal pressure is then reduced to 6–8 mm Hg throughout the rest of the procedure. At the end of the operation, the sling is cut and the tube is simply pulled out.

The benefit of this simple device is threefold: it lifts the abdominal wall to create the necessary operating space, displaces upward the falciform ligament, and lifts the central portion (segments 3–5) of the liver (Fig. 4).

Patients

The technique has been used in eight patients with myocardial ischaemic heart disease and in four patients with chronic bronchitis (ASA 3) with no cardiac, respiratory, or metabolic adverse changes during the operation or subsequently. In view of the excellent elevation of the liver, the combined abdominal wall/falciform lift has been used extensively in fit patients with ptotic livers or hypertrophied quadrate lobe undergoing laparoscopic cholecystectomy or common bile duct exploration and to facilitate the left subhepatic exposure during laparoscopic antireflux surgery, cardiomyotomy, and achalasia. There have been no complications resulting from use of this sling device in 30 consecutive patients.

Discussion

Our experience with the upper abdominal wall lift has been most favorable. Despite the low-pressure pneumoperitoneum, the exposure of the upper abdominal contents is actually improved due to the elevation of the falciform ligament and the central portion of the liver. The insertion of the abdominal wall lift adds on average an extra 2 min to the operating time.

In addition to the patient groups outlined here, the technique is recommended for use in pregnant females undergoing laparoscopic surgery in view of the uncertainty of possible adverse effects on the developing fetus that may be caused by a sustained high-pressure CO_2 pneumoperitoneum.

Minor modifications of the device are currently being evaluated. These include a central rigid segment of the tube and adhesive cups to prevent CO_2 leakage from the wounds around the exit limbs of the sling—although the latter has not been a real problem.

A prospective comparative evaluation of the cardiovascular, respiratory, and metabolic changes in fit patients undergoing laparoscopic cholecystectomy randomized to ordinary-pressure pneumoperitoneum (12–14 mm Hg) or to the low-pressure (6–8 mm Hg)/abdominal lift system is in progress.

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