Abdominal access techniques (including laparoscopic access)

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Abstract

This article discusses the safe exposure of intra-abdominal organs using laparoscopy and laparotomy. Newer methods of minimal access surgery including single incision laparoscopic surgery (SILS), and natural orifice transluminal endoscopic surgery (NOTES) are also discussed. Common abdominal incisions are illustrated.

Keywords Laparoscopy; laparotomy; natural orifice transluminal endoscopic surgery; single incision laparoscopic surgery

Introduction

The word laparotomy has Greek roots, 'lapara' referring to 'the soft parts of the body between the costal margin and hips' and 'tome' meaning 'cutting'. The first successful elective laparotomy is attributed to Ephraim McDowell, in 1809 in Kentucky, USA. Through a nine-inch left lower abdominal incision he removed a large ovarian cyst in a 46-year-old lady on his kitchen table — without anaesthetic! The lady recovered and lived to the ripe age of 78. The first successful laparoscopy in a human was credited to Hans Christian Jacobaeus of Sweden in 1910.[1] In 1981 Kurt Semm, a gynaecologist in Germany performed the first laparoscopic appendicectomy.[2] Eriche Mühe of Böblingen, Germany performed the first laparoscopic cholecystectomy in 1985. This achievement was credited by SAGES (The Society of American Gastrointestinal Surgeons) in 1999.[3] Phillipe Mouret performed the first laparoscopic cholecystectomy in France in 1987. Minimally invasive laparoscopic methods are now routinely used in many branches of surgery.

Considerations of surgical method

Preparation in the operating theatre

Common abdominal incisions are shown in Figure 1.

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Positioning

The patient is positioned to allow optimal access to the area of interest. This is most often supine, however for surgery involving the pelvis or perineum, the Lloyd-Davis or lithotomy ('legs up') positions provide better access. In the latter, the patient is supine and the legs flexed at the hips and knees, with sufficient abduction to allow access to the perineum. The lower legs are placed in attachable pneumatic supports or hanging stirrups. In the Lloyd-Davies position, often used in colorectal surgery, the legs are abducted with slight flexion of the knees and hips. Supports are now usually a cushioned boot design to reduce pressure, especially on the popliteal fossa and common peroneal nerve. Prolonged placement in this position increases the risk of deep venous thrombosis or compartment syndrome and intermittent pneumatic compression can be applied to reduce the former.

The position may be further adjusted to facilitate different steps of the operation, for example:

- Trendelenberg (head-down, to facilitate access to the pelvis)
- reverse Trendelenberg (for better access to the upper abdomen)
- left or right tilt.

Cleaning

Skin is cleaned with an antiseptic agent, usually povidone-iodine or chlorhexidine in either aqueous or alcoholic solution, progressing from the incision site to the periphery. A randomized control trial has shown a significantly lower rate of surgical-site infection (41% reduced risk) with chlorhexidine (2% in alcohol) compared to aqueous povidone-iodine (10%).[4]

Areas of high microbiological counts (groin, axilla, pubis, open wounds) should be prepared last and stoma sites isolated from the prepared area. The antiseptic agent must remain on the skin for sufficient time to achieve maximum effectiveness. This is the time taken to air-dry for alcoholic agents; at least 30 seconds is needed for non-alcoholic agents. Alcoholic agents should not be used on mucous membranes or open wounds. Care must be taken to prevent alcoholic antiseptic agents from pooling beneath the patient or around diathermy pads to reduce the risk of burns.

Drapes

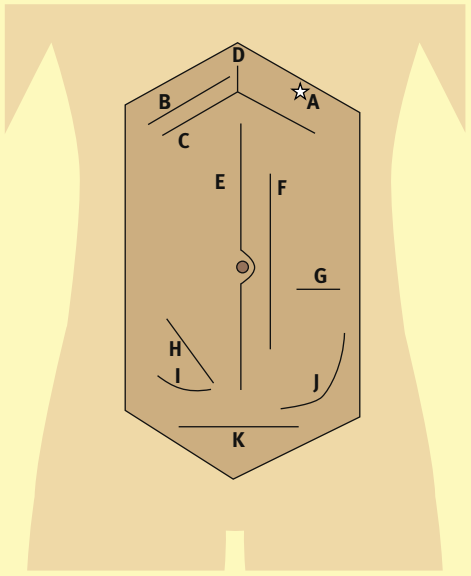
The prepared area of the skin and drape fenestration should be sufficiently large to accommodate extension of the incision, the need for additional incisions, and all potential drain or stoma sites. Adhesive plastic drapes, with or without iodine impregnation, through which the surgeon makes the incision are sometimes used, however a systematic review has shown no evidence of benefit (relative risk 1.23, p=0.03).[5]

Laparoscopy

Laparoscopy provides a less traumatic access to all parts of the abdominal cavity, superb views of anatomy, excellent cosmetic result and an attenuated stress response to surgery.

The pneumoperitoneum may be achieved via open (Hasson) or closed (Veress needle, see below) methods. Drainage

Common abdominal incisions



Name of incision	Commonly used for
A Palmer's point	Insertion of Veress needle
B Kocher's	Open cholecystectomy
C Rooftop	Liver surgery
D 'Mercedes Benz'	Liver transplantation
E Midline	Can be upper, lower – many abdominal operations
F Paramedian	Now less commonly used for laparotomy
G Transverse	Closure of stomas
H Gridiron	Open appendicectomy (now old fashioned)
I Lanz	Open appendicectomy
J Rutherford Morrison	Renal transplant (either on left or right side of abdomen)
K Pfannenstiel	Gynaecological, laparoscopic colectomy

Figure 1

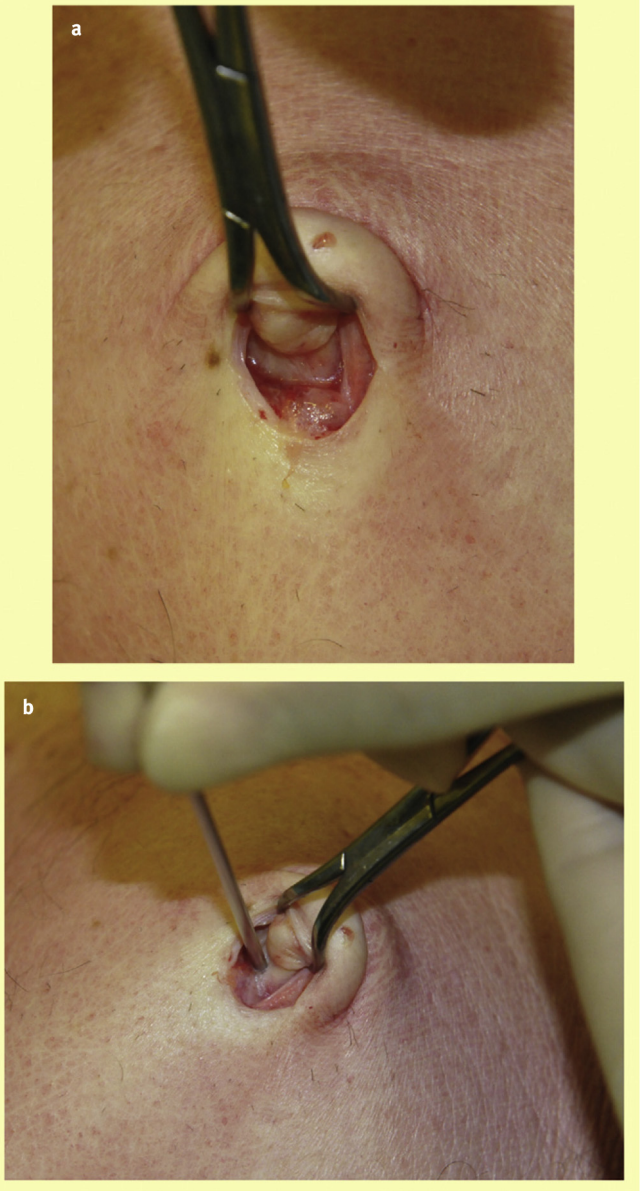


Figure 2 Veress needle insertion. (**a**) Following incision just below the umbilicus, the umbilicus is elevated with a towel clip and the stalk is dissected and the junction with the linea alba defined. (**b**) Insertion of the Veress needle. The needle is held halfway down the shaft with the tap open. The ring and little finger stabilize the needle as it is advanced through the abdominal wall at the base of the umbilicus with abdominal wall elevation as countertraction.

of the bladder reduces risk of injury and improves views of the pelvis.

Closed method

The closed method uses a spring-loaded Veress needle to insufflate the peritoneal cavity with carbon dioxide followed by blind introduction of the first port. The anterior abdominal wall may be elevated to provide countertraction, traditionally manually, more usually with skin clips, or following dissection down to the umbilical cicatrix–linea alba junction and elevation with clips or sutures (Figure 2). The needle angulation should vary from 90° in overweight or obese to 45° in thin patients. As the needle traverses the abdominal wall two clicks/points of resistance should be noted, the first passing through the linea alba and the second entering the peritoneal cavity. Confirmation of the correct position can be by several methods as well as the 'double click', these include the following.

Manometer test: the insufflator is connected with low flow. If the needle is in the correct place, the gas flows freely, initial intra-abdominal pressure is low.

Hanging drop test: a drop of saline is placed on the open end of the Veress needle and is sucked into the peritoneal cavity by negative intra-abdominal pressure when the anterior abdominal wall is manually elevated.