7 Basic surgical skills

Abdominal wall closure and laparoscopic port closu

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Abdominal wound closure technique The surgical technique involved in abdominal wall closure varies from hospital to hospital with practice heavily influenced by local opinion and training exposure. The objective of abdominal wall closure is to provide a tension-free closure with adequate strength to prevent early dehiscence or an incisional hernia in the long term. Most abdominal incisions are closed such that the rectus sheath or linea alba is approximated in a continuous manner using delayed absorbab le or non-absorbable sutures employing a five-eighths circle, round-bodied, blunt-tipped needle. How ever, despite a plethora of meta-analyses certain controversies abound. /uni25CF Layered versus mass closure of the abdomen Abdominal wounds can be closed either by closing all lay ers of the abdomen (musculoaponeurotic layers avoiding skin) together or by closing individual layers of the rectus sheath. An alterna tive would be to approximate only the anterior rectus sheath in situations where mass closure is not feasible (Figure 7.17). /uni25CF Continuous versus interrupted sutures . Simple continuous sutures theoretically seem to be better than interrupted sutures as the tension is evenly distributed, re sulting in less ischaemia; in addition, they are quicker to perform. The literature supporting this practice is, how ev er, sparse. /uni25CF Absorbable versus delayed absorbable versus non-absorbable suture material . Delayed Figure 7.17 (a) (b) the suture material of choice. In patients with multiple previous operations, non-absorbable material such as - nylon or polypropylene may be an alternative. /uni25CF Big bites, big needle versus small bites, small needle . Abdominal closure is commonly performed by placing the sutures 1 /uni00A0 cm apart from each other and 1 /uni00A0 cm from the fascial edge. Recent studies have shown decreased incisional hernia when the interval between sutures is reduced to 0.5 /uni00A0 cm and performed using a smaller sized needle (2.0 PDS as opposed to the much larger 1 PDS). It is argued that the larger needle causes buttonhole defects when compared with the entry point of a narrow needle and thread. This, coupled with the increased distance between bites, causes the suture to act like a cheese wire through the tissue, thereby slackening the stitch and result - ing in hernia. Despite these variations in practice it is important to pro - vide a tension-free approximation, to avoid subcutaneous fat (as the fat is likely to necrose) and, if employing a continuous - suturing technique, to start from the inferior and superior ends with two separate sutures and meet in the middle to aid in better visualisation of the final stitches. . -

(a) (b) Abdominal closure techniques. Layered closure. /uni00A0 Mass closure of all musculoaponeurotic layers (courtesy of Dr Vinay Timothy Kuruvilla).

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Advanced vessel-sealing devices

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Advanced laparoscopic procedures have driven a parallel explosion in novel technologies that facilitate the perfor mance of such procedures. This is particularly the case for vessel-sealing devices. Monopolar diathermy still plays a vital and e ff ective role in laparoscopic surgery , but has limitations in ter ms of sealing larger blood vessels and is accompanied by the risks outlined above. Therefore surgeons have increasingly used advanced energy devices to facilitate dissection and to seal and divide blood vessels up to 7 /uni00A0 mm in diameter. Furthermore, it is suggested that the use of advanced vessel-sealing devices reduces operative time and thus recovery is enhanced. There are three main types of advanced energ y devices: bipolar electrosurgery , ultrasonic electrosurgery and combina tion devices. In all cases, the surgeon needs to be aware of the characteristics of these de vices and their capacity to cause thermal injury in order to use them safely . Bipolar electrosurgery devices Advanced bipolar tissue fusion technology is a vessel-sealing system that is used in both open and laparoscopic surgery by fusing the vessel walls to create a permanent seal. It uses a combination of pressure and energy to create vessel fusion that can withstand up to three times the normal systolic pressure. New technology such as the LigaSure™ system (Medtronic) involves advanced bipolar technology that uses the body’s collagen and elastin to both seal and divide, allowing surgeons to reduce instrument handling when dissecting, ligating and grasping – a valuable asset particularly during laparoscopic surgery . The feedback-sensing technology incorporated in the instrument is designed to manage the energy delivery in a precise manner and results in automatic discontinuation of energy once the seal is complete, thus removing any concern that the surgeon has to use guesswork as to when the seal is complete. The newer instruments actively monitor tissue impedance and provide a real-time adjustment of the energy being delivered. Using this technology , LigaSure can seal vessels of up to 7 /uni00A0 mm diameter, with an average seal time of 2–4 seconds, as well as pedicles, tissue bundles and lymphatics with a consistent controlled and predictable e ff ect on tissue, including less desiccation. Robert Lawson Tait , 1845–1899, surgeon, Birmingham, UK. The harmonic scalpel is an instrument that uses ultrasound technology to cut tissues while simultaneously sealing them. It utilises a hand-held ultrasound transducer and scalpel that is controlled by a hand switch or foot pedal. During use, the scal - pel vibrates in the 20 /uni00A0 000–50 /uni00A0 000-Hz range and cuts through tissues, e ff ecting haemostasis by sealing vessels and tissues by - means of protein denaturation caused by vibration rather than heat (in a similar manner to whisking an egg white). It pro vides cutting precision, even through thickened scar tissue, and visibility is enhanced because less smoke is created by this system during use compared with routine electrosurgery . Currently , the harmonic scalpel is in common use during laparoscopic procedures, as well as open surgery , such as thy - roidectomy , and several plastic sur gery operations, e.g. cos - metic breast surgery . There are several such devices on the market, which vary in form and function. - Combination energy devices In the last 5 years, technology has evolved concerning both harmonic and bipolar advanced energy devices. One product, the Thunderbeat STM (Olympus), has combined both modal - ities in a single device. By simultaneously using ultrasonic vibration and bipolar diathermy , this device can seal and divide arteries and veins up to 7 /uni00A0 mm in diameter in a shorter amount of time with no smoke or mist. Advanced vessel-sealing devices

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Alternatives to sutures

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Skin adhesive strips Self-adhesive tapes may be used where there is no tension and the wound is clean; for example, adhesive strips are used following clean procedures on the face. Tissue glue - Tissue glue can be used as a means of primary tissue apposi - tion or as an adjunct to sutures. Some specific uses have been - described such as closing a laceration on the forehead of a fractious child in Accident and Emergency , thus dispensing with local anaesthetic and sutures. Staples There is a wide range of mechanical devices that can be used to staple skin, bowel or even major vascular pedicles. Most of these devices are disposable and relatively expensive, but their cost is o ff set by the saving of operative time. Alternatives to sutures

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DRAINS IN SURGERY

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In 1887 Lawson Tait suggested ‘when in doubt drain!’. This edict has been criticised and the value of routine drain place - ment has been scrutinised. Drains are inserted to allow fluid that might collect in a body cavity to drain freely to the surface. The fluid to be drained may include blood, serum, pus, urine, faeces, bile, lymph or air. Drains may also be used for wound irriga tion in certain circumstances. Their use can be regarded as prophylactic or therapeutic, depending on the circumstance warranting their insertion. Abdominal drains are usually placed in the pelvis to drain collections as this is the most dependent area. Other locations are usually dictated by the pathology and procedure performed. /uni25CF Open drains (Figure 7.20a). These aid in passive drain age of a cavity based on gravity by forming a channel between the body and the external environment. They are often unsightly , require frequent dressing changes and may act as a conduit that enhances bacterial colonisation. The Penrose and corrugated drains are examples of an open drain used in debrided wounds and abscess cavities. /uni25CF Closed drains: /uni25CF Suctioned (active) (Figure 7.20b). These maintain negative pressure, thereby actively suctioning out fluid and/or obliterating dead space and preventing fluid accumulation. Caution must be exercised when used adjacent to vital structures. A suction drain is often used Figure 7.20 (a) (b) (c) Charles Bingham Penrose , 1862–1925, Professor of Gynecology , The University of Pennsylvania, Philadelphia, PA, USA. and in head and neck surgery . /uni25CF Non-suctioned (passive) (Figure 7.20c). Use - capillary action and gravity to drain fluid. The most common examples are urinary catheters, nasogastric drainage systems and a Robinson’s drain, which is used within the abdominal cavity to help to ev acuate fluid without sucking viscera or omentum.

(a) (b) (c) Drains in surgery. Open drainage of a wound using a corrugated drain. A closed suction drain using a vacuum-assisted drainage system. A closed, non-suction drain commonly used to drain the abdominal cavity (courtesy of Dr Vinay Timothy Kuruvilla).

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Draping

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Draping is the process of forming a sterile perimeter around the operating site using disposable or reusable sterile sheets. The drape sheets ideally serve to form a fluid-resistant barrier; they are antistatic, flame resistant, lint free and, although waterproof, are porous enough to prevent heat build-up. Each procedure has a unique method of draping; this is beyond the scope of this chapter. However, a few practical con siderations are discussed below . /uni25CF The drapes are usually placed over the periphery of the area that has been painted, once the antiseptic solution has dried. This can be aided by dabbing the perimeter with a sterile cloth or waiting for the antiseptic solution to dry . /uni25CF It is advisable to stand an arm’s length away from the op erating table and spread the drapes with arms extended. /uni25CF Avoid reaching across the operating table to drape. /uni25CF Sharp towel clips pierce the drapes and thereby contam inate the sterile field; they should be avoided if possible. Karl Ritter von Edenberg Langer , 1819–1887, Professor of Anatomy , Vienna, Austria, described these lines in 1862. technique, then it is advisable to redo the process or at least replace/cover the o ff ending drape. /uni25CF Draping non-disposable equipment such as laparoscopic cords, ultrasonic devices, image intensifiers and light han - - dles may be required. Prefabricated, customised drapes are preferred where possible. /uni25CF The routine use of transparent adhesive skin drapes (with or without antibiotic impregnation) over the surgical site cannot be recommended based on the available literature. Summary box 7.3 - Salient features in preparing the operative area /uni25CF /uni25CF /uni25CF - /uni25CF /uni25CF -

Remove metal rings and piercings from the surgical /f_i eld Hair removal is advised only if it interferes with surgery Hair clippers are preferred to razor blades Alcohol-based povidone–iodine or chlorhexidine solution for skin antisepsis Drape the perimeter of the operative /f_i eld using sterile drapes

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ELECTROSURGERY

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Electrosurgery employs high-frequency electrical current to assist in making surgical incisions, dissection of tissue and achieving haemostasis. Its widespread use in open, laparoscopic and intraluminal endoscopic surgery such as transurethral resection of the prostate have made it an indispensable part of the surgeon’s armamentarium. It is therefore vital for a surgeon to have a sound understand - ing of the principles of electrosurgery to facilitate safe surgery (Summary box 7.9). Summary box 7.9 - Safe electrosurgery - /uni25CF /uni25CF - /uni25CF /uni25CF /uni25CF e - /uni25CF -

Always check diathermy setting before use Use the safest, lowest diathermy current setting Be careful when diathermy is used near other metallic instruments Employ the diathermy intermittently and for brief spells Use bipolar diathermy and advanced vessel-sealing devices where appropriate Smoke extractors to remove bio-aerosolised particles are essential

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Electrosurgery employs high-frequency electrical current to assist in making surgical incisions, dissection of tissue and achieving haemostasis. Its widespread use in open, laparoscopic and intraluminal endoscopic surgery such as transurethral resection of the prostate have made it an indispensable part of the surgeon’s armamentarium. It is therefore vital for a surgeon to have a sound understand - ing of the principles of electrosurgery to facilitate safe surgery (Summary box 7.9). Summary box 7.9 - Safe electrosurgery - /uni25CF /uni25CF - /uni25CF /uni25CF /uni25CF e - /uni25CF -

Always check diathermy setting before use Use the safest, lowest diathermy current setting Be careful when diathermy is used near other metallic instruments Employ the diathermy intermittently and for brief spells Use bipolar diathermy and advanced vessel-sealing devices where appropriate Smoke extractors to remove bio-aerosolised particles are essential

Emergency gastrointestinal surgery and drains

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While there seems to be some anecdotal evidence advising against drainage following appendicular perforation, duode nal perforation and bowel pathology leading to localised or generalised peritonitis, a less dogmatic approach is more realistic. Patients with four-quadrant peritoneal contamination usually benefit from routine drainage, whereas a more selective appr oach can be tailored in patients with localised peritoneal contamination. The decision to avoid drain placement in emergency surgery needs to be contextualised, taking into account the patient’s clinical state and comorbid illnesses as well as the healthcare and hospital setting, including access to round-the clock interventional radiologists. Emergency gastrointestinal surgery and drains

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FURTHER READING

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Hair removal from the surgical site

Hair removal from the surgical site

- Hair is removed from the surgical site when it is deemed to interfere with the operation; it also makes postoperative plaster - or dressing changes relatively pain free. However, removal of hair causes microabrasions and can potentially cause cellulitis and SSI. Timing of hair removal The ideal time and place for hair removal is on the operating table after a dose of prophylactic antibiotic is given. Preopera - tive removal of hair outside the confines of the operating room is discouraged. Skin clippers with disposable blades are preferred as they are safe and result in the fewest SSIs. Shaving using a razor blade is discouraged as unintended microincisions caused by the blade often result in exaggerated skin infection and inflam mation. Hair removal from the surgical site
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Hazards of diathermy

Hazards of diathermy

Burns These are the most common type of diathermy accidents and occur when the current flows in some way other than that which the surgeon intended; they are far more common in (b) monopolar than bipolar diathermy . Diathermy can also cause thermal injury to the surgeon and theatre sta ff . These may occur as a result of: /uni25CF Faulty application of the indi ff erent electrode (footplate) with an inadequate contact area. /uni25CF The patient being earthed by touching any metal object, e.g. the Mayo table, the bar of an anaesthetic screen or - a leg touching the metal stirrups used in maintaining the lithotomy position. /uni25CF Faulty insulation of the diathermy leads. /uni25CF Inadvertent activity such as the accidental activation of the diathermy or accidental contact of the active electrode with other metal instruments, such as retractors or towel clips. A hole in the glove can also result in burns to the fingers, double gloving may help prevent this.

Diathermy unit Active cable Two small active electrodes (b) Bipolar diathermy /uni00A0 Bipolar diathermy.

Figure 7.19 (a) (b) Electrocution Today , diathermy machines are manufactured to very high safety standards, which minimise the risk. However, as with any electrical instrument, there must be regular and expert servicing. Explosion Sparks from the diathermy unit can ignite volatile or inflam mable gas or fluid within the theatre. Alcohol-based skin preparation can catch fire if allowed to pool on or around the patient. It may be di ffi cult to detect these flames early on as they may be invisib le under the bright operating theatre lights. Channelling Channelling of current happens when current is applied to tissues that have a narrow stalk, resulting in a ‘bottleneck’ caus ing current to concentrate and thereby damage or char tissue. Channelling is also used to describe a phenomenon wherein distant tissues may be a ff ected if current contacts and then travels through tissue, resulting in unintentional coagulation of distant tissue. For example: /uni25CF coagulation of the penis in a child undergoing circumci - sion; /uni25CF coagulation of the spermatic cord when the electrode is applied to the testis. In such situations, diathermy should not be used; if it is necessary , then bipolar diathermy should be employed. Interference with implantable electronic - devices Diathermy currents can interfere with the working of a gastric or cardiac pacemaker, implantable cardioverter defibrillator, cochlear implants, etc. The use of an ultrasonic scalpel and bipolar diathermy are relatively safer; it may be prudent to liaise with the cardiology team and the anaesthetist pre-emptively in /uni00A0 such circumstances. Occupational hazard from surgical smoke - Viral particles, bacteria, respiratory and ophthalmic irritants and carcinogens have been identified in surgical smoke from diathermy devices. Universal precautions, smoke evacuation systems or simple suction devices can be used to minimise the risk to theatre personnel.

(b) Cutting and coagulation of tissue using monopolar diathermy (courtesy of Dr Vinay Timothy Kuruvilla).

Diathermy burns are a particular hazard in laparoscopic surgery owing to a relative lack of visibility of the entire instrument. Such burns may occur by: /uni25CF faulty insulation of any of the laparoscopic instruments or equipment; /uni25CF intraperitoneal contact of the diathermy with another met al instrument while activating the pedal (direct coupling); /uni25CF inadvertent activation of the pedal while the diathermy tip is out of the vision of the camera; /uni25CF retained heat in the diathermy tip touching susceptible structures, such as the bowel. Hazards of diathermy

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Introduction

INTRODUCTION

Successful outcomes in surgery depend on knowledge, skills and judgement. While this chapter focuses on technical skills, the importance of surgical preparedness in the form of appro priate safety checks, correct positioning and non-technical skills such as communication and teamwork cannot be overstated.

Knotting techniques

Knotting techniques

Knot tying is one of the most fundamental techniques in surgery and a poorly constructed knot may jeopardise an otherwise successful surgical procedure. The general principles behind knot tying are as follows: Figure 7.15 Figure 7.16 /uni25CF The knot must be tied firmly , but without strangulating the tissues. /uni25CF The knot must be as small as possible to minimise the amount of foreign material. /uni25CF The knot must be tightened without exerting any tension or pressure on the tissues being ligated, i.e. the knot should be bedded down carefully , only exerting pressure against counter-pressure from the index finger or thumb. /uni25CF The suture material must not be ‘sawed’ as this weakens the thread and cuts through delicate tissue like a cheese wire. /uni25CF The suture material must be laid square during tying; oth - erwise, tension during tightening may cause breakage or fracture of the thread. /uni25CF When tying an instrument knot, the thread should only be grasped at the free end, as gripping the thread with the needle holder can damage the material, resulting in break - age or fracture. /uni25CF The standard surgical knot is the reef knot with a third throw for security , although with monofilament sutures six throws are required for security . /uni25CF When added security is required, a surgeon’s knot using a two-throw technique is advisable to prevent slippage.

(b) (b) Mattress suture techniques. Subcuticular suture technique.

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Laparoscopic access and port placement

Laparoscopic access and port placement

There are two fundamental ways to access the abdomen laparoscopically: - 1 the open technique (Hasson’s or modified Hasson’s) 2 the closed technique (V eress needle and/or visual entry trocar). The advantages and complication rates of each of these techniques are not significantly di ff erent; therefore, the tech - nique that the surgeon is most accustomed to should be used. Figure 7.9 (a) (b) (d) (c) (e)

(a) (b) (d) Midline laparotomy incision. Skin incision; /uni00A0 peritoneum is picked up between haemostats and incised; (c) (e) subcutaneous fat is incised; linea alba is opened to expose peritoneum; peritoneal cavity opened (courtesy of Dr Vinay Timothy Kuruvilla).

Figure 7.10 (a) (b) (c) (d) (e)

(c) (e) (d) Laparoscopic access to the abdomen using the mod

i /f_i ed Hasson’s technique. Umbilicus everted, revealing the stalk of the umbilicus. Periumbilical skin incision. The junction of the umbilicus and linea alba is identi /f_i ed and opened longitudinally. A curved haemostat used to break the peritoneum, which is then stretched open. A blunt-tipped primary trocar is inserted.

with both techniques to provide access as directed by circum stances such as pregnancy , scars from previous operations or as dictated by disease pathology . Blind trocar insertion with or without V eress needle insuf flation is avoided. Open Hasson’s technique for laparoscopic primary trocar insertion In most cases, the umbilicus is the preferred site for a 10–12-mm initial port placement (Figure 7.10a–e). 1 The umbilical cicatrix is everted with a toothed tissue- grasping forceps. It is important to grasp the cicatrix directly as this is closest to the adherent peritoneum. Counter-traction is maintained throughout the subsequent steps until the primary trocar is inserted. 2 The umbilical stalk is palpated inferior to the everted cica trix while maintaining cephalad traction. 3 A curved 10–12-mm transverse incision is made inferior to the cicatrix. 4 The umbilical stalk is exposed with sharp and blunt dissec tion to reveal the decussation (crossing) of fibres just above its junction with the linea alba. 5 A 5-mm vertical incision is made through the decussation with an

11-blade scalpel, taking care only to incise the fas cia at this point and not to enter the peritoneum. 6 A blunt haemostat angled away from the bowel and major vessels is then pushed through the pre-peritoneal fat and peritoneum; the surgeon will feel a ‘pop’ as the instrument enters the peritoneal cavity . 7 A blunt-tipped 10- or 12-mm trocar is pushed through the same point of insertion of the haemostat and in the same direction. 8 The laparoscopic camera is used to confirm successful placement in the peritoneal cavity before insu ffl ation with CO gas. 2 9 CO gas insu ffl ation is commenced at low flow (1–4 litres 2 per minute) and increased to a maximum pressure of 15 /uni00A0 mmHg and with a maximum flow rate of 20 /uni00A0 L/min. 10 For the patient with scars from previous abdominal surgery , the safest technique is an open approach at Palmer’s point, 3 /uni00A0 cm below the left subcostal margin in the mid-clavicular line. Adequate lighting and good assistance with retraction are essential. Veress needle and optical entry A V eress needle is a spring-loaded needle that consists of an outer sharp bevel that cuts through tissue. Once the needle enters the peritoneal cavity , owing to the loss of resistance the spring-loaded blunt inner stylet deploys and prevents inadver tent injury to the bowel or blood vessels. The V eress needle can be inserted in the umbilical region or in other regions of the abdomen, such as Palmer’s point. The steps involved in V eress needle insertion are as follo (Figure 7.11) . Raol Palmer , 1904–1945, gynaecologist, France. - - - - - Figure 7.11 1 A 10-mm incision in Palmer’s point (3 /uni00A0 cm below the left costal margin, in the mid-clavicular plane) is the location preferred by many surgeons for V eress needle insertion. 2 The needle is advanced until it reaches the muscle. The abdominal wall is then lifted and the needle advanced through the oblique muscles. 3 Classically , a ‘pop’ is heard and a ‘give’ felt on successful insertion into the peritoneal cavity . 4 The intraperitoneal placement is confirmed using a com - bination of the following techniques. /uni25CF The hanging drop method, wherein a drop of water is placed in the hub of the needle; on elevating the abdominal wall the resultant loss of intra-abdominal pressure would result in the drop emptying into the ab - dominal cavity . /uni25CF Free flow of saline into the peritoneal cavity and no - return of bowel content or blood on aspiration. /uni25CF Abdominal pressure reading of less than 10 /uni00A0 mmHg. 5 Once the position is confirmed CO insu ffl ation at a slow 2 pace is commenced until the target pressure is reached. ws The needle is now removed.

(c) (b) Veress needle to establish pneumoperitoneum (courtesy of Dr Vinay Timothy Kuruvilla).

flation: /uni25CF The primary port is placed by following the V eress needle track. A visual entry port is recommended as it allows for a more controlled entry under vision. This technique involves the placement of a 0° laparoscope through a transparent optical port, which is tunnelled into the abdomen under vision. The port is advanced with a twisting motion while the camera is held steady . /uni25CF The layers of the abdominal wall musculature are seen. When the peritoneal cavity (distended beforehand us ing the V eress needle) is entered the omentum and intra-abdominal viscera are seen and a gush of air is heard and felt. The 0° camera is subsequently replaced with an appropriate 30° camera if r equired. /uni25CF It is also common practice to use the optical entry meth od without prior insu ffl ation using a V eress needle. The basic principles of secondary port (trocar) placement in laparoscopic surgery are as follows: 1 All secondary trocars should be inserted under direct vision to avoid damage to bowel, bladder and blood vessels. A two-handed or controlled single-handed technique should be used to avoid sudden movement, resulting in plunging of the trocar intraperitoneally . 2 Trocars should always be inserted perpendicular to the abdominal wall. Oblique insertion results in increased pressure or torque while instruments are used, which causes fatigue for the surgeon and increased trauma to the patient’s abdominal wall.

This is of particular relevance in obese patients. 3 A hand’s breadth (the patient’s hand) either side of the midline represents the extent of the rectus sheath, which contains the epigastric vessels. By placing non-midline trocars lateral to the rectus sheath, usually in the mid clavicular line, the epigastric vessels can be avoided. 4 Where possible, smaller diameter trocars should be used as they are associated with less postoperative pain, a lower incidence of port site incisional hernia and better cosme sis. All port sites above 5 /uni00A0 mm in diameter should undergo suture closure of the fascial layers to reduce the possibility of port site hernia. 5 All secondary trocars should be removed under direct vision to observe for port site bleeding. Summary box 7.5 The benefits of laparoscopic surgery /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Less postoperative pain Better cosmesis Earlier return to normal physiology Shorter hospital stays Fewer intraoperative adhesions created Better perception of anatomy as image is often magni /f_i ed

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(c) (b) Veress needle to establish pneumoperitoneum (courtesy of Dr Vinay Timothy Kuruvilla).

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Less postoperative pain Better cosmesis Earlier return to normal physiology Shorter hospital stays Fewer intraoperative adhesions created Better perception of anatomy as image is often magni /f_i ed

Laparoscopic access and port placement

There are two fundamental ways to access the abdomen laparoscopically: - 1 the open technique (Hasson's or modified Hasson's) 2 the closed technique (V eress needle and/or visual entry trocar). The advantages and complication rates of each of these techniques are not significantly di ff erent; therefore, the tech - nique that the surgeon is most accustomed to should be used. Figure 7.9 (a) (b) (d) (c) (e)

(a) (b) (d) Midline laparotomy incision. Skin incision; /uni00A0 peritoneum is picked up between haemostats and incised; (c) (e) subcutaneous fat is incised; linea alba is opened to expose peritoneum; peritoneal cavity opened (courtesy of Dr Vinay Timothy Kuruvilla).

Figure 7.10 (a) (b) (c) (d) (e)

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Lateral position

Lateral position

Left or right lateral positioning (Figure 7.5) are useful alterna tives to prone positioning in many circumstances, such as the drainage of perianal or pilonidal abscesses. The lateral position also allows for good access to the thorax when perf orming a lateral thoracotomy . A modified lateral position, commonly referred to as the ‘kidney position’, can aid in urological and retroperitoneal procedures by increasing the distance between the costal margin and the iliac bone. This is achieved by ‘break ing the table’ or angulating the table with the summit near the middle of the table and the two ends sloping away . Key points /uni25CF The lower leg is slightly flexed at the knee, a pillow is placed between both the legs and the upper leg is flexed in a more exaggerated position. /uni25CF The arms are usually placed in stirrups. /uni25CF Maintaining cervical alignment of the head is very import ant. Potential complications /uni25CF Respiratory complications secondary to preferential venti lation of one lung over the other and accidental endobron chial migration of the tube. /uni25CF Traction injury of the brachial plexus and ulnar nerve in jury . /uni25CF Corneal abrasions and ocular trauma. Lateral position

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To understand: The importance of safe patient positioning • The steps involved in surgical site preparation • The principles of surgical exposure and laparoscopic • access Learning objectives

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Lithotomy and Lloyd-Davies position

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This is commonly employed for gynaecological, perineal and urological procedures. The patient is positioned supine with the legs flexed at the hip and knee and placed in stirrups. In degree of hip and knee flexion can be controlled depending upon the type of procedure performed (Figure 7.3). T he Lloyd-Davies position is a modification of the lithotomy position with hips minimally flexed to around 15° with a 30° head-down tilt. Key points /uni25CF Both legs are simultaneously placed in the stirrups. /uni25CF The fingers should not extend past the edge of the table as they can be crushed or even amputated accidentally . /uni25CF The legs should not be externally rotated or unduly ab - ducted. /uni25CF Sequential compression devices may be useful to prevent venous stasis, especially in major operations. Potential complications /uni25CF V enous and arterial insu ffi ciency in long procedures can lead to limb ischaemia and compartment syndrome, besides having a higher chance of deep venous thrombosis. /uni25CF Digital amputation at the edge of the bed. /uni25CF Hyperflexion can cause damage to the sciatic nerve. /uni25CF Saphenous and peroneal neuropraxia when legs are placed - in the stirrups. Lithotomy and Lloyd-Davies position

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Monopolar and bipolar diathermy

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In monopolar surgery (Figure 7.18a), the electrical current created in the ESU passes through a single electrode (diathermy pencil) to the tissue, causing the desired tissue e ff ect (cut or coagulation). To complete the cycle, the current then passes through the tissues and returns via a very large surface plate (the indi ff erent electrode or disper sive cable) back to the earth pole of the generator. In bipolar diathermy (Figure 7.18b), the two active elec - trodes are usually represented by the limbs of a pair of dia - thermy forceps, blades of scissors or graspers. Both forceps ends are therefore active and current flows between them and only the tissue held between the limbs of the forceps heats up. This form of diathermy is used when working in sensitive areas (e.g. near the recurrent laryngeal nerve in thyroid surgery) or in patients with implantable electrical devices, as current can interfere with these devices. A se parate return electrode (the indi ff erent electrode) to return current is not needed. Figure 7.18 (a)

unit Active cable Active electrode Dispersive Patient cable plate Monopolar diathermy (a) The principles of diathermy. Monopolar diathermy. TABLE 7.4 Comparison of cutting and coagulation of tissue using diathermy. Cutting Coagulation Lower voltage current Higher voltage current Continuous (current is ‘on’ 100% of the time when Interrupted (current /f_l ows 6% of the time and off for the remaining 94%) used) Energy concentrated over a small area Energy dispersed over a large area The modulated current allows the tissue to cool slightly, so tissue heating is slower Tissue is heated rapidly and to a higher temperature, than with cutting mode. This causes a dehydration effect (loss of cellular /f_l uid causing vaporisation of tissue and thereby resulting in and protein denaturation), resulting in coagulation of tissue. Dehydration is not as ‘cutting’ tissue effective as vaporisation for cutting tissue but is ideal for haemostasis. Bleeding is stopped by a combination of the distortion of the walls of the blood vessel, coagulation of the plasma proteins and stimulation of the clotting cascade Minimal lateral spread and collateral damage Extensive lateral spread Similar to cutting and works best when held just above the tissue, with no contact Cutting divides tissue by generating sparks, which arc or minimal contact with tissue to the tissue; this is most ef /f_i cient when the tip is held just above the tissue Uses: coagulation and achieving haemostasis Uses: clean cut of tissue To be used to dissect and divide tissue and not just to make skin incisions

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Needles

Needles

Most needles in present practice are eyeless, or ‘atraumatic’, with the suture material embedded within the shank of the needle. The needle has three main parts: 1 shank; 2 body; 3 point. imately one-third of the way back from the rear of the needle, avoiding both the shank and the point. The body of the needle is either round, triangular or flat - tened. Round-bodied needles gradually taper to a point, while - triangular needles have cutting edges along all three sides. The point of the needle can be r ound with a tapered end, conven - - tional cutting, which has the cutting edge facing the inside of the needle’s curv ature, or reversed cutting, in which the cutting edge is on the outside. Round-bodied needles are designed to separate tissue fibres rather than cut through them and are commonly used in intestinal and cardiovascular surgery . Cutting needles are used where tough or dense tissue needs to be sutured, such as skin and fascia. Blunt-ended needles are now being advocated in certain situations, such as the closure of the abdominal wall, to diminish the risk of needle-stick injuries in this era of virally transmitted disorders. The choice of needle shape tends to be dictated by the accessibility of the tissue to be sutured, and the - more confined the operative space, the more curved the nee - dle. Hand-held straight needles may be used on skin, although today it is advocated that needle holders should be used in all - cases to reduce the risk of needle-stick injuries. Half-circle needles are commonly utilised in the gastroin - testinal tract, while J-shaped needles, quarter-circle needles and compound curv ature needles are used in special situations such as the laparoscopic port site closure, eye and oral cavity , respectively . The siz e of the needle tends to correspond with the gauge of the suture material, although it is possible to get similar sutures with di ff ering needle sizes (Figure 7.12) . When choosing suture materials, there are certain specific requirements depending on the tissue to be sutured. /uni25CF Vascular anastomoses require smooth, non-absorbable, non-elastic material. /uni25CF Biliary anastomoses require an absorbable material that will not promote tissue reaction or stone formation. /uni25CF When using absorbable material, always be mindful that certain tissues require wound support for longer than oth - ers; for example, muscular aponeuroses compared with subcutaneous tissues. /uni25CF - Bowel anastomosis is usually performed using polyglactin, PDS or polypropylene based on the surgeon’s preference. /uni25CF The size of the needle and suture size used depends on the tissue that is approximated (Table 7.3). - -

TABLE 7.3 Size of suture material. Metric (EurPh) Range of diameter (mm) USP (‘old’) 1 0.100–0.149 5–0 1.5 0.150–0.199 4–0 2 0.200–0.249 3–0 3 0.300–0.349 2–0 3.5 0.350–0.399 0 4 0.400–0.499 1 5 0.500–0.599 2

None Cardiovascular surgery, plastic surgery, ophthalmic surgery, general surgical subcuticular skin closure Polypropylene None Cardiovascular, ophthalmic, plastic and general surgery Polyester epair, plastic None General surgical use, e.g. skin closure, abdominal wall mass closure, hernia r surgery, neurosurgery, microsurgery, ophthalmic surgery Nylon Should not be used in conjunction with prosthesis of different metal Closure of sternotomy wounds. Previously found favour for tendon and hernia repairs Surgical steel Not advised for use with vascular prostheses Ligation and suturing in gastrointestinal surgery. No longer in common use in most centres Linen olonged ess. Not for use with vascular prostheses or in tissues requiring pr approximation under str Risk of infection and tissue reaction makes silk unsuitable for routine skin closure long-term tissue support is Ligation and suturing when necessary. For securing drains externally Silk Non-absorbable suture materials.

Contraindications Frequent uses TABLE 7.1 Suture ® , Premilene ® Mono /f_i lament. Dyed or undyed Polymer of propylene In /f_i nite (>1 year) Non-absorbable: remains encapsulated in body tissues Low Prolene ® Mono /f_i lament or braided multi /f_i lament. Dyed or undyed. Coated (polybutylate or silicone) or uncoated Polyester (polyethylene terephthalate) In /f_i nite (>1 year) Non-absorbable: remains encapsulated in body tissues Low Ethibond ® , Da /f_i lon ® oximately Ethilon Mono /f_i lament or braided multi /f_i lament. Dyed or undyed Polyamide polymer Loses 15–20% per year Degrades at appr 15–20% per year Low on, nickel and Steel Mono /f_i lament or multi /f_i lament An alloy of ir chromium In /f_i nite (>1 year) Non-absorbable. Remains encapsulated in body tissues Minimal Linen Twisted Long staple /f_l ax /f_i bres Stronger when wet. Loses 50% at 6 months; 30% remains at 2 years Non-absorbable. Remains encapsulated in body tissues Moderate

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Types Raw material T Absorption rate Tissue reaction

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Figure 7.12

1/2 curved J needle Cross- section Cutting needles for stitching skin Needles used for suturing the bowel The threads are swaged into the needles Types of needle.

Needles

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Patient safety and transfer to the operating table

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Patient safety is of paramount importance. The safe transfer and positioning of the patient is a responsibility that is shared by the anaesthetist, surgeon, nurse and operating department practitioners. The anaesthetist managing the airway usually coordinates the transfer of the patient by calling the count. The transfer of the patient is a critical moment during which there is a signiï¬�cant risk of falls and injuries, not to mention injury to operating theatre personnel. Additional care and specialised equipment may be required when transferring patients who are obese or emaciated and those at extremes of age. Patient safety and transfer to the operating table

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Prone position

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In the prone position (Figure 7.4) , the patient is intubated and - then log-rolled onto the operating bed with the assistance of at least four members of the team. This position is used in - spinal surgery and in certain general surgical procedures, e.g. extrale vator abdominoperineal excision for rectal cancer. A common modification of the prone position is the jack - knife position, which o ff ers excellent access to the perineum. Key points /uni25CF Axillary and lateral chest rolls are essential to aid in the movement of the chest, abdomen and diaphragm. /uni25CF Female breasts and male genitalia have to be carefully po - sitioned. /uni25CF Arms may be placed by the side of the head by reversing the arm boards with care taken to avoid shoulder disloca - tion. - /uni25CF Toes should be elevated o ff the bed by placing pads under the shins. /uni25CF Specially designed pillows with a hollow to accommodate the face and endotracheal tube, while gently supporting - the forehead and chin, are also used. Figure 7.5 Potential complications /uni25CF Brachial plexus injury and shoulder dislocation. /uni25CF Facial trauma, including blindness secondary to vascular congestion of the eye. /uni25CF Pressure necrosis of the breasts, external genitalia and pressure-bearing bony prominences. /uni25CF Displacement of the endotracheal tube

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Removal of drains

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A drain should be removed as soon as it has served its purpose. It is important to define the objective of each drain and to ensure that, once that objective has been met, the drain is removed rather than waiting for an arbitrary drain volume amount. be removed after 24 hours. /uni25CF Drains put in because of infection should be left until the infection is subsiding or the drainage is minimal. /uni25CF Drains placed following routine bowel anastomoses should be removed at 3–5 days. However, it should be stressed that in no way does a drain prevent an intestinal anastomotic leak, but merely may assist any such leakage to drain ex - ternally rather than producing life-threatening peritonitis. /uni25CF A suction drain should have the suction taken o ff before removal of the drain. /uni25CF During removal of a chest drain, the patient should be - asked to breathe in and hold their breath, thus doing a Valsalva manoeuvre. In this way , no air is sucked into the pleural cavity as the tube is removed. Once the drain is out, - a previously inserted purse-string suture should be tied. Removal of drains

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SURGICAL EXPOSURE AND WOUND APPROXIMATION

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Skin antisepsis

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Skin antisepsis removes transient organisms and dirt, thereby preventing SSI. The principles involved in skin antisepsis are as follows. /uni25CF The use of alcohol-based antiseptic solution is recom mended. The World Health Organization recommends the use of chlorhexidine alcohol; however, the clinical di ff erence between povidone–iodine and chlorhexidine is marginal and therefor e the use of any alcohol-based anti septic solution is acceptable. /uni25CF Extensions of the main incision, additional incisions and drain placement have to be factored in when planning the preparation of the surgical site. /uni25CF A slender cotton-tipped swab can be used to clean the um bilicus when preparing for an abdominal procedure. /uni25CF In contaminated or dirty wounds it is advisable to start from an area of lower bacterial contamination and move towards a region with greater contamination. However, in clean procedures, starting from the area where skin inci sion is likely to be made and working towards the periph ery is advised. /uni25CF Using concentric circles, horizontal or vertical lines do not make a di ff erence in preventing SSI. /uni25CF It is important to allow the antiseptic solution to dry and to avoid dripping of the solution onto the diathermy elec trodes or pooling under the patient. Skin antisepsis

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Skin incisions

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Skin incisions in general surgery. A, sternotomy; B, periareolar; C, inframammary; D, subcostal; E, paramedian; F , transverse; G, /uni00A0 periumbilical; H, McBurney's; I, Pfannenstiel; J, Kocher's incision for thyroidectomy; K, clamshell thoracotomy; L, chevron incision; M, midline incision; N, inguinal incision (courtesy of Dr Vinay Timothy Kuruvilla). 15 10 11 23 22 Scalpel blade sizes and shapes. The 22-blade is often used for abdominal incisions, the 11-blade for arteriotomy and abscess drainage and the 15-blade for minor surgical procedures.

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Specialist use of drains

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Nasogastric drainage The role of nasogastric tube placement in the surgical patient has been steeped in dogma. There is no doubt that selective use of nasogastric tubes have a vital place in the perioperative management of patients; however, there is a trend to move away from routine placement of nasogastric tubes and from keeping them in place for protracted lengths of time when inserted. Most enhanced recovery after surgery (ERAS) pathways forbid the prophylactic use of nasogastric tubes in the elective setting, except following procedures in the upper aerodigestive tract. The indications and potential problems associated with nasogastric drainage have been detailed in Summary boxes 7.12 and 7.13 . Specialist use of drains

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Supine position

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This is the most common position for general surgical proce - dures. The patient’s arms may be placed by their side or extended to a ff ord access to intravenous and arterial cannulae. This is a versatile position and can be modified as follows: /uni25CF Rose’s position: slight neck extension for head and neck surgery . /uni25CF Shoulder and arm extended: to assist in axillary and breast surgery . /uni25CF Trendelenburg position: the head end of the table is tilted down on an incline with the patient’s knees slightly flexed. This is often used in pelvic procedures and when resusci - tating a patient in shock (Figure 7.1). /uni25CF Reverse Trendelenburg position: the head end of the table is tilted up, thereby placing the head higher than the feet (Figure 7.2). In advanced laparoscopic surgery , exaggerated and fre - quent position changes during the course of the operation are used to enhance surgical exposure. An excellent example - Figure 7.1 Figure 7.2 would be in laparoscopic resection of the rectum, wherein the table is tilted to the right to aid in left colon mobilisation; a neutral or reverse Trendelenburg position is used to mobilise the transverse colon; and pelvic dissection is completed with a steep Trendelenburg position. This can only be achieved if the patient is well positioned and secured (Figure 7.3). Straps and supports to secure the patient /uni25CF The safety belt to prevent the patient from sliding o ff the table is placed 5 /uni00A0 cm above the knee and never over the abdomen. /uni25CF Shoulder supports are used if the Trendelenburg position is necessary . /uni25CF Side supports to prevent lateral displacement of the pa tient are essential if the table needs to be tilted laterally . /uni25CF Foot support is required for the reverse Trendelenburg po sition. /uni25CF Alternatively , vacuum-activated positioning systems that gently conform to the contours of the patient’s body can be used. Potential complications specific to supine positioning /uni25CF Ulnar, axillary , peroneal and brachial neuropraxia. /uni25CF To reduce the risk of brachial plexus injury , the arm should not be hyperextended (abducted by greater than 90°). Pronation of the extended arm causes traction of the brachial plexus and also causes pressure on the ul nar nerve. /uni25CF Pressure necrosis of the heels, shoulder, sacral region and scalp. /uni25CF Steep Trendelenburg position can cause respiratory com promise and raise intracranial and intraocular pressure. Figure 7.3 Figure 7.4

Trendelenburg position. Reverse Trendelenburg position. Secure positioning in complex laparoscopic procedures is aided with shoulder and side supports, straps and stirrups. Prone position. Padded material is placed under the axillae and extends down to the iliac crest to facilitate breathing.

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Surgical access to the abdomen in general surgery

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Access to the abdominal cavity can be achieved in many ways and the exposure required will depend on the surgical pathology anticipated, procedure performed and expertise of the surgeon (Summary box 7.4). Summary box 7.4 Surgical exposure of the abdomen /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Scalpel versus diathermy? Abdominal incisions can be made using a scalpel or diathermy . Recent data suggest that there is no di ff erence with regards to SSI, blood loss or operative time between the two; however, using diathermy resulted in a lower requirement for postoper ative analgesia. Usually , it is down to the surgeon's preference as there appears to be no clinically discernible di ff erence. Transverse versus longitudinal? Transverse incisions result in less pain, better pulmonary function and fewer incisional hernias but have higher wound infection rates. However, as a rule of thumb, the midline Harrith Hasson , 1931–2012, Professor of Gynaecology , Chicago, IL, USA. Janos Veress , 1903–1979, surgeon, Hungary . laparotomy is preferred for most emergency procedures as this is quicker to perform and is more versatile. The steps in performing a midline laparotomy are detailed . This below . Ever y incision should be made with closure in mind and based on the suspected site of pathology: an upper mid- line , lower midline or mid-midline laparotomy incision can be made and extended as required. 1 The first step is to make a skin incision using landmarks such as the xiphisternum, umbilicus and pubic symphysis as reference (Figure 7.9a) . 2 The subcutaneous tissue is then dissected away , exposing the rectus and the linea alba (Figure 7.9b) . 3 The linea alba is longitudinally incised close to the umbil - ical cicatrix to prevent straying into the rectus sheath on either side, thereby exposing the pre-peritoneal fat (Figure 7.9c) . 4 The pre-peritoneal fat is divided carefully and the perito - neum is picked up between two haemostats and incised using scissors (Figure 7.9d). 5 Once the peritoneum is entered, the surgeon's fingers are usually inserted into the peritoneal cavity and the desired length of the peritoneal cavity is opened (Figure 7.9e) . Re-entry incisions Avoid railroading and criss-crossing incisions as they can lead to skin necrosis; it is better to make an incision through the previous scar or excise the scar in total. Extending the skin incision past the previous scar to enter the peritoneal cavity at a virgin plane may help avoid inadvertent injury to the underlying viscera, which may be adherent to the scar.

Open surgical exposure Intraperitoneal access Longitudinal Transverse Oblique Pelvic Retroperitoneal access – /f_l ank incision Multicompartment access – thoracoabdominal incisions Laparoscopic exposure Multiport, single port, hand-assisted laparoscopy X Y Y X Y

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Surgical access to the abdomen in general surgery

Access to the abdominal cavity can be achieved in many ways and the exposure required will depend on the surgical pathology anticipated, procedure performed and expertise of the surgeon (Summary box 7.4). Summary box 7.4 Surgical exposure of the abdomen /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Scalpel versus diathermy? Abdominal incisions can be made using a scalpel or diathermy . Recent data suggest that there is no di ff erence with regards to SSI, blood loss or operative time between the two; however, using diathermy resulted in a lower requirement for postoper ative analgesia. Usually , it is down to the surgeon's preference as there appears to be no clinically discernible di ff erence. Transverse versus longitudinal? Transverse incisions result in less pain, better pulmonary function and fewer incisional hernias but have higher wound infection rates. However, as a rule of thumb, the midline Harrith Hasson , 1931–2012, Professor of Gynaecology , Chicago, IL, USA. Janos Veress , 1903–1979, surgeon, Hungary . laparotomy is preferred for most emergency procedures as this is quicker to

perform and is more versatile. The steps in performing a midline laparotomy are detailed . This below . Ever y incision should be made with closure in mind and based on the suspected site of pathology: an upper mid- line , lower midline or mid-midline laparotomy incision can be made and extended as required. 1 The first step is to make a skin incision using landmarks such as the xiphisternum, umbilicus and pubic symphysis as reference (Figure 7.9a) . 2 The subcutaneous tissue is then dissected away , exposing the rectus and the linea alba (Figure 7.9b) . 3 The linea alba is longitudinally incised close to the umbil - ical cicatrix to prevent straying into the rectus sheath on either side, thereby exposing the pre-peritoneal fat (Figure 7.9c) . 4 The pre-peritoneal fat is divided carefully and the perito - neum is picked up between two haemostats and incised using scissors (Figure 7.9d). 5 Once the peritoneum is entered, the surgeon’s fingers are usually inserted into the peritoneal cavity and the desired length of the peritoneal cavity is opened (Figure 7.9e) . Re-entry incisions Avoid railroading and criss-crossing incisions as they can lead to skin necrosis; it is better to make an incision through the previous scar or excise the scar in total. Extending the skin incision past the previous scar to enter the peritoneal cavity at a virgin plane may help avoid inadvertent injury to the underlying viscera, which may be adherent to the scar.

Open surgical exposure Intraperitoneal access Longitudinal Transverse Oblique Pelvic Retroperitoneal access – /f_l ank incision Multicompartment access – thoracoabdominal incisions Laparoscopic exposure Multiport, single port, hand-assisted laparoscopy X Y Y X Y

Suture characteristics

Suture characteristics

There are five characteristics of any suture material that need to be considered: 1 Physical structure : monofilament or multifilament. /uni25CF Monofilament sutures are smooth and tend to slide through tissues easily , but are more di ffi cult to knot e ff ectively . Such material can be easily damaged by gripping it with a needle holder and this can lead to fracture of the suture. /uni25CF Multifilament or braided sutures are much easier to knot but have a surface area of several thousand times that of monofilament sutures and thus have a capillary be responsible for persistent infection or sinuses. To overcome some of these problems, certain materials are produced as a braided suture that is coated with silicone to make it smooth. 2 Strength : the strength of a suture depends upon its con stituent material, thickness and its response to various tissues and circumstances. Suture material thickness is clas sified according to its diameter in tenths of a millimetre. T he tensile strength of a suture can be expressed as the force required to br eak it when pulling the two ends apart. Absorbable sutures show decay of this strength with time. Although the material may last in the tissues for the stated period in the manufacturer's product profile, its tensile strength cannot be relied on in vivo for this entire period. Materials such as catgut (no longer in use in the UK) have a tensile strength of only about a week while polydioxanone sulphate (PDS) will remain strong in the tissues for several weeks . However, even non-absorbable sutures do not necessarily maintain their strength indefi nitely . Non-absorbable materials of synthetic origin, such as polypropylene, probably retain their tensile strength indefinitely , whereas non-absorbable materials of bio logical origin, such as silk, will fragment with time and lose their str ength, and such materials should never be used in vascular anastomoses for fear of late fistula formation. 3 Tensile behaviour : suture materials behave di ff erently depending upon their deformability and flexibility . Some may be 'elastic', in which case the material will return to its original length once any tension is released, while others may be 'plastic', in which case this phenomenon does not occur. Many synthetic materials demonstrate 'memory', which means they keep curling up in the shape that they adopted within the packaging. A sharp but gentle pull on the suture material helps to diminish this memory , but the more memory a suture material has, the less is the knot security . 4 Absorbability : suture materials may be non-absorbable (Table 7.1) or absorbable (Table 7.2). 5 Biological behaviour : the biological behaviour of suture materials within the tissues depends upon the con stituent raw material. Biological or natural sutures, such as catgut, are proteolysed, but this involves a process that is not entirely predictable and can cause local irritation; therefore , such materials are seldom used. Man-made syn thetic polymers are hydrolysed and their disappearance in the tissues is more predictable. The presence of pus, urine or faeces influences the final result and renders the out come more unpredictable. Suture characteristics

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Suture techniques

Suture techniques

There are four frequently used suture techniques. 1 Interrupted sutures . Interrupted sutures require the needle to be inserted at right angles to the incision and then to pass through both aspects of the suture line and exit again at right angles (Figure 7.13a). The needle needs to be rotated through the tissues rather than to be dragged through for fear of enlarging the needle hole. As a guide, the distance from the point of the needle to the edge of the wound should be appro ximately the same as the depth of the tissue being sutured, and each successive suture should be placed at twice this distance apart (Figure 7.13b suture should reach into the depths of the wound and be placed at right angles to the axis of the wound. In linear wounds, it is sometimes easier to insert the middle suture first and then to complete the closur e by successively insert ing sutures, halving the remaining deficits in the wound length. 2 Continuous sutures . For a continuous suture, the first suture is inserted in an identical manner to an interrupted suture, but the rest of the sutures are inserted in a contin uous manner until the far end of the wound is reached (Figure 7.14) . Each throw of the continuous suture should be inserted at right angles to the wound and this will mean that the externally observed suture material will usually lie diagonal to the axis of the wound. It is important to have an assistant w ho will follow the suture, keeping it at the same tension to avoid either purse stringing the wound by too m uch tension or leaving the suture material too slack. There is more danger of producing too much tension by using too little suture length than there is of leaving the suture line too lax. Postoperative oedema will often take up any slack in the suture material. At the far end of the wound, this suture line should be secured either by using an Aberdeen knot or by tying the free end to the loop of the last suture to be inserted. 3 Mattress sutures . Mattress sutures may be either ver -). Each tical or horizontal and tend to be used to produce either eversion or inversion of a wound edge (Figure 7.15). The initial suture is inserted as for an interrupted suture, b ut then the needle moves either horizontally or vertically - and traverses both edges of the wound once again. Such sutures are very useful in producing an accura te approxi - mation of wound edges, especially when the edges to be anastomosed are irregular in depth or disposition. 4 Subcuticular suture . This technique is used in skin - where a cosmetic appearance is important and where the skin edges may be approximated easily (Figure 7.16) . The suture material used may be either absorbable or

Straight Compound curve Needles used for suturing the abdominal wall: Round-bodied needles for peritoneum, muscles and fat Cutting needles for aponeurosis

Figure 7.13 (a) (b) Figure 7.14 non-absorbable. For non-absorbable sutures, the ends may be secured using a collar and bead, or tied loosely over the wound. When absorbable sutures are used, the ends may be secured using a buried knot. Small bites of the subcuticular tissues are taken on alternate sites of the wound and then gently pulled together, thus approximating the wound edges without the risk of the cross-hatched markings of interrupted sutures.

(a) (b) X X 2X X Interrupted suture technique. Reproduced with permission from Royal College of Surgeons of England. The siting of sutures. As a rule of thumb, the distance of insertion from the edge of the wound should correspond to the thickness of the tissue being sutured (×). Each successive suture should be placed at twice this distance apart (2 ×). Continuous suture technique.

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T-tube drains

T-tube drains

A T-tube (Figure 7.21) may be inserted after exploration of the common bile duct and stone retrieval or following repair of a damaged common bile duct. The principle is to allo w bile to Indications for placement of the nasogastric tube /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Summary box 7.13 Placement of nasogastric tubes /uni25CF - /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF - Figure 7.21

Drainage purposes Conservative management of postoperative paralytic ileus Conservative management of bowel obstruction (adhesional or partial) Decompression of the stomach before an emergency operation Prophylactically, when postoperative ileus is anticipated following extensive bowel handling Feeding purposes Following procedures in the upper aerodigestive tract (nasogastric or nasoenteral) In patient with motor neurone disease or stroke Contraindications Suspected or proven base of skull fracture as this may result in inadvertent cranial injury Oesophageal stricture or recent oesophageal surgery (unless under vision) Complications Upper airway damage – pressure necrosis of the nasal ala owing to the placement of an oversized tube or following prolonged placement Re /f_l ux oesophagitis Pulmonary aspiration due to impaired function of the lower gastro-oesophageal sphincter Inadvertent placement into the lungs Traumatic placement causing bleeding and perforation T-tube.

and to act as a safety valve if there are any stones retained in the distal common bile duct. Despite its perceived uses, the T-tube is not without problems; a recent Cochrane analysis concluded that it is associated with increased bile leakage and increased hospital stay and cost with minimal benefits. Once inserted, a T-tube should remain in place for at least 2–3 weeks to encourage fistulous tract formation, thereby minimising the risk of biliar y peritonitis after removal of the T-tube. Before removal, a T-tube cholangiogram should demonstrate the free flow of bile into the duodenum with no retained stones or bile leak. The T-tube is then clamped for 24 hours and removed. The T-tube is clamped to allow pref erential drainage of bile to the duodenum; if there is no distal obstruction the patient will be asymptomatic. Once the T-tube is removed, there will be minimal bile leakage through the fis tulous tract for a few days. This should stop as a fistula will close if there is no distal obstruction. T-tube drains

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TECHNIQUE

TECHNIQUE

The suturing of an incision or wound needs to take into consid - eration the site and tissues involved. There is no ideal wound closure technique that would be appropriate for all situations, and the ideal suture has yet to be produced, although many of the desired characteristics are listed in Summary box 7.6 . Summary box 7.6 - Suture material: desired characteristics /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF - /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Clean wounds with a good blood supply heal by primary intention and so closure simply requires accurate apposition of the wound edges. However, if a wound is left open, it heals by secondary intention through the formation of granulation tissue, which is tissue composed of capillaries, fibroblasts and inflammatory cells. Wound contraction and epithelialisation assist in ultimate healing, but the process may take several weeks or months. Delayed primary closure or tertiary inten - tion is utilised when there is a high probability of the wound being infected. The wound is left open for a few days and if the infective process is resolved then the wound is closed to heal by primary intention. Skin g rafting is another form of tertiary intention healing. - Summary box 7.7 Types of wound healing - /uni25CF /uni25CF /uni25CF

Easy to handle Secure knotting ability Predictable behaviour in Inexpensive tissues Minimal tissue reaction Predictable tensile strength Non-capillary Sterile Non-allergenic Glides through tissues easily Non-carcinogenic Primary intention – clean wounds that are often sutured together Secondary intention – healthy granulation tissue /f_i lling up an open wound Tertiary intention – delayed closure or skin grafting

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TOPICAL HAEMOSTATIC AGENTS

TOPICAL HAEMOSTATIC AGENTS

- Physical or biological topical haemostatic agents are considered adjuncts to traditional mechanical and electrosurgical tech - niques. The physical agents commonly used are absorbable gelatin, absorbable collagen and oxidised cellulose and func - tion by providing a sca ff old that encourages fibrin deposition and accelerates clot formation; they can also soak up as much as 40 times their w eight in blood, providing tamponade and compression. Biological topical haemosta tic agents such as thrombin and fibrin sealants encourage clot formation and are often injected or sprayed over the bleeding site. A combination of the abov e can also be used. TOPICAL HAEMOSTATIC AGENTS

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Diathermy (Figure 7.19) can be used for two basic purposes (Table 7.4): 1 coagulation: to achieve haemostasis; 2 cutting: incision and dissection of tissues during surgery . Several ‘blend’ options are also available, combining vari ous proportions of the two main modalities. The effects of diathermy

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The principles of electrosurgery

The principles of electrosurgery

Electric current is defined as the flow of charged particles through a circuit. Alternating current (AC), a type of current wherein current periodically changes direction, is solely employed in electrosurgery . The time taken to complete one positive and one negative alternation is called one cycle. Frequency , measured in Hertz (Hz), denotes the number of such cycles in 1 second; the more the cycles, the higher the frequency . Electrosurgical units (ESUs) work by converting electrical frequencies from the wall outlet (50–60 /uni00A0 Hz) to high frequencies ranging from 500 /uni00A0 000 to 3 /uni00A0 000 /uni00A0 000 /uni00A0 Hz. When current passes through a conductor at such high frequencies, energ y is con - verted to heat, which is used to cut or coagulate tissue. It is important to bear in mind that human muscle and nerves are stimulated at frequencies below 10 /uni00A0 000 /uni00A0 Hz; there - f ore, ESUs must convert electrical frequency to a much higher frequency . The principles of electrosurgery

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The role of drains in modern surgery

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The routine use of surgical drains has generated much contro - versy . Protagonists suggest that the use of drains may: /uni25CF help remove the collection of purulent material, blood, serous fluid, bile, chyle, pancreatic or intestinal secretions; /uni25CF act as a signal for postoperative haemorrhage or anasto - motic leakages /uni25CF provide a track for long-term drainage. However, detractors claim that the presence of a drain may: /uni25CF increase intra-abdominal and wound infections by intro - ducing skin bacteria into the peritoneal cavity; /uni25CF delay recovery and increase hospital stay; /uni25CF increase abdominal pain; /uni25CF decrease pulmonary function; /uni25CF falsely reassure the clinician that there is no intra- abdominal collection, when in fact the drain is blocked. In reality , the use of drains depends on the surgeon’s indi - vidual preference and surgical philosophy . However, there is reasonable consensus regarding the role of drains in certain surgical procedures, as elucidated in Summary boxes 7.10 and 7.11 . Summary box 7.10 Current role of drain placement in non-gastrointestinal surgery /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Avoid routine drain placement Thyroid surgery Breast lumpectomy Inguinal hernia repair Consider routine drain placement Radical and modi /f_i ed radical neck dissection Parotid surgery Axillary dissection with or without mastectomy Inguinal lymphadenectomy Ventral hernia repair in obese patients

Current role of drain placement in gastrointestinal surgery /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Avoid routine drain placement following Colonic surgery Small bowel resections Hepatic resections Cholecystectomy Consider routine drain placement following Oesophageal surgery Major pancreatic resection Selective use of drains following Rectal surgery Gastric resections

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Bleeding encountered during an operation can be arterial, venous or capillary . Surgical haemorrhage is categorised as primary (during the operation), reactionary (24–48 hours postoperatively) or secondary (days to weeks postoperatively). Reactionary haemorrhage is usually a consequence of a slipped ligature or when a vessel injury is missed with bleed ing temporarily stopped owing to a combination of vasocon striction and hypotension. In the postoperative period, once blood pressure improves bleeding will ensue. Secondary hae morrhage is often a manifestation of a deep-seated infection eroding into a blood v essel. As depicted in Summary box 7.8 , it is obvious that ther is a plethora of devices and techniques to help control surgi cal bleeding; however, there can be no substitute for adequate preoperativ e preparation, careful management of antiplatelets and anticoagulants and meticulous surgical technique. When establishing haemostasis, care should be taken to avoid damage to adjacent nerves and organs, prevent unin tentional vascular thrombosis and avoid adjacent tissue injury . Plunging clamps and suturing blindly in pools of blood may cause more damage than serving any purpose. The appropriate use of di ff erent tec hniques to control haemorrhage will depend on the site of bleeding, the extent of bleeding and the surgical pathology encountered. Summary box 7.8 Common haemostatic technique used intraoperatively /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Mechanical Digital pressure Ligatures Haemostatic clamps and ligating clips Vascular stapling devices Wound packing Bone wax Image-guided embolisation Thermal Electrosurgery Cryosurgery Argon beam coagulation Vessel sealing devices Chemical or topical haemostatic agents Physical: absorbable collagen, gelatin, oxidised cellulose Biological: topical thrombin, /f_i brin sealant, tranexamic acid

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