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" YTP UPDATE 2020"

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SURGICAL PEARLS FOR PREVENTION AND MANAGEMENT OF VASCULAR INJURIES DURING LAPAROSCOPIC SURGERY

INTRODUCTION

- Major vascular injuries occur in up to 1 in 200 laparoscopies
- Most commonly occurs during veress needle insertion or primary trocar entry.
- Associated with significant morbidity and up to 23 % mortality.
- Second most common cause of death from laparoscopy after anaesthetic complications.
- Risk factors-previous and complex surgery, intra-abdominal pathology, Low/ High BMI and inexperienced surgeon.
- Although laparoscopy provides a superior vision for prevention and treatment of minor vascular injury, management of major vascular injury is more challenging in laparoscopy when compared to open surgery.
- Early recognition, prompt coordinated resuscitation and measures to arrest the bleeding should be ensured.
- Standardised management protocol should be available and rehearsed in all laparoscopic units.

PATHO-PHYSIOLOGY OF INJURY

- Inadvertent injury to Aorta, IVC or Iliac vessels while inserting primary trocar.
- Injury to inferior epigastric vessels and iliac vessels while inserting secondary lateral trocars and aortic injury during suprapubic port insertion.
- Inadvertent thermal injury due to excessive activation of energy devices. (There are reports of vascular injury, including injury to the external iliac artery, resulting from failure of the insulating sheath of monopolar scissors).
- Accidental needle prick to the great vessels.
- Excessive oncological resection, poor surgical skills and dissection techniques.

KEY CONSIDERATIONS FOR REDUCTION

Pre- operative assessment-

- Identification of risk factors
- Counselling and optimization of the patient
- Ensure availability of blood for every surgery.

Intra-operative measures-

- Ensure correct patient position.
- Choose familiar and suitable entry technique.
- Confirm intra-abdominal placement of trocar before insufflation
- Keep an eye on the vitals of the patient.
- Insert all secondary trocars under proper vision and in trendelenburg position.

ELEMENTS OF BEST PRACTICE IN ABDOMINAL ENTRY TECHNIQUES

- Use the technique you are most familiar with unless there are specific reasons to use an alternative
- Avoid previous scar when choosing the entry point.
- Make an adequate skin incision avoiding the need for the excessive pressure to pass the trocar through the skin.
- Consider insertion of veress or primary trocar in supine position and direct it vertically and stop as soon the peritoneum is penetrated(Fig 1)
- While using veress, increase pneumoperitoneum pressure to at least 20mmHg before inserting trocars.
- Consider using open technique or palmers point entry in women with a low BMI or history of previous surgery.
- Consider alternative method of entry after two unsuccessful attempts.

VESSELS AT RISK

Vessels at risk of laparoscopic gynaecological surgery
Anterior abdominal wall
Inferior epigastric artery
Superficial circumflex iliac artery
Posterior abdominal wall
Aorta
Common iliac arteries and vein
External iliac artery and vein
Internal iliac artery and vein
Inferior vena cava
Corona mortis
Others
Omental vessels
Mesenteric vessels

1- ***Inferior epigastric artery*** – arises from external iliac artery close to round ligament. At umbilicus it lies between 3 cm and 6 cm from the midline and at the pubic symphysis, it lies 1.2–7.5 cm from the midline. So, there is a 'safe zone (for trocar insertion) of less than 1 cm or more than 8 cm from midline and more than two-thirds along the line between the midline and the anterior superior iliac spine. Direct visualisation of the inferior epigastric artery by Doppler ultrasound or transillumination has been recommended, but this becomes more difficult with increasing BMI. A 'yellow island' which exists one-third of the way from the anterior superior iliac spines to the umbilicus and can be identified easily in those with increased BMI (Fig 2) can safely be used for port placement. Inserting ports perpendicular to the abdominal wall also helps to minimise inadvertent inferior epigastric artery injury.

2- ***Aorta-*** The abdominal aorta bifurcates into the right and left common iliac arteries at the level of L4. In the supine position, the aortic bifurcation ranges from 5 cm cephalad to 3 cm caudal to the umbilicus, whereas in the Trendelenburg position, it ranges from 3 cm cephalad to 3 cm caudal to the umbilicus. Thus supporting insertion of primary trocar in the supine position.

3- ***Common iliac arteries-*** As the aortic bifurcation occurs just to the left of the midline, the right common iliac artery is at higher risk of injury during instrumentation of the umbilicus than the left. Keeping the Veress needle and trocar in the midline during entry minimises the risk of injury to these vessels(Fig 3).

4- ***Venous system-*** The vena cava is formed by the confluence of the common iliac veins. This occurs anterior to the L5 vertebra, caudal to the bifurcation of the aorta and approximately 2.5 cm to the right of the midline. An injury to the vena cava is therefore more likely when a trocar is inserted next to the midline instead of in the midline. The left iliac vein crosses the midline caudal to the umbilicus and can be injured even by a midline trocar. The walls of the major veins are delicate and injury can lead to catastrophic bleeding. Blunt dissection along the common iliac vein, inferior vena cava, pelvic sidewall or the presacral area can avulse small tributaries from larger veins with resultant haemorrhage.

5- ***Corona mortis*** -This is an anastomosis between the obturator and the external iliac or inferior epigastric arteries or veins situated behind the superior pubic ramus, which may be injured during pelvic lymphadenectomy.

MANAGEMENT

Anterior abdominal wall vascular injury - The most common vascular injury overall is laceration of the inferior epigastric artery during placement of lateral trocars (usually as secondary trocars) in the lower abdomen. Bleeding from the port sites may present immediately, disturbing the intraoperative view at the time of surgery, or it can be delayed. If recognition of the injury is delayed, bleeding is usually noted within an hour of transfer from the operating theatre. Delayed abdominal wall haematomas can present 2–3 days after surgery with abdominal wall pain, or abdominal wall or flank ecchymosis.

If bleeding is noted immediately, the following techniques may be employed :

- Electrosurgery to coagulate the bleeding point.
- A Foley catheter may be inserted through the port site, and the balloon inflated in the peritoneal cavity. The balloon can then be pulled up against the bleeding point with a resultant tamponade effect.
- The lacerated inferior epigastric vessels can be sutured using a straight needle or intracorporeal suturing. This can be passed under direct laparoscopic vision superior and inferior to the bleeding vessel.

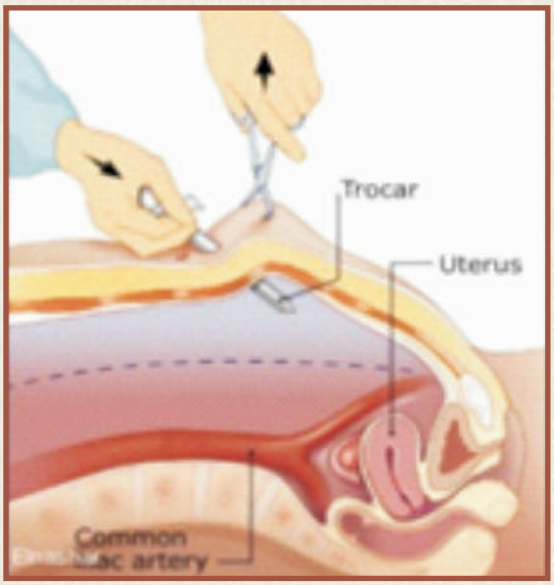
If delayed bleeding is there management should be conservative if the woman has an abdominal wall haematoma but is hemodynamically stable with no signs of haematoma expansion. Intervention is indicated if the haematoma is expanding and the woman becomes hemodynamically unstable or sepsis secondary to an infected haematoma. Following interventions can be considered :

- Percutaneous embolization.
- Laparotomy for rapidly expanding haematomas or those in women who are haemodynamically unstable. A low transverse incision can be used, but if there is any doubt about it being sufficient, a midline incision should be made.

Posterior abdominal wall vessel injury-

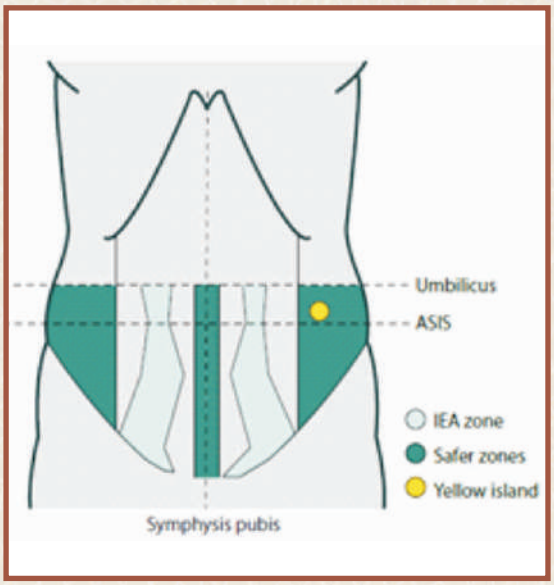
Potentially life-threatening, demanding early recognition, prompt coordinated resuscitation and arrest of bleeding. Understandably, there are no randomised controlled trials providing reliable recommendations as to whether the management should be laparoscopic or by laparotomy. In each situation, this clinical decision should be taken by the lead surgeon depending on their level of expertise, experience, technical and institutional assistance available. Once the injury is identified, the bleeding point is sought to apply direct pressure to stop the bleeding, while simultaneously other members of the team call for help and blood products. If the primary surgeon is experienced, or once vascular surgeon has arrived, clamp the vessel above and below the bleeding point, so that injury can be repaired using one of the various techniques including primary repair, polytetrafluoroethylene graft interposition or Dacron patchplasty. Minor vascular injuries during the operation can be managed using laparoscopic techniques such as direct pressure, electrocautery energy, intracorporeal/extracorporeal suturing, clips and haemostatic agents.

Figure:1



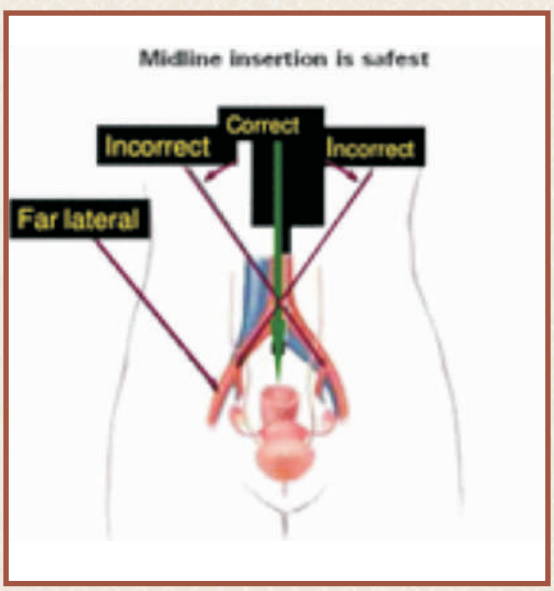
Primary trocar should be inserted 90 degree to the skin and towards sacral hollow or the uterus.

Figure:2



Areas likely to contain the inferior epigastric artery, safer areas and Tinelli's "yellow island".

Figure:3



CONCLUSION

Laparoscopic vascular injury is a serious and potentially fatal event. Prevention of injury needs good surgical skills, appropriate use of instruments, good knowledge of anatomy and safe use of abdominal entry techniques. Management of vascular injury depends on the vessel injured and the experience of the operating surgeon. Immediate stabilisation of the patient followed by appropriate involvement of a multidisciplinary team will minimise morbidity