LAPAROSCOPIC COMPLICATIONS AND THEIR PREVENTION

ESHRE Campus course
Endoscopy in Reproductive Surgery

Leuven 25-28 November 2009
Complications

• According to the step of the surgery
  ▪ during the insertion of the first trocar
  ▪ intra-operative technique
  ▪ early post-operative
  ▪ late post-operative

• Complications related to the type of Laparoscopic surgery performed
  ▪ diagnostic laparoscopy
  ▪ minor laparoscopic surgery
  ▪ major laparoscopic surgery
  ▪ advanced / complex laparoscopic techniques

• Types
  ▪ anaesthesiological complications
  ▪ abdominal Wall injuries (trocar entry complications)
  ▪ vascular injuries
  ▪ Gastro Intestinal Tract injuries
  ▪ urinary injuries
• Injury after Verres needle insertion is 0.8/10000, (Chapron1999)
Veress Needle

- developed in 1930 by Veress
- most commonly used in gynaecology
- sharp outer sheath
- blunt stylet
- retracts when passing through
- springs forward when tissue resistance drops
Check list of steps

• check the spring mechanism, open tap for air entry
• patient flat level on the table
• adequate skin incision
• lift the abdominal wall away from vessels
• insert in the lower part of the umbilicus
• angle depends on BMI
• 2 audible clicks - rectus sheath, peritoneum
• safety tests
Safety checks

- aspiration test
- hanging drop test
- hissing sound test
- manometer test
Safety tests

Aspiration test (1)

- syringe with saline (Palmer’s test) or air
- aspiration
  - contains bowel contents or urine – remove!

- *if blood is aspirated*…..
  - needle is left in place
  - exploratory laparotomy
  - ? vascular injury
Safety tests

Aspiration test (2)

- no material aspirated
- 5 mL of saline
- reattempt to aspirate
- no fluid-BINGO!!!!
- if the saline is removed

in case the needle is in pre-peritoneal space – DON´T PANIC!!!

Reposition
Safety tests

hanging drop test

drop of water

abdominal wall is elevated

water should disappear down the shaft

Modification-using syringe with the plunger out
Modifications of the insertion point

Palmer’s point-adhesions are extremely unlikely; even after multiple surgeries.

Percuss for spleen naso-gastric tube!!! Microlaparoscopy
NO NO!

- wiggle the tip side to side
- use of Trendelenburg
- modify technique with previous surgery
Safety tests

- Manometer test
  - connect gas tubing to the Veress and elevate the abdominal wall to create vacuum-
  - the pressure should drop
  - low flow

- Intra-abdominal pressure less then 10! ...is the most reliable sign!

- ...and the only sign that helps to identify the correct position
Direction of entry

lower edge of umbilicus
Direction of entry

relaxed abdominal wall is pulled away from abdominal vessels
Direction of entry

Elevation increases distance between aorta and umbilicus from 0.1-2.5 cm
Direction of entry

towards sacral hollow midline

First trocar 0.84/1000 Bowel injury
1 in every 100,000 (Champault, 1995)
Initial step in laparoscopy is the creation of Pneumoperitoneum – in case of failure...

- Veress needle fails to enter the peritoneal cavity (recognize the incorrect placement leave the needle to empty the CO2 and reinsert the needle)
- Mediastinal emphysema –severe forms causes difficult to ventilate the patient
- Omentum emphysema – usually is self limited. Can make visualization of the abdominal and pelvic structures more difficult
- Pneumothorax is very rare but possible
- Penetrating injury in a blood vessel, if not recognized may lead to gas embolism and death (treatment: 100% O2 + CVS support)
Modifications

BMI < 25

BMI > 30

BMI = 25-30
Pressure

- usually preset to 15 mm Hg
- high pressure - 25-30 mm Hg
  - gaining acceptance since first introduced in 1990’s
  - short duration<2 min in healthy women has no effect on pulmonary function
  - same lung compliance in horizontal position as in 15 o Trendelenburg
Trocar Tips – Sharp Cone / Pyramidal
ENTRY TECHNIQUES

CLOSED
VERES needle

OPEN
Hasson

OTHERS
OPTICAL TROCARS
RADICALLY EXPANDING TROCARS
TERNAMIAN TROCARLESS CANNULA

DIRECT ENTRY
Introduction of primary trocar - another crucial step
FDA TROCAR INJURY REPORT

Shielded trocar risk injury & hernia X10 higher Leibl 1999

Evidence Based Recommendation FDA 2005
Document - Study - Report
Near Miss & Adverse Event

In HIGH RISK CASE use alternate
Palmer’s / Open / Visual OR Laparotomy Fuller 2005

>½ reported serious injury are entry related

Despite advances serious entry injury remain
common avoidable complication Hurd 2002
Introduction of primary trocar

- preset intraabdominal pressure >15 mmHg
- sufficient skin incision
- no wall elevation
- towards the sacral hollow
- full control of the trocar—speed is constant until loss of resistance
- less force, more rotation

insert the trocar vertically, change the direction impacting the fascia
Ternamian trocarless cannula
IMPORTANCE OF VISUAL ENTRY

• 1-RECOGNIZE INJURY
  • Improves OR team entry SAFETY AWARENESS
  • Raise error RECORDING & REPORTING compliance Wanzel 2002
  • Allows timely repair & Eliminates HINDSIGHT BIAS

• 2-LEARN FROM ERROR
  • Human Behavior study show routine
  • Video tape improve outcome Cuschieri 1998
  • Video capture & recall allows detailed
  • Causation & Error Analysis Mackenzie 1995

• 3-ANTICIPATE Mishaps
  • Vision adds human & technologic redundancy Visual ports
EVIDENCE FOR VISUAL ENTRY

- Requires less ENTRY FORCE
  Validated RCT

- Applies less intra abdominal pressure
  Glass 2003

- Offers radial & controlled entry
  Munro 2002

- MUSCLE DAMAGE SCORE
  significantly less

- FASCIAL-MUSCLE DEFECT
  smaller Tarney 2002

- >2,300 entry+ NO serious
- Entry related complications
  Ternamian 2008
Complications during the installation phase of laparoscopy

- **risk Factors:**
  - surgeon
  - inexperience
  - negligence
  - ignorance
  - lack of respect of the procedures
  - Trendelenbourg

- **patient**
  - history of laparotomy (adhesions into 68%)
  - extreme BMI

- **independent**
  - trocar type: single-use or reusable trocars
Important to have a clear picture in mind what lies in the abdomen underneath the trocar

**SFEG’s register:** 1/3 of complications occur at the initial phase of laparoscopy / first entry TROCAR
67-83% major vascular injuries
30-75% bladder injuries
57% deaths
Direct entry

• as safe as other methods, minor complications rate is lower than Veres

• advantage: 1 blind procedure Vs 3 (Lancet, Veress, Trocar)

• always insert parallel to vessels

• lowest entry failure rate (5% vs 0.9%)
Open laparoscopy - Hasson

- open visualisation of every layer
- until peritoneum
- anchoring fascia
- securing conical collar
- placing trocar through the collar
HASSON

- place in previous surgery
- midline scar
- drawbacks: loss of CO₂, bigger incision, longer time, especially in the obese patients
- does not prevent bowel injury, vascular accidents are less common
Optical trocar
open-laparoscopy

- has its own Complications (= minilaparotomy)
  - infection
  - haematoma
  - adhesions

- the risk of vascular injury is decreased

- doesn’t reduce the risk of GIT injury (0,6/1000)

- but lowers the risk of unknown gastrointestinal injury by factor 2
  - late diagnosis in 33% of cases during open versus 64% in needle procedures

Harchaoui, 1997
Secondary trocars
Secondary trocars
Secondary Trocars

Obliterated umbilical artery

Urachus

Bladder

Secondary Trocars
Complications due to entry ports

- Mortality only few data published as 3,33/100000
- Due to major vascular injuries +++
- During installation phase ++

- Infections of the wall about 1% but after major laparoscopic surgery is about 3%
- depends on:
  - hospital hygiene
  - antibiotic prophylaxis
  - drainage and presence of urine catheter
Prevention

- pay respect to the procedures
- technological issues
  - Miniscopes
  - Endotip ®
- technique issues
  - Insufflation in the Palmer’s point
  - Open-laparoscopy
  - Direct insertion
Complications during laparoscopic surgery

- Gastro Intestinal Tract injuries
- Urinary tract injuries
- Vascular injuries
# Gastrointestinal injury

<table>
<thead>
<tr>
<th>Reference</th>
<th>Laparoscopy (n)</th>
<th>Operative laparoscopy (n)</th>
<th>Operative laparoscopy %</th>
<th>Gastrointestinal injuries during laparoscopy (n)</th>
<th>(n) per thousand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Härkki-Sirén and Kurki (1997)</td>
<td>70 607</td>
<td>11 427</td>
<td>16.2</td>
<td>44</td>
<td>0.62</td>
</tr>
<tr>
<td>Jansen et al. (1997)</td>
<td>25 764</td>
<td>3 967</td>
<td>15.4</td>
<td>29</td>
<td>1.13</td>
</tr>
<tr>
<td>Chapron et al. (1998)</td>
<td>29 966</td>
<td>18 061</td>
<td>60.3</td>
<td>48</td>
<td>1.60</td>
</tr>
</tbody>
</table>
Risk factors GIT complications

- during the installation phase:
  adhesions and anterior laparotomy are found in 68% of bowel injury
- during the surgery procedure: 65% endometriosis (ISGE 2001)
- the history of pelvic surgery X 10 risk of GIT lesion (Chi, 1982)
Risk Factors

Mechanical injuries to the bowel are ten folds more frequent in patients who underwent PREVIOUS PELVIC SURGERY.

SEVERE ENDOMETRIOSIS is the main contributing factor for bowel injuries in patients with no previous surgery.

Chi IC et al., 1982
Chapron C et al., 2001
Nezhat C, 1992
Mechanism of GIT injuries

- **direct trauma (instruments, forceps)**
  - manipulation
  - adhesiolysis, enterolysis (bowel adhesions separation)

- **thermal trauma**
  - bipolar
  - monopolar ++
  - ultracision, thermofusion, sealing methods
Late Diagnosis

in average 4.0 + 5.4 (0-23) days after surgery

mechanical injuries 1.3 days (0-4)
electro-thermal injuries 10.4 days (0-38)
Intestinal complications are responsible for most of morbidity and mortality during laparoscopic surgery.

Mortality in the bowel injury group was 21% when the diagnosis was delayed.

Bhoyrul S, et al., 2001
Prevention of gastrointestinal complications

• Before surgery:
  - PV / PR examination
  - Trans Vaginal / Trans Rectal ultrasound
  - Imaging dynamic / spiral CTS / MRI
  - bowel preparation?! In high risk cases such in severe endometriosis involving the colon and recto-vaginal space and patients with history of previous GIT operation
  - Nasogastric tube / mask ventilation (avoid stomach distention)
  - Vaginal packing / uterine manipulator
  - To opt for the lateral dissection
  - Attention to the electrical current used
Urinary Tract Complications

- ureteral injuries
- bladder injuries
- fistulas
- bladder injuries are identified more often (87%) than ureteral injuries

The rate increase with the difficulty of technique
- 0.027%
- 1.6% major laparoscopic procedures
- 3% hysterectomies
Ureteric lesions: sites

Ureter is vulnerable
- at the fossa ovarica
- at the Uterine artery
- at the uterosacral/cardinal lig
- at the Infundibulo-pelvic lig

- Bishoff JT et al. 1999
High Risk Conditions

• pelvic endometriosis (65% of ureteric injuries)
• large uterus during hysterectomy
• Oophorectomy for a large ovarian/paraovarian cysts, residual or ovarian remnant syndrome
• cervical or intra-broad ligament myomas
• pelvic adhesions: due to previous pelvic inflammatory disease or surgeries
• congenital anomalies: pelvic kidney, ureteral duplication
• 50-75% of ureteral lesions occur during surgery of benign lesions, described as easy surgeries by the surgeon.
Atraumatic dissection: some rules

- no brutal manipulation
- do not pull and do not push the ureter
- do not grasp the ureter with your forceps
- use atraumatic forceps
- control of forces: ergonomics

If $A=B$ precision & force
If $A>B$ too much force
If $B>A$ no precision
Prevention

- Ureter must be localized in all moments during the laparoscopy
- by identification under the peritoneum
- by dissection
- by pre-operative catherization (stenting), IVP, cystoscopy
- Ureteral catheter: systematic placement was abandoned because it does not prevent all lesions and has its own morbidity
- at the end of the surgery see ureter peristalsis and absence of dilatation
Postoperative Ureteric injury Symptoms

- Clinical abdominal pain side (flank) pain
- Distended abdomen
- Ileus
- Fever
- IV Ureterogram (IVP)
- Retrograde Ureterogram
Bladder trauma

• 1 to 2.3% in the advanced laparoscopy
• mechanical or electro-thermal trauma

Prevention

• Bladder catheterisation
• Secondary trocars under vision
• Blunt dissection better than electrosurgery
Mechanical trauma to Bladder occurs

• During
  – Adhesiolysis
  – Resection of endometriosis implants

• The history of previous laparotomy increase the risk:
  – Myomectomy
  – Cesarian section
Diagnosis after Bladder injury

- Pneumo sac – swollen bladder – entrapped CO2
- Hematuria
- Presence of urine in the abdominal pelvic cavity
- Post-operative Anuria
Hemorrhage Complications

- at the level of the wall
- major vascular injuries
- secondary hemorrhages
Vascular injuries

- Hypogastic vessels
- External Iliac
- Vena Cava
- Aorta
- Femoral aa/vv

Usually happens during the installation phase and of course any injury may happen during surgery.
Bleeding complications of the Abdominal wall can be avoided

• Prevention
  – inspection
  – anatomical landmarks
  – trans illumination
  – to avoid oblique entry ways

• Treatment
  – direct coagulation
  – transparietal suture (straight needle) and Bourdonnet
  – Folley’s catheter
  – Minilap.
Intra-operative vascular injuries

The vessels more likely to be injured are:

- Internal iliac artery
- Medial rectal artery
Intra-operative vascular injuries: intra-operative management

• In case any vessel is injured, it is of vast importance to control the bleeding as quickly as possible:
  • A laparoscopic grasper can occlude the bleeding vessel
  • Pressure should be applied if visualization is obscured
  • In case of a large vein injury grasping may result in its further laceration
• 11-25% of deaths in case of major vessel injury
  Nordestgaard 1995 / Chapron 1997
Treatment of Vascular injuries

- Depends
  - on the size
  - on the vessel type

- What to do?
  - Decision to stop the bleeding or sticking to the success of events
    - avoid to contaminate the optic
    - Suction of the pneumoperitoneum
    - Intestine returns in the pelvis
Treatment of Vascular injuries

• To stop the bleeding with any instrument
• To identify the surrounding vulnerable organs
• To identify the type of the vessel
• To close the vessels
  – Bipolar coagulation
  – Clips
  – Suture
  – Laparotomy....
Treatment of Vascular injuries

- Bipolar
  - Effective at the veins and the arteries
  - Until 7 to 8 mm

- however it is unacceptable in case of too voluminous vessels and for essential vessels

- clips are effective on the big veins
- endo-loop is effective on extensive arterial bleeding
- if it’s necessary suture
Secondary haemorrhage

- role of the positive pressure of pneumoperitoneum
- check final haemostasis under low pressure
Late Complications

• Hernia
  – the risk depends on the trocar’s diameter
    • 0.2% for 10 mm
    • 3% for 12 mm
  – umbilical ++

• Trocar metastasis
  • Endometriosis
  • Cancer metastasis

• Prevention
  – Trocar insertion ++++
Conclusion

• The risk of complications depends not only on the surgeon’s experience but dramatically on the surgeon’s knowledge.

• This emphasizes the need of
  – teaching the anatomy
  – teaching the suturing techniques
  – teaching the principles of energies
This presentation has been prepared by the European Academy of Gynaecological Surgery

- Vasilios Tanos
- Natasha Waters
- Filipa Osorio
- Brice Rodriguez
- Rudi Campo
- Arnaud Wattiez