Introduction

- Laparoscopic surgery started in the mid 1950s.

- In recent years, advanced laparoscopic surgery has targeted older and sicker patients.

- New technique of laparoscopic surgery challenges for anesthesiologists where an appraisal of potential problems.
Advantages vs Disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>- Reduction postoperative pain</td>
<td>- Compromise the CVS and RS functions</td>
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<td>- Cosmetic results</td>
<td>- Pneumoperitoneum</td>
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<td>- Quicker return to normal activities</td>
<td>- Effect of patient positioning</td>
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<td>- Less intraoperative bleeding</td>
<td>- Effect of carbon dioxide insufflation</td>
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<td>- Reduced metabolic derangement</td>
<td>- Learning curve of Teams</td>
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<td>- Better postoperative respiratory function</td>
<td>- Prolong operation time in non-experienced hand</td>
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<td>- Less postoperative wound infection</td>
<td>- Technical problems and high cost-value of equipment</td>
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Topic

- The choice of insufflated gas
- Pathophysiological changes during Laparoscopy
- Anesthetic management and techniques
The ideal insufflated gas

- Minimal peritoneal absorption
- Minimal physiologic effects
- Rapid excretion
- Inability of support combustion
- Minimal effect from intravascular embolization
- High blood solubility

Choice of insufflated gas (1)

- **Air** and **Oxygen** cannot be used for insufflation during laparoscopic surgery because the support combustion whenever bipolar diathermy or laser are used.

- **Nitrogen** can result in more serious cardiovascular sequelae whenever an intravascular gas embolization.

- **Helium** : cost effectiveness in laparoscopy have been raised.
Choice of insufflated gas(2)

- **Argon** may have unwanted hemodynamic effect especially hepatic blood flow.

- **Carbon dioxide**: nearly the ideal insufflating gas and maintains its role as the primary insufflation of Laparoscopy. Residual gas is more rapidly clear but can causes of hypercarbia and intravascular embolization.

- **The gasless laparoscopic technique**: alternative way to avoid the effect of creation of the pneumoperitoneum.

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**Gasless laparoscopic surgery**

Contraindications for laparoscopy

- No absolute contraindication
- Precaution in patients:
  - Poor cardiovascular reserve
  - Hyperreactive airway disease or COPD
  - Poor renal function or ESRD
  - High intraabdominal pressure or symptom of abdominal compartment syndrome
  - High ICP

Pathophysiological changes during laparoscopy

- Effect of carbon dioxide absorption
- Creation of pneumoperitoneum
  - Cardiovascular effects
  - Respiratory effects
  - Neurological effects
- Patient positioning
  - Cardiovascular changes and patient positioning
  - Respiratory changes and patient positioning
Effect of carbon dioxide absorption

- Carbon dioxide diffuses to the body during extraperitoneal more than intraperitoneal insufflation.
- Extraperitoneal insufflation leads high PaCO$_2$.
- Intraperitoneally, carbon dioxide increase intraabdominal pressure above the venous vessel pressure, which prevent carbon dioxide resorption.
- Hypercapnia leads to increase minute ventilation as much as 60 % and activated in sympathetic nervous system,
- Sympathetic simulation leading to increase in blood pressure, heart rate and myocardial contractility.

Creation of pneumoperitoneum

- Cardiovascular effect ;
  - Alteration in blood pressure
  - Cardiac arrhythmias
- Respiratory effect ;
  - Reduction in lung volumes
  - Increase peak airway pressure
  - Decrease in pulmonary compliance secondary to increase intraabdominal pressure
- Neurological effect ;
  - Increase ICP
  - Decrease in cerebral perfusion pressure
Factors effected CVS changes

- Creation of pneumoperitoneum on IAP attained
- Volume of carbon dioxide
- Patient’s intravascular volume
- Ventilatory technique
- Patient positioning
- Surgical condition
- Anesthetic agent used

Critical determinant of cardiovascular function during laparoscopy are IAP and patient position

Clinical algorithm on pneumoperitoneum for laparoscopic surgery.

1. Pre-op
   - Patient is scheduled for laparoscopic surgery
   - Define patient for co-morbid.
   - Administer adequate preoperative volume loading (A)

2. Pre-surgical intervention
   - Is patient comorbid?
     - No
       - Start monitoring ETCO2 after insufflation (A)
     - Yes
       - Start invasive monitoring (A)
       - Insert urine catheter (B)
       - Consider pharmacologic intervention (e.g., Betablocker, nitroglycerine) (A)
       - Consider gasless laparoscopy (B)

3. Surgical intervention
   - Estimated duration of surgery > 2hr
     - No
       - Use intermittent pneumatic compression (C)
     - Yes
       - Use external heating device
Surgical intervention

Establish pneumoperitoneum either by closed or open access technique (A)

Apply lowest possible pressure level (A)

Use small instruments, if suitable (A)

Perform surgery

After end of operation, remove residual gas (B)

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**Secrets of safe Laparoscopic surgery**

J. minimal access surgical 2010

- All the cardiopulmonary compromised patients should be accessed preoperative evaluation by a physicians or cardiologist. They are not absolute contraindication.
- Informed consent for associated complications
- Lower pressure of pneumoperitoneum (12-15 mmHg)
- Using Helium or nitrogen for creation pneumoperitoneum in cardiopulmonary compromised patients.
- Minimize the operation time by taking the help of experienced person.
- Measuring of ETCO2 and pulse oximetry. In patient with cardiopulmonary compromised may be used invasive monitoring to observe ABGs.
- Extra-long troca need in obese patients and precaution to prevent DVT.
Patient positioning (1)

- Cardiovascular changes
  - The head-up position reduces venous return and cardiac output, with decrease in mean arterial pressure. This effect of position may be mistaken with side effect of anesthetic drugs.
  - The head-down position increase venous return and normalize blood pressure.
  - In serious-ill patients, Transesophageal echocardiography may be used to evaluation in cardiac function.

Patient positioning (2)

- Respiratory changes
  - Blood gas changes and respiratory mechanics are affected by;
    - Duration of pneumoperitoneum
    - Patient position
  - The deterioration in respiratory function is reduced when the patient is in the reverse Trendelenburg position and worse when the patient is in the Trendelenburg.
Anesthetic technique

- General anesthesia;
  - “GA with ET tube and controlled ventilation is the safer technique”
- Regional anesthesia.
  - Neuraxial blocks
  - Peripheral nerve blocks
- Local anesthesia infiltration

Patient monitoring

- Anesthetic technique and proper monitoring to detect and reduced complications of laparoscopic surgery.
- Routinely, standard monitoring is suitable for laparoscopy (NIBP, EKG, SpO2, EtCO2, nerve stimulator and temperature)
- For hemodynamically unstable patients with compromised cardiovascular function, use invasive monitoring for continuous and blood gas sampling.
Recovery after laparoscopy

- During early postoperative period, respiratory rate and EtCO2 of patient breathing spontaneously are higher after laparoscopy compared with conventional surgery.
- The cause of increase in ventilatory impaired:
  - Carbon dioxide load can lead to hypercarbia
  - Residual anesthetic drugs
  - Diaphragmatic dysfunction
- Patient with cardiac disease are more prone to hemodynamic changes and instability after surgery.

Incidence of postoperative period

- After 24 hour laparoscopy (telephone follow-up):
  - 50% of incisional pain
  - 36% of drowsiness
  - 24% of dizziness
- Incidence after 7 days laparoscopy:
  - 71% abdominal pain
  - 45% shoulder pain
  - 3% nausea
  - Only 8% of patients have preferred overnight stay.
Postoperative pain.

- Local anesthesia
- Opioid
- NSAIDs
- Multimodal analgesia techniques
  - Anticholinergic drugs
  - Tramadol
  - Acetaminophen
  - Alpha-2 agonist; Dexmedetomidine

Postoperative nausea and vomiting (PONV)

- Anesthetic techniques
  - TIVA vs. Volatile anesthesia
  - The concomitant of NSAIDs and opioid
  - Spontaneous recovery without reverse by neostigmine
- Antiemetic medications
  - Ondansetron (5-HT3 receptor) is effective than older antiemtics.
  - Ondansetron given at the end of surgery result in significant greater antiemetic effect.
  - Dexamethasone reduced PONV in first 24 hours and reduced the requirement for rescue antiemetics with no adverse events in single dose of steroid.
Complications of Laparoscopy

1. Inadvertent extraperitoneal insufflation
2. Pneumothorax
3. Pneumomediastinum and pneumoperitonium
4. Vascular injury
5. Gastrointestinal injury
6. Urinary tract injury

Summary

- Laparoscopy is most commonly performed with the patient under general anesthesia.
- In pelvic laparoscopy can used regional anesthesia involving peripheral and neuraxial blocks and local infiltrations.
- Peripheral nerve blocks and local infiltrations are useful adjuncts to general anesthesia and facilitate postoperative analgesia.
- Other techniques such as spinal and epidural anesthesia and combination of two techniques are suitable as a sole anesthetic technique for pelvic laparoscopy.
Thank you