An Introduction to Minimally Invasive Surgery I
Laparoscopy - Introduction and basic principles

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History of Minimally Invasive Surgery

Human Medicine:

- 1924 - Heinz Kalk - Germany
  - The first to use laparoscopy for liver biopsies

- 1987 - Philippe Mouret - France
  - First videolaparoscopic cholecystectomy

Veterinary Medicine:

- 1985 - Wildt DE et al.
  - First report of laparoscopic sterilization in dogs and cats

- 2000 onwards - increasing literature
Progress of MIS

+ MIS in veterinary medicine has lagged greatly behind human field

+ In the last ten years general increase in interest has occurred

+ Driven by:

- Increased availability of equipment and training

- Increased awareness of owners of MIS procedures
Current use of MIS in veterinary medicine in the USA

+ Almost all vet schools and many specialty clinics equipped with MIS equipment

+ Increase in uptake of MIS in general practice is occurring:

- Many attendants at MIS continuing education meetings are general practitioners

- The more likely general practitioners are to perform MIS the more likely they are to refer cases that are complex for MIS
Advantages

- Less post-operative pain
- Faster return to function
- Smaller incisions are more cosmetic
- Less morbidity (??)
- Faster (??)

Disadvantages

- Expense of the equipment
- Experience necessary
- Surgical team required
- Need for conversion?
- Not all procedures can be performed via laparoscopy/thoracoscopy
Equipment

- Medical grade monitor
- Camera
- Xenon light source
- Insufflator
- Data recording device
Telescopes

- **Viewing angles** - 0°, 30°
- **Diameter of scope**
  - 1.9mm, 2.4mm, 2.7mm, 3mm, 5mm, 10mm
- **Sheath or no sheath**
TROCARS FOR LAPAROSCOPY

+ **Disposable**
  - Light weight
  - More versatile
  - Expense
  - Prevention of tissue trauma

+ **Non-disposable**
  - Cheaper
  - Heavy
  - Reducer caps required
  - Trocars become blunt
Instrumentation

- Hook scissors
- Right-angle grasping forceps
- Kelley grasping forceps
- Cup biopsy forceps
- Punch biopsy forceps
- Knot pusher
- 10mm Babcock forceps
- 5mm Babcock forceps
- Metzenbaum scissors
- Blunt probe
Miscellaneous Equipment

Specimen Retrieval Bags

Suction/Irrigation

EndoGIA stapling device
Hemostasis - Options

+ Extracorporeal suture
+ Intracorporeal suture
+ Laparoscopic clip applier
+ Monopolar and bipolar electrocautery
+ Vessel-sealing technology
  - Ligasure (Covidien Inc.)
  - Harmonic Scalpel (Ethicon Endosurgery)
Hemostasis - Extracorporeal Ligatures

- Multiple types of slipknots
- Tied externally
- Fed through a trocar with knot pusher
- Modified Roeder
- 4S modified Roeder is most secure (four wraps and a square knot)

Extra-corporeal suture placement – modified Roeder knot
Laparoscopic clip applier

Microline Pentax M/L-10 autoclabale multifire Clip applier
Monopolar and bipolar cautery

- Both are possible to use
- However monopolar use is more hazardous as injuries to tissues not in field of view can be damaged by insulation failure

Monopolar

Bipolar

Hotblade™ (Patton Surgical Inc.)
Hemostasis - Vessel-sealing devices

+ **Ligasure© & Enseal©**
  - bipolar electrocautery
  - 150-400°F created
  - melts elastin and collagen
  - licensed to 7mm a&v

+ **Harmonic Scalpel**
  - ultrasonic energy
  - 50-100°
  - licensed to 5mm a&v
Bipolar vessel-sealing device
LAPAROSCOPY - ABDOMINAL ACCESS

+ Hasson technique

- Incision made in peritoneum just below umbilicus
- Keep incision very small
- Can place sutures around trocar
- Use blunt cannula
HASSON TECHNIQUE
Telling whether you’re in? use the insufflator

- Most reliable way to tell is to see falciform fat
- Insert trocar and then start to insufflate
- Watch insufflator
- Should start to see abdominal tympany fast
Laparoscopy - Abdominal Access

Option 2: Veress needle

- Sharp-tipped needle with spring-loaded blunt stylet to prevent organ penetration

- Once placed insufflate with gas and then place first cannula
Veress needle: Midline insertion
3rd option: optical entry

- Laparoscope is placed into trocar as its inserted and layers of the body wall directly visualized
- Rarely used in vet medicine
- Used with increasing frequency in human medicine

Fios first entry™, Applied medical Inc.
Morbidity associated with access

+ **50% of all lap injuries in people are during access**

+ **Most common lap access problems in veterinary medicine**

  - Inability to enter peritoneal cavity or inability to tell when cavity is entered/create pneumoperitoneum

  - Gas insufflation into SQ space

  - Splenic laceration

  - Gastrointestinal penetration
Pneumoperitoneum

- Usually created with CO2
- Can use N2O but NOT with electrocautery
  - Supports Combustion
- Do not exceed 15mmHg otherwise
  - Respiratory and cardiac depression
  - Decreased perfusion to internal organs
- Tilting head up/down compromises ventilation
Pneumoperitoneum - anesthetic considerations

+ **Must ventilate for patient**

+ **Pressure on diaphragm limits TV**

+ **CO2 is absorbed rapidly and can lead to hypercarbia in animals that are not adequately ventilated**

+ **Advise use of capnography/blood gas**
Instrument port placement

+ Insert camera into camera port
+ Make small skin incision where port to be placed
+ Observe with camera entrance of trocar
+ Use SHARP cannula or threaded trocar
+ Point away from delicate organs
Instrument port placement
Tips for MIS - Operating room positioning

+ Always make a straight line from the camera operator to the lesion to the monitor
Tips for MIS -
Use gravity to aid in retraction of organs

- Lateral tilting, Trendelenburg, Reverse Trendelenburg
Tips for MIS -
Miscellaneous

+ Empty bladder
+ One surgeon operates camera and one instrumentation
+ Minimize camera motion – observe lesion
+ Develop spatial awareness
Complications

- **Hemorrhage** - most commonly splenic laceration
- **Iatrogenic damage to organs**
  - Great magnification but decreased perspective
- **Seroma formation at port site**
- **Herniation at port site**

- Close all port incisions $\geq 5\text{mm in size}$
**Splenic laceration**

- Not usually hemodynamically significant but impairs visualization

- To avoid splenic trauma

  - Always use blunt trocars pointed away from spleen
  
  - Maintain good pneumoperitoneum
  
  - Manipulate spleen with body of instruments
  
  - Careful manipulating animals with trocars in deep positions
Laparoscopic Ovariohysterectomy or Ovariectomy

- Empty bladder
- Place endoscopy tower at foot of patient
- Clip widely
- Can use 1, 2 or 3-port technique
- For all techniques use a routine subumbilical camera portal
- If using one-port technique need to use operating laparoscope
Three port technique

- Subumbilical camera portal + two instrument cannulae (3-5 cm cranial to umbilicus and 3-5 cm cranial to the pubis on midline)

- Tilt table 15-30 degrees

- The blunt probe is placed in the caudal portal to manipulate organs away from ovaries
TWOPORT APPROACH

- Uses the transabdominal suspension suture or Karl Storz suspension device
- Only caudal most instrument port is inserted: midway between pubic brim and camera portal
Single port approach

* Single port laparoscopic ovariectomy/ovariohysterectomy has been described

* Operating laparoscope has a working channel for an instrument

* Single incision multiport devices are now also available
**Pyometra resection**

Case selection is important:
- \( \leq 5-6\text{cm} \) diameter of uterine horns
- Dogs \( \geq 10\text{kg} \) ideal
- No evidence of rupture with septic peritonitis

Similar technique is used as for routine OVH

Use a wound retraction device to exteriorize the uterus from the peritoneal cavity
Laparoscopic liver biopsy

- **Simplest technique:** 5mm cup biopsy forceps
- **Take several bites from several different liver lobes**
- **Can use Gelfoam to plug biopsy tract if hemorrhage significant**
Kidney Biopsy

Use 14G spring-fired trucut biopsy needle
Smaller dogs and cats can use 16-18G

Laparoscopic Pancreatic Biopsy

- For diagnosis of diffuse pancreatic disease
- Avoid body of pancreas
- Avoid pancreatic blood supply:
  - Right lobe: caudal pancreaticoduodenal A&V
  - Left lobe: branches from splenic A&V
- Pancreatic biopsy shown to be safe in healthy dogs (Harmoinen et al. Vet Therap 2002)
- Can use a laparoscopic or lap-assisted technique
Laparoscopic pancreatic biopsy

- 2 instrument port technique
- Use 5mm cup biopsy forceps or endoloop
- Can use harmonic scalpel or clips also. **Harmonic reduces hemorrhage but increases inflammation** (Barnes et al. Vet Surg 2006)
Laparoscopic-assisted Gastrointestinal biopsy

+ **2 instrument ports usually placed**
+ **10mm Babcock forceps used to grasp small intestine**
+ **Stay sutures placed and biopsy taken**

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Rawlings et al. Laparoscopic-assisted enterostomy tube placement and full-thickness biopsy of the jejunum with serosal patching in dogs, AJVR 63, 1313-1316 2002
LAP-ASSISTED GI BIOPSIES

Use of wound retraction device is a variation of previous technique

Alexis™ (Applied Medical Inc.) retractor can be used for GI biopsy as well as other organs

Forms 360° wound protection

Radial force produced dilates wound incision
Placement of Alexis wound retractor
Lap-assisted intestinal resection and anastomosis
Laparoscopic cryptorchidectomy

• Can be performed laparoscopically-assisted (1 instrument portal) or totally laparoscopically (2 instrument portals)

• Great for diagnosis of cryptorchidism
Laparoscopic examination of caudal abdomen

Normal descended testicle

Cryptorchid testicle
Laparoscopic Cryptorchidism
Testicle removal
Laparoscopic and Laparoscopic-assisted Gastropexy

- Mortality as high as 15-24% (Brockman et al. 1995, Beck et al. 2006)
- Lifetime risk in Great Danes: 42% (Glickman et al. 2000)
- Other risk factors: High thoracic depth to width ratio, one meal per day, previous splenectomy
- Prophylactic gastropexy
  - 29.6X decreased mortality (Ward MP et al. 2003)
  - At 1 yr post-op 100% intact (Rawlings et al. 2002)
Laparoscopic-assisted gastropexy

To reduce risk for gastric-dilation volvulus (GDV) syndrome

Camera portal in subumbilical location

Instrumental portal (10mm)

-Just lateral to the right margin of the rectus abdominus and 3-5cm caudal to the last rib

Rawlings CA et al. A rapid and strong laparoscopic-assisted gastropexy in dogs. AJVR 2001
Lap-assisted gastropexy

Procedure

+ **Remove all omentum covering antrum of stomach**

+ **With 10mm Babcock forceps grasp a firm hold of the gastric antrum**

+ **Purge pneumoperitoneum**

+ **Enlarge the port incision to approximately 4cm**

+ **Exteriorize antrum and place stay sutures**
Suturing the gastropexy

- Elevate stomach with stay sutures
- An incision is made in the seromuscular layer of the stomach
- Simple continuous suture placed from seromuscular layer of stomach to transversus abdominis
Laparoscopic-assisted gastropexy technique
Any Questions?

Yellowstone National Park