

Minimally Invasive Surgery

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November 4, 2012



TYPES OF SURGERY

- Thoracic
- Abdominal
- Gastrointestinal
- Urogenital
- Neurologic
- Orthopedic
- Skin and Reconstructive
- Surgical Oncology
- Ophthalmic
- Minimally Invasive



Minimally invasive surgery

- History of Endoscopy
- Role in Veterinary Medicine
- Advantages/Disadvantages
- Equipment
- Laparoscopy
- Thoracoscopy
- Arthroscopy
- Future Directions

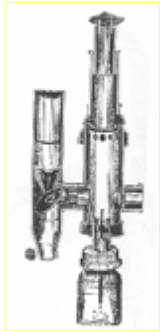


History of endoscopy

- 1806 - **Philip Bozzini** built an instrument that could be introduced into the human body to visualize internal organs.
- He termed this instrument the **LICHTLEITER**
- At that time people did not understand this procedure.
- He was reviewed by the Vienna medical faculty and punished for his curiosity



History of endoscopy



- 1853 - **Antoine Jean Desormeaux** - first introduced Bozzini's Lichtleiter into a patient.
 - He is considered by many to be the “Father of Endoscopy”



History of endoscopy

- 1879 - **Maximilian Carl-Friedrich Nitze** - used a heated wire with cooling system and created the first optical endoscope with built-in source of illumination.
- 1887 - **Nitze** - Constructed a source of illumination that did not require cooling



History of endoscopy



- 1881 - **Josef Leiter** succeeded in constructing the first useful clinical gastroscope in Billroth's clinic in Vienna



History of endoscopy

- 1901 - **Georg Kelling**, a German physician from Dresden, performed the first laparoscopy of a dog's abdomen.
- He coined the term 'coelioskope' to describe the technique that used a cystoscope to explore the abdominal cavity of dogs.
- He also used filtered air to create a pneumoperitoneum with the goal of stopping intra-abdominal bleeding. He referred to this technique as 'air-tamponade'.



History of endoscopy

- 1910 - **Hans Christian Jacobaeus**, a Swedish physician, performed the first laparoscopy and thoracoscopy in a human.
- 1911 - **Bertram Moses Bernheim**, from Johns Hopkins Hospital, introduced laparoscopic surgery to the United States. He named the procedure "organoscopy".



Bernheim



History of endoscopy



- 1929 - **Heinz Kalk**, a German gastroenterologist, is considered the founder of the German School of Laparoscopy. He used laparoscopy as a diagnostic method for liver and gallbladder disease.
- In 1939 he published his experience of 2000 liver biopsies performed using local anesthesia without mortality.



History of endoscopy

- 1938 - **Janos Veress**, of Hungary, developed the spring-loaded needle. Its main purpose was to perform therapeutic pneumothorax to treat patients suffering from tuberculosis.
- Today, it is mainly used to create a pneumoperitoneum to aid in laparoscopy.



History of endoscopy

- 1980 - Patrick Steptoe, from England started to perform laparoscopic procedures in the operating room under sterile conditions.
- 1981 - The American Board of Obstetrics and Gynecology made laparoscopy training a required component of residency training.
- 1982 - First solid state camera was introduced. This is the start of "video-laparoscopy".
- 1987 - Phillipe Mouret, performed the first video-laparoscopic cholecystectomy in Lyon, France.
- 1994 - A robotic arm was designed to hold the laparoscope camera and instruments with the goal of improving safety, reducing resource utilization and improving efficiency and versatility for the surgeon.
- 1996 - First live broadcast of laparoscopic surgery via the Internet.



History of veterinary endoscopy

- 1977-GF Johnson described the use of laparoscopy in dogs for the diagnosis of neoplasia. *Vet Clinics*.
- 1977-DC Twedt described the use of laparoscopy in the evaluation of dogs with liver disease. *Am J Dig Dis*.
- 1983-GF Grauer described using laparoscopy for renal biopsy in dogs and cats. *JAVMA*.
- 1993-LD Silva described a laparoscopic technique for vasectomy in male dogs. *J Reprod Fertil Suppl*.
- 1999-DC Twedt described the use of laparoscopy in the diagnosis of pancreatic disease in dogs. *Small Animal Endoscopy*.
- 2002-CA Rawlings described laparoscopic gastropexy technique. *JAAHA*.
- 2002-CA Rawlings described the use of laparoscopy for small intestinal biopsy and feeding tube placement. *AJVR*.
- 2008 - American College of Veterinary Surgeons made minimally invasive surgery training a required component of residency training for residency class of 2011.



Endoscopy: advantages

- Less post-operative pain
- Faster return to function
- Smaller incisions are more cosmetic
- Potentially faster
- Excellent magnification and image capture
- Better documentation of lesions



Endoscopy: disadvantages

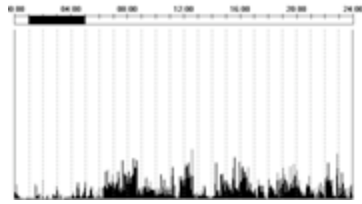


- Expense of the equipment
- Setup time of equipment
- Techniques can be very difficult
- Long learning curve
- Surgical team required
 - Usually require a camera operator
- Not all procedures can be performed via laparoscopy/thoracoscopy
- Potential need to convert to open procedure



Pain measurement

- Subjective pain scoring systems
- Activity monitoring
 - Indirect measure of discomfort?, pain?
 - Validated for use in dogs (Hansen et al. 2007)
 - Multiple studies have proven decreased activity postoperatively with open procedures relative to laparoscopic procedures
 - Laparoscopic ovariectomy (LOV) (Culp, et.al, 2008)
 - Significantly lower activity levels in small dogs (<6 kg) with open procedure versus LOV
 - Highlights that laparoscopic procedures are useful even in our small patients
 - Laparoscopic gastropexy (Mayhew & Brown, 2008)
 - Totally Laparoscopic Gastropexy (TLG) resulted in 25-33% greater activity compared to Laparoscopic-Assisted Gastropexy (LAG) in 7d post-op
 - Effect lasted for ~5 days post-op

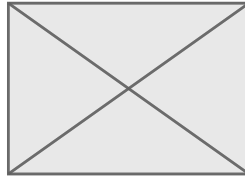


Activity monitor counts



Equipment

- Rigid Laparoscope/Arthrocope
 - 3mm, 5mm, or 10mm
 - 0 degree or 30 degree
- Camera - 1 chip or 3 chip, HD
- Light source - halogen or xenon
- Monitor - flat screen or crt
- Video or digital image recording
- Insufflator and CO₂ (Laparoscopy)
- Electrosurgical unit
- Selection of trocars and instruments



Equipment

- Instruments:
 - Selection of trocars
 - Sharp trocars
 - Hasson trocar
 - Veress needle
 - Obturators



Equipment



- Instruments:
 - Scissors
 - Dissecting forceps
 - Grasping forceps
 - Biopsy instruments
 - Blunt Probe
 - Suturing instruments
 - Stapling equipment
 - Suction / Irrigation
 - Electrocautery



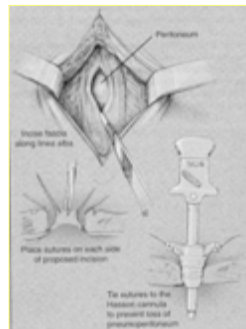
Laparoscopy

- Procedure:
 - Establishment of pneumoperitoneum
 - Open vs. closed techniques
 - Placement of trocars for laparoscope and instruments, location and number depends on procedure
 - Air tight seal needed



Establishment of pneumoperitoneum

- Open technique:
 - Small incision made into peritoneal cavity
 - Hasson trocar is placed
 - Gas introduced through trocar (fast)
 - Slower due to incision
 - Less risk of damaging organs



Hasson Technique



Establishment of pneumoperitoneum



Veress Needle

- Closed technique:
 - Use Veress needle to place gas in abdomen
 - Faster than open technique
 - More risk of iatrogenic damage to internal organs



Effects of laparoscopy

- Effects of abdominal insufflation:
 - Usually use CO₂ but N₂O may be used
 - Keep intra-abdominal pressure < 15mmHg
- Detrimental effects of increased IAP:
 - Respiratory depression
 - Cardiovascular depression
 - Decreased perfusion of internal organs



Laparoscopy

- Helpful hints:
 - Use positioning to your advantage
 - Empty bladder prior to procedure
 - Position trocar slightly off midline to avoid falciform fat



Laparoscopic cryptorchidectomy

- Laparoscopic-assisted
 - Two port technique
- Laparoscopic
 - Three port technique



Laparoscopic-assisted cryptorchidectomy



Laparoscopic gastropexy

- **Totally laparoscopic stapled gastropexy** (Hardie RJ et al. 1996)
 - Adv: Totally laparoscopic
 - Disadv: extended surgical time, 14% gastric perforation, expensive
- **Laparoscopic-assisted gastropexy** (Wilson ER et al. 1996; Rawlings CA 2001&2002)
 - Adv: User-friendly, rapid, cheap
 - Disadv: full thickness body wall incision, infection
- **Laparoscopic intracorporeally sutured gastropexy** (Mayhew & Brown, 2008)
 - Adv: Totally laparoscopic, decreased pain relative to open or LAG
 - Disadv: extended surgical time, long learning curve



Laparoscopic-assisted gastropexy



Laparoscopic-assisted



Alexis Wound Retractor (2-4cm)

- Initial laparoscopic exploratory
- Alexis wound retractor
 - Intestinal resection and anastomosis
 - Gastrointestinal biopsies
 - Foreign bodies



Veterinary thoracoscopy

- 1995-AM Remedios described laparoscopic and thoracoscopic fenestration of the intervertebral disk in dogs. *Vet Surg.*
- 1998-KK Faunt described using thoracoscopy for lung lobe biopsy. *AJVR.*
- 2000-K Isalov described the use of thoracoscopy to ligate the ligamentum arteriosum in dogs with PRAA. *JAVMA.*
- 2001-MacPhail and Monnet also described thoracoscopic ligation of PRAA in dogs. *JAAHA.*
- 2001-ED Malone described thoracoscopic diaphragmatic hernia repair in a dog. *Vet Surg.*
- 2002-MG Radlinsky described thoracoscopic ligation of the thoracic duct in dogs. *Vet Surg.*
- 2002-J Jackson described thoracoscopic partial pericardectomy in 13 dogs. *JAVMA.*



Thoracoscopy

- Also called Video Assisted Thoracic Surgery (VATS)
- Same instrumentation as laparoscopy
- Can be positioned in lateral or dorsal recumbency
- Airtight seal not necessary



