

# Exploratory Celiotomy, Abdominal Approaches and Closure

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Exploratory celiotomy is a valuable technique for diagnosis and/or therapy of some abdominal disease conditions. The need for exploratory has decreased since the advent of ultrasound. Ultrasound requires appropriate equipment and of course is VERY examiner sensitive. Exploratory remains valuable in specific situations.

To perform a COMPLETE abdominal exploratory an incision is made from the xiphoid to the pubis. In many cases the exploratory incision can BE MODIFIED or shortened depending upon the animals signs and laboratory values. Incisions that are too small are a HUGE source of frustration to the surgeon making visualization, palpation, and performance of specific surgical procedures difficult.

## **Landmarks= Xiphoid-----Umbilicus-----Pubis**

In the male dog, the midline skin incision from the umbilicus caudally starts to curve laterally at the cranial aspect of the prepuce. As the incision curves on the lateral aspect of the prepuce you will encounter branches of the caudal superficial epigastric artery and vein that are isolated and ligated; in smaller dogs cautery is appropriate but ligation is necessary for larger dogs. The subcu tissue is incised and the midline linea alba incision continues with the prepuce reflected to one side. You'll note the linea becomes smaller and narrower as you progress caudally.

### **Cranial 2/3rds incision-Xiphoid to ½ way between umbilicus and pubis will generally allow you to explore and examine**

- Diaphragm
- Hepatobiliary System
- Stomach/Pylorus
- Duodenum,Jejunum, Ileum,transverse colon
- Pancreas
- Spleen (large mass may require bigger incision)
- Kidneys
- Adrenals

You will NOT be able to explore the ureters completely, the descending and pelvic colon, the bladder and urethra or the prostate in the male.

### **Caudal ½ incision Umbilicus to pubis will allow you to examine**

- Colon
- Urinary Bladder
- Prostate
- Mid to caudal ureters

### **\*\*\*Do sponge count before beginning surgery**

## **Approach to the abdomen**

The animal is positioned in dorsal recumbency and positioned so it's absolutely straight on the operating table. The table should be V'd as necessary and/or sand bags used to maintain the animals' position. This will ease your finding the midline considerably.

- Skin incision is made with #10 scalpel blade.
- Continue with scalpel sharply through subcutaneous tissue to the abdominal wall
- Electrocautery for subcutaneous bleeders or clamp and ligate if necessary
- Locate the midline which is marked by the linea alba ("white line")
- Optional-Cut the subcu tissue attachments to the linea, the disadvantage of doing this is creation of dead space. The advantage is you are able to clearly identify the abdominal wall for anatomic and correct closure. You can ablate dead space during closure. Experienced surgeons often do NOT perform this step
- Tent the abdominal wall by picking up the linea with thumb forceps and use the inverted scalpel blade to make a controlled but definitive stab incision into the abdominal cavity. If a large dog and you are too timid you may leave the peritoneum intact. If so, simply tent the peritoneum and incise through it with your blade. The entrance is usually very easy in the cat.
- Extend the abdominal wall incision using scalpel and concurrently protecting abdominal viscera by using the blunt end of the thumb forceps as a guide.
- The falciform ligament which is most prominent between the umbilicus and xiphoid is excised by cutting at its attachments along the abdominal wall edge. Use of cautery if available will decrease hemorrhage from small bleeders supplying the falciform. As the base of the falciform is reached cranially adjacent to the xiphoid a Carmalt or Kelly

clamp is applied to the ligament and a single encircling ligature is placed and tightened. Removing the falciform ligament enhances visualization and facilitates accurate closure of the abdomen. Some surgeons leave the ligament in place and split it digitally to allow visualization of the abdomen, your choice.

- Incision on the ventral aspect of the xiphoid is acceptable, if you incise on the lateral aspect (either side) of the xiphoid you may open the thoracic cavity by creating a defect in the ventral diaphragm.

### **Exposure/visualization of the abdomen**

Balfour retractors are an absolute necessity in my mind; they give you an extra pair of “hands” by exposing the abdomen; if you do have the luxury of an assistant it saves their hands for retracting specific tissues. I place lap pads on the edges of the abdominal wall prior to placing Balfours, other surgeons do not.

Place balfour retractors and begin your exploration.

Adequate lighting is essential. Good surgical lights and/or lighting worn on the surgeon’s head may benefit you enormously.

Exploratory Celiotomy may be done by organ system, quadrants of the abdomen or both. The idea is to accomplish the exploratory exam in a complete and thorough way; the way to accomplish this is to do the same exam/technique each time; this will help in making sure we do not miss abnormalities.

Another point I suggest is to ignore obvious findings initially in favor of a complete exploration before turning attention to obvious lesions. Exceptions to this suggestion are obvious/active hemorrhage, leaking abdominal viscus such as perforated bowel or a large mass that prohibits you from doing a complete exploration such as a large splenic mass.

### **Explore**

- Diaphragm
- Liver Lobes
  - Left lateral & left medial
  - Quadrate
  - Right lateral & Right medial
  - Caudate
- Gall Bladder & Bile duct course through hepatoduodenal ligament
- Gastroesophageal junction
- Stomach/Pylorus
- Duodenum
- Pancreas
  - Right and left lobes
- Duodenocolic ligament
- Ileocecal junction medial to the duodenum and work aboral to oral back to the duodenum
  - Mesenteric lymph nodes at ileocecal junction
- Colon is followed to its entrance into the pelvic cavity; usually palpation is not valuable since fecal material is present within the colon
- Use duodenum and mesoduodenum to pack off viscus to the left side exposing the right kidney and right retroperitoneal space and right ureter
  - Right adrenal gland is partially/mostly covered by the vena cava immediately cranial to the right renal veins’ entrance into the cava
- Use colon and mesocolon to pack off viscus to the right side exposing the left kidney and by moving the spleen the left adrenal gland. The left ureter can be followed caudally
- Both ureters travel caudally and leave the retroperitoneal space and traverser the lateral ligaments of the bladder before tunneling through the bladder wall and emptying onto the ureteral papilla on the dorsolateral aspect of the bladder mucosa
- The urinary bladder is tethered by ventral and lateral peritoneal reflections to the abdominal wall. Those reflections can usually be cut, as there are no vessels within them. Do not cut the lateral ligaments with ureters. Most cystotomies are performed on the ventral aspect after packing off the urinary bladder. An apical stay suture is placed in the apex of the bladder and a stab incision made, the ventral approach allows you to examine the trigonal area if necessary. Closure of the bladder is by appositional (simple continuous) or a single layer inverting pattern using a Cushing pattern. I prefer the Cushing pattern except when the bladder wall is thickened and then I perform appositional closure. Either way, a good principle to follow is to not have suture in contact with the urine. I prefer 3/0 or 4/0 monocril or PDS on a tapered needle. A leak-test is performed by inflating the bladder with saline to check for security of closure. Omentum can be

laid over the bladder if desired but is not necessary routinely. If stones are removed from the urinary bladder I always take a postoperative radiograph to assure all stones have been removed.

- The prostate in an intact dog is quite prominent and biopsy of the prostate is indicated in some instances. The prostate may be located within the pelvic cavity or within the abdominal cavity if larger or a large cyst attached. Passage of a urinary catheter is recommended prior to biopsy so the urethra can be avoided.

### **Biopsy techniques**

The surgeon should anticipate and assume that biopsies will be necessary during exploration. Abdominal viscus that is commonly biopsied in individual cases may include the liver, stomach, small intestine (duodenum, jejunum, ileum), kidney, lymph nodes, spleen, and prostate. A decision to take specific organ biopsies is based on the history, clinical signs, laboratory data, and appearance of tissue at the time of surgery. Due to its contaminated nature, the colon is not routinely biopsied unless a specific lesion is identified or suspected.

Liver is easily biopsied by the “guillotine” method in which a loop of absorbable suture is used to encircle a portion of liver on the periphery of a lobe. The suture is slowly tightened so as to strangulate a portion of tissue and the tissue is excised several millimeters distal to the ligature. Use of a skin biopsy punch is also quick and easy for obtaining hepatic biopsy especially when the lesion is more centrally located rather than the periphery of the liver. The instrument is inserted into the parenchyma to be biopsied and then slowly twisted partial thickness into hepatic tissue. The tips of scissors or a scalpel are used to free the deeper attachments of the tissue within the liver. Placing a small plug of gelatin hemostatic sponge within the biopsy site conveniently provides hemostasis.

Prior to biopsy, the gastrointestinal tract is packed off with moistened laparotomy pads from the remainder of the abdomen. The stomach and/or intestine are biopsied by making a full thickness 3-5 mm elliptical incision into the lumen either transversely or longitudinally with a number 15 or number 11-scalpel blade. The biopsy site is typically closed with interrupted appositional sutures of 3/0 or 4/0 monofilament absorbable suture (polydioxanone or polyglyconate) on a tapered needle. The intestine is “leak tested” by injecting saline into the biopsied segment while the area is occluded digitally or with Doyen forceps.

Lymph nodes may be biopsied by excisional or incisional methods. The mesenteric lymph nodes located at the ileocecal junction are often biopsied by incision since excision may disturb blood supply to the intestine. The spleen may be sampled by splenectomy, partial splenectomy or biopsied in a manner similar to the guillotine method described for liver biopsy.

The kidneys are biopsied with a Tru-cut biopsy needle or by incisional wedge biopsy. There is less hemorrhage with the needle technique but tissue sample size is small. Digital pressure is usually sufficient to stop any renal hemorrhage from needle biopsy. Incisional wedge biopsy of the kidney helps to ensure adequate tissue but there is increased hemorrhage and it is necessary to close the biopsy site with one to two mattress sutures of absorbable suture.

### **Abdominal closure**

Prior to closure the abdomen is lavaged with several liters of warm saline and the lavage completely removed by suction. The abdominal wall is closed with simple continuous or simple interrupted suture of appropriate size. Absorbable suture is typically used however nonabsorbable suture such as nylon is also used successfully. When a continuous pattern is elected, suture one size larger than normal is often selected for abdominal closure. In either closure, the external rectus fascia is engaged and no effort is made to close the peritoneum or the internal rectus sheath. Exposed muscle is not included in the suture when avoidable. Dead space caused by subcutaneous tissue incision is closed and the skin apposed with staples or suture.

All tissue biopsies are submitted in 10% buffered formalin for histologic examination. The morbidity and mortality of exploratory celiotomy is directly related to the patient’s condition preoperatively and the morbidity of any surgical procedure performed.

#### **Exploratory celiotomy mistakes**

- Incision too small
- Failure to do complete exploration
- Failure to take biopsy/cultures
- Failure to place feeding tubes
- Failure in preparation/planning
  - Equipment needed (stapling?)
  - Is blood needed?

Consider lavage and suction of lavage fluid from the abdomen prior to closure. No, we do not add substances to the lavage fluid, we use warm saline.

**\*\*\*Do sponge count now before closure**

**Abdominal closure**

1. Most critical and strength holding layer of the abdomen is closure of the abdominal wall. Specifically, the external rectus fascia is the strength holding layer of the abdominal wall. A minimum of 5 mm bite of rectus fascia should be included in each suture pass through the abdominal wall.
  - a. Continuous suture closure of the abdominal wall is routine in most surgeons hands remembering the following key points:
    - Use one size larger suture than you would with interrupted closure
      - 1-20 pounds= Size 3-0
      - 20-50 pounds= Size 2-0
      - 50-100 pounds= Size 0
      - Consider closing  $\frac{1}{2}$  of the incision and starting new line if larger
    - Place 5-6 throws on suture at each end of the closure
    - Do not handle suture with needle holders
    - Suture bites are about 3-5 mm apart
    - Use PDS, Maxon, or a non-absorbable material such as nylon or polypropylene
  - b. Structures not important and not included in the suture closure include actual rectus muscle and the internal sheath and peritoneum. Including the peritoneum and internal rectus fascia is “Old school” and likely only results in increasing adhesions. It does not increase the strength of the closure.
  - c. You should not see muscle fibers between rectus fascia. FASCIA to FASCIA
2. If subcutaneous tissue is abundant run a simple continuous layer of Monocryl tacking the subcu to the external rectus fascia with a small bite every other pass.
3. Intradermal closure with 3/0 or 4/0 monocryl. Use of PDS in the Intradermal tissue may cause fistulation. PDS is over-kill in this location.
4. Skin closure with non-absorbable suture (nylon for me) and cruciate pattern.