CADAVER LAB
SURGICAL DISSECTOR:
Pelvic Anatomy Primer and Clinical Correlation

Designed for use by Veronica Lerner MD for
NYU obgyn residency Program

This guide correlates with Grant’s Dissector 14th edition

Last updated August 8, 2013
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**PART 1 A: Bony pelvis**

- Identify the following structures on a bony pelvis:
  - **Obturator foramen** (within bone)
    - obturator canal is the tunnel thru which obturator bundle travels, important to know location in relation to TOT trocar placement)
  - **Ischial tuberosity**
  - **Ischial spine**
  - **Sacrotuberous ligament** (from ischial tuberosity to sacrum/coccyx)
  - **Sacrospinous ligament** (from ischial spine to sacrum)
  - **Greater sciatic foramen** (formed by ligaments)
    - Piriformis muscle, pudendal and sciatic nerves travel thru it
  - **Lesser sciatic foramen**
    - Pudendal bundle travels thru it
Part 1 B: Getting into the Abdomen and superficial abdominal anatomy

(Grant’s dissector pages 78-79, 81-83)

- Before you start your dissection, take laparoscopic trocars and place them thru the abdominal wall where you would normally place them during laparoscopy (place palmer’s point, 3 lateral and one umbilical trocars). Attempt to identify your entry points throughout your dissection in order to see their relationship to the nearby anatomic structures.
- For the purpose of exposure for this cadaver lab, we will perform a midline vertical incision from symphysis to xiphoid process
- Follow instructions on p 79-80 and identify following structures (make skin incisions as in figure 4.5 and remove the skin, attempt to identify the following structures):
  - Camper’s fascia
  - Scarpa’s fascia
  - Inguinal ligament
- branches of Iliohypogastric and Ilioinguinal nerves (see clinical correlation in the nerve injury section)
- Look for them superficial to external oblique and in the inter-muscular space between internal and external oblique
- superficial epigastric vessels if they are identifiable
- make a large Pfannenstiel incision on the fascia
- Dissect the fascia from the rectus abdominus superiorly and inferiorly
- Now perform a modified Cherney incision by identifying the two bellies of the rectus muscles. Sharply divide them from their insertion onto the symphysis and reflect the muscles cephalad.
- Identify inferior epigastric vessels
- you can practice ligating them for a true Cherney incision and for a complete Maylard incision
- You have now effectively exposed your Space of Retzius (we will come back to this portion later)
- Dissect out the rectus muscles (p 85-86), identifying
  - Linea alba
  - Arcuate line
  - Superficial epigastric vessels
  - Superior epigastric vessels
  - Pyramidalis muscle
  - Transversalis fascia
- Enter the peritoneum above the bladder and extend for visualization of the abdominal cavity.
  - Reflection of the abdominal wall: P 87-88
  - Identify median umbilical fold, medial umbilical fold, lateral umbilical folds
- Muscles of anterior abdominal wall
  - Rectus
  - External oblique
    - Fibers run caudal/medial
  - Internal oblique
    - Fibers run cephalad/medially
  - Transversus abdominus
    - Fibers run medially
  - Intercostals

A Maylard incision is a muscle-dividing incision, you should find the inferior epigastric vessels at the lateral borders of the rectus sheaths and suture ligate them. Avoid ligating epigastric vessels if LE circulation is suspected to be impaired as it is a collateral source of circulation to LE and can result in ischemia. Practice Maylard incision on your cadavers.

For a true Cherney incision (when rectus muscles are transected at their tendineus attachment at the symphysis pubis commonly used in oncology and for access to the space of Retzius for better exposure), you should find the inferior epigastric vessels at the lateral borders of the rectus sheaths and suture ligate them. To close the incision, ends of the tendons are approximated with interrupted sutures, avoiding periosteum in an effort to decrease the risk of osteomyelitis. Practice Cherney incision on your cadavers making this incision and putting
Laparoscopic entry at Palmer’s point:
- 3cm below left subcostal arch in mid-clavicular line
- Place Veress needle at 90%
- No need to elevate abdominal wall
- Abdominal wall is thin (3-4 cm)
- Place NG tube to deflate stomach
- Make sure no hepatosplenomagaly or prior gastric or splenic surgery
- 3 successful releases, muscle splitting
- Avoid superior epigasricst which are medial
- Place 5 mm trocar with camera (may not need Veress needle)
- Use umbilical entry under direct visualization
- You will need 30 degree scope to work in the pelvis or will need to place umbilical trocar for the 0 degree scope
- May see omental emphysema
- layers: skin, fat, external oblique, internal oblique, transversalis fascia, fat, peritoneum (3 pops)
On your cadavers practice placing trocars through the abdominal wall layers to see how they correlate to internal anatomy

Bladder dome
- Can be distorted by prior surgery, at risk for cystotomy during lsc entry or suprapubic port placement. Can fill bladder retrograde to outline it better with distention; can also so LSC mapping with spinal needle in addition to plan trocar placement

Urachus=median umbilical ligament
Medial umbilical folds=obliterated umbilical artery
- Can be followed into broad ligament
- Turns into superior vesicle artery
- Lateral umbilical fold(epigastric vessels
- Exit external iliac vessels at internal inguinal ring
- Trocars should be placed lateral to that

Falciform ligament attaching to anterior abdominal wall posterior to umbilicus (palmer’s point placement allows you to avoid this area).
Obliterated urachus or median umbilical ligament is a midline structure that extends from the bladder dome toward the umbilicus.
Bilateral medial umbilical folds are obliterated umbilical arteries which can be followed into the broad ligament and turn into superior vesicle arteries.
Medial umbilical ligaments and medial umbilical ligaments fuse together just below the umbilicus.

Location of the bladder dome can be distorted by the prior surgery and located much more cephalad then expected, putting it at risk during suprapubic port placement. Foley catheter placement decompresses the bladder and maximizes visualization of pelvic structures.
One way to better define the most superior bladder edge is to fill the bladder retrograde via Foley catheter, and if need be, to perform laparoscopic mapping with the spinal needle to locate exact spot for the trocar placement.
Figure 5-3. Caudal view of the pelvis and anterior abdominal wall, depicting the relative positions of the lower accessory trocar site in relation to the deep circumflex iliac artery, external iliac artery, and rectus muscle.

Figure 7-10. Deep inferior epigastric vessels run lateral to the umbilical ligaments.
Part 1C: Clinical correlation to the laparoscopic entry into the abdomen
• Left common iliac vein crosses midline 3-6 cm inferior to the umbilicus and could be a potential site of vascular injury during laparoscopic entry. In the figure below, umbilicus is depicted as circle demonstrating its relationship to the vessels below.

• Because of insufflation pressures, left common iliac vein is often flat and difficult to identify during laparoscopy, and its identification is essential during procedures such as presacral neuralexotomy and sacrocolpopexies.

• What vessels are mostly likely to be injured during LSC entry?
• Although the most common injury site reported varies from study to study, common iliac vessels and aorta are commonly sited. Arterial injuries are more common, and most right side appears to dominate. Aorta, right common iliac arteries appear to be more frequent, and left common iliac artery and left or right external or internal iliac arteries follow. Vena cava can also be injured.

• Both aorta and vena cava lie above the level of the umbilicus, so their injury might be a result of inserting instruments at angles greater than 90 degrees to the plane of the spine. The preponderance of right-sided injuries might be due to the tendency of a surgeon to stand on the left side of the patient, using right hand to insert the instruments, deviating to the right of the midline.

• Risk factors for vascular injury during laparoscopy, identified from retrospective reviews, include obesity and injury during entry.

• One should avoid multiple attempts at entry, which are failing, and care should be taken with the use of longer trocars. Use of optical trocars during entry does not eliminate that risk, so same precautions should be used.

Veress needle entry:
• Next, the surgeon needs to consider the angle of the needle during insertion. This will depend on the BMI of the patient.
• In a thin patient with normal BMI, an angle closer to 45 degrees is chosen, allowing the needle to aim toward the pelvis, avoiding major vessels underneath the umbilicus (see figure to the right).
  – Some surgeons advocate 90 degree angle of insertion to advance the needle through the fascia (2-3 cm in normal BMI patient) for those who have adequate training for this technique, after the fascia is engaged, it is aimed at 45 degrees into the pelvis.
• It is also important to point the needle toward the midline, avoiding lateral deviation toward the sidewall, where great vessels are more likely to be injured.
• Umbilicus is normally located anterior to aortic bifurcation, but in obese patient is will be located a few centimeters lower.
• Thin patients, on the other hand, abdominal wall is located closer to the great vessels, so abdominal elevation is very important during entry.
In an obese patient, an angle close to 90 degrees is chosen to avoid tracking of the needle in the subcutaneous fat which increases the distance between the skin and the peritoneal cavity (see figure that follows).

The bifurcation of the aorta is most commonly at L4, beneath the umbilicus. This relationship is especially important to remember in laparoscopy.
Sensory nerves of abd wall:

**Iliohypogastric:** mons, lateral labia, inner thigh (can get trapped in Pfannenstiel inc)

**Ilioinguinal:** groin, symphysis (can get trapped in Pfannenstiel inc)

**Genitofemoral:** upper labia, ant. superior thigh. It runs along ventral surface of the psoas muscle, lateral to external iliacs. Can get injured during debulking or LND.

**Lateral femoral cutaneous:** ant and post lateral thigh.

Neuropathy can occur via direct injury during skin or fascial incision, stretch injury or prolonged compression. Transected nerves can also get trapped in the scar tissue of incisional closure and can form a neuroma, which in some cases needs to be removed surgically. Patients present with parasthesia and pain in the dermatome. Diagnosis can be made via lidocaine injections, which relieve pain.

Ilioinguinal and Iliohypogastric n. injury is rare if incisions are above ASIC. This becomes relevant during lateral trocar placement.

See neuropathy section for complete summary of the nerve injuries that can occur in gyn surgery.
Part 1D: What is parametria?

- **Parametria:**
  - Thickening in endopelvic fascia that attaches cervix and upper vaginal to pelvic side wall
  - **parametria** = cardinal + uterosacral ligaments
  - **parametria** = all tissues that attach to the uterus
  - **Uterosacral ligament** = medial margin of Parametrium and border of post cul-de-sac
  - **Cardinal ligament** = attaches lateral margins of the cervix and vaginal to pelvic side wall
  - Lower edge of the broad ligament

- **What is endopelvic fascia?**
  - Entire pelvis is covered by serosa
  - Exception: ant cervix is covered by the bladder
  - “endopelvic fascia”
    - Tissue that connects the organs to pelvic wall (Te Linde’s 9th ed p 84)
    - Not like “abdominal fascia”
    - 7 potential “spaces”
    - 2 are paired
    - Planes are potential spaces until developed

- How does endopelvic fascia relate to DeLancy’s levels of pelvic support?
  - Level 2 DeLancy support consists of:
    - **Tendineus arch of levator ani muscle (ATLA)**
      - also referred to as ATLA (arcus tendineus levator ani): connective tissue from pubis to ischial spine
      - thickening (condensation) of the parietal fascia of the obturator internus muscle. It provides the site of origin for the
entire ilieococcygeus muscle and the lateral portion of the pubococcygeus muscle.

- **Arcus tendineus fascia pelvis (ATFP):**
  - Insertion site of endopelvic fascia to pelvic sidewall
  - is a thickening (condensation) of the parietal fascia of the obturator internus muscle running from the ischial spine to the pubic ramus.
  - is the lateral attachment site for the pubocervical septum and the proximal rectovaginal septum

- The ATFP and the ATLA are merged at or just above the ischial spine. From this point of origin they diverge with the ATFP running more medial to insert at the superior pubic ramus adjacent to the pubic symphysis. The ATLA runs nearly parallel, but lateral to the ATFP as they course across the obturator internus muscle. It inserts on the superior pubic ramus lateral and slightly posterior to the site of insertion of the ATFP
Fig. 4. Lateral view of the pelvic sidewall and floor. Pelvic organs were transected at the level of the proximal urethra. Note the anterior vaginal wall and its connective tissue connections to the ATPF provide a tissue platform that supports the urethra. The attachments of the anterior vaginal wall to the medial portion of the levator ani muscles at this level account for elevation of the urethra with increases in intra-abdominal pressure.

(Courtesy of Lianne Kruger Sullivan, Dallas, TX; with permission.)
Pelvic Cavity (p 137-145)

- Identify uterus, ovaries, tubes, round ligament, cardinal and uterosacral ligaments, ovarian suspensory ligaments
• **PART 2 Surgical spaces in the pelvis**

**Potential Surgical Spaces in the Pelvis** (8 total 2 are paired)

- **1. Paravesicle (2)**
  - Medial-obliterated umbilical
  - Lat-obturator internus
  - Ant-pubic symphysis
  - Post-cardinal L.
    - Approach: enter under pubic ramus, medial to external iliac vessels and obturator nerve, lateral to sup vesicle art.

- **2. Pararectal (2)**
  - Med-rectum
  - Lat-hypogastric a.
  - Ant-cardinal L.
  - Post-sacrum
    - Approach: enter between ureter and rectum medially and hypogastric artery and pelvic wall laterally, post to uterine art.

-inf for both: levator ani muscles+coccygeous m.  
-cardinal L. separates paravesicle and pararectal spaces

- **3 Prevesicle (retropubic space of retzius)**
  - Ant-pubic symphysis
  - Post-bladder, urethra
    - Enter between dome of the bladder and post surface of pubic symphysis

- **4. Vesicovaginal**
  - Lat-bladder
  - Ant-bladder pillars
  - Post-cervix
    - Enter thru vesicouterine reflexion
    - Superior portion of bladder pillars is vesicouterine ligament; contains ureter on its way from the cardinal ligament to the infero-lateral portion of bladder wall
    - Anterior leaf of vesicouterine ligament is divided during RH to release the ureter

- **5 Rectovaginal**
  - Lat-rectal pillars
  - Ant-vaginal
  - Post-rectum
    - Enter thru peritoneal reflexion in pouch of Douglas
    - Rectal pillars are distal communications of the uterosacral ligaments; contain the hemorrhoidal arteries

- **6. Presacral (retrorectal)**
  - Lat-distal uterosacral
  - Ant-rectum
  - Post-sacrum
    - Enter between post rectal wall and fascial covering of sacrum
Part 2A: Space of Retzius/Retropubic space

1. After you enter the peritoneum above the bladder and extend for visualization of the abdominal cavity, dissect in front of the bladder by bluntly mobilizing bladder and peritoneum from the pubic bone
2. Dissect the peritoneum from the pubic bone and develop the Space of Retzius bluntly
3. Boundaries of the Space of Retzius are the symphysis pubis, the suprapubic ramus, and sidewall of obturator internus muscle
4. Separate the fatty tissue between the bladder and the symphysis
5. Find the ileopectineal line and Cooper’s ligament just beneath the superior margin of the symphysis pubis
6. Inferiorly you can find the urethrovesical junction and the lateral vaginal fornices
7. Use the Foley balloon to guide you toward the UVJ
8. Place one hand in the vagina while it tugs on the Foley
9. Locate the UVJ with both the vaginal hand and the free hand
10. Lateral development extends to the paravesical space and the obturator internus
11. The arcus tendineus fascia pelvis runs from the pubic symphysis to the ischial spine at the posterior margin of the obturator internus
12. Locate the ischial spine
13. Create a paravaginal defect by bluntly dissecting the vesicovaginal connective tissue from the arcus tendineus – running your finger from the inferior pubic ramus to the ischial spine
14. Now that you have this paravaginal space open, find the obturator vessels and nerve as they exit the obturator foramen
15. Indicate where Burch and paravaginal repair sutures would be placed

Clinical correlation: Abdominal Paravaginal Repair

Goal: to re-attach bilaterally the anterior lateral vaginal sulcus with its overlying fascia to the lateral sidewall at the level of the arcus tendineus fasciae pelvis.

- clinical caveat: the pubocervical fascia is attached to the arcus tendineus fascia pelvis, not to the arcus tendineus levator ani

Retropubic space is entered, the bladder and vagina are depressed and retracted medially to allow visualization of the lateral retropubic space and the lateral pelvic sidewall, including the obturator internus muscle and the fossa containing the obturator neurovascular bundle. Blunt dissection is carried out dorsally from that point until the ischial spine is palpated. The arcus tendineus fascia pelvis (white line) is visualized as a white line running from the back of the symphysis pubis to the ischial spine. It is the anatomic separation between the lower edge of the obturator internus muscle and beginning of the iliococcygeal portion of the levator ani muscle. A Paravaginal defect is an avulsion of the vagina off the white line or avulsion of the white line from the obturator internus m.

Clear off the entire lateral pelvic sidewalls; with a vaginal finger, make sure you have located the ischial spines on both sides. Bluntly dissect the bladder medially from the pubocervical fascia, again with vaginal finger guiding the dissection. With a series of interrupted sutures, re-attach the pubocervical fascia to the arcus tendineus
The surgeon’s non-dominant hand is inserted into vagina. While gently retracting bladder medially with the sponge sticks, the surgeon elevates the anterior lateral vaginal sulcus. Starting near the vaginal apex, a suture is placed 1st thru the full thickness of the vagina excluding the epithelium. The needle is then passed into the obturator internus fascia or the white line, 1-2 cm anterior to the ischial spine. After the 1st stitch is tied, an additional four or five sutures are placed in the same way at 1 cm intervals toward the pubic ramus. The distal suture is placed as close as possible to the pubic ramus into the pubourethral ligament. 2-0 or 3-0 non-absorbable sutures ad used.

If have SUI, can do Burch at the same time (Paravaginal plus procedure).
FIGURE 2. Laparoscopic paravaginal repair. In this approach, the tissues to be sutured together are adjacent, whereas the vaginal paravaginal repair requires placement of the vaginal sutures with the tissue everted, and distant from the targeted area of reattachment.
Fig. 12. Retropubic space. (Courtesy of Genevra Garrett, Dallas, TX; with permission.)
The answer is A. The following photograph was obtained during laparoscopic dissection of the retropubic space just before placement of Burch sutures. The following photograph elucidates the anatomy of the retropubic space:

- Cooper’s ligament (aka iliopubic ligament)
- Obturator internus muscle
- Pubic symphysis
- Arcus tendineus fascia pelvis (aka “white line”)
- Bladder
- Vagina
Vaginal paravaginal repair:

Clinical correlation: Abdominal Burch Procedure

Bring double-bite sutures through the pubocervical fascia at the levels of a) the urethra-vesicical junction and b) the mid-urethra on each side. Bring the arms of each suture through Cooper’s ligament on each side. Tie the sutures to provide support, but without over-correction.
**Birch Colposuspension (steps):**
- retropubic space is entered
- sponge sticks mobilize bladder to the opposite side
- non-dominant vaginal hand with index and middle fingers on the side of the proximal urethra
- palpate Foley at the bladder neck
- ant vaginal wall is tiled upward and forward
- O or 1 delayed or non-absorbable (ethibond on SH) sutures are used double bites are placed bilaterally
- place sutures lateral to the bladder neck
- distal suture is placed 2 cm lateral to proximal 1/3 of the urethra
- proximal suture is placed 2 cm lateral to the bladder wall or slightly proximal to the level of the urethrovaginal junction
- take full thickness bites excluding the epithelium
- can use fumble to protect the vaginal hand
- once 2 sutures on each side are placed, they are passed thru the cooper’s (pectineal) ligament so that all 3 sutures exit above the ligament
- if bleeding happens, use pressure, fixation sutures, and clips
- tie distal sutures 1st, then proximal, and elevate vagina with vaginal hand during tying
- its ok if vaginal wall does not meet the dome (it tissue does not have to be approximated perfectly

Test yourself:
- **Clinical correlation/board matching question:**
  - (1) paravaginal repair with (iv) endopelvic fascia of anterolateral vagina to arcus tendineus;
  - (2) Pereyra needle suspension with (iii) periurethral tissue to rectus fascia;
  - (3) Marshall, Marchetti, and Krantz (MMK) procedure with (ii) urethrovaginal tissue to periosteum of the pubic symphysis;
  - (4) Burch colposuspension with (i) urethrovaginal tissue to Cooper's ligament (pectineal ligament)
Increased intra-abdominal pressure forces urethra against intact pubocervical fascia, closing urethra and maintaining continence.

Defective fascial support allows posterior rotation of U-V junction because of increased pressure, opening urethra and causing urine loss.

Sutures placed through Cooper’s ligament.
Part 2 B: Presacral space

- Find the sacral promontory
- Find the aortic bifurcation – notice the location of the left iliac vein
- Identify the right common iliac and ureter
- Enter the presacral space
  - pull the rectosigmoid to the left side of the pelvis
  - incise the peritoneum vertically just to the right of the sigmoid peritoneal attachment
- The middle sacral vessels descend over the sacrum into the sacral hollow
- Identify suture placement for mesh fixation during sacrocolpopexy

Clinical correlation: Presacral neurectomy

- Removal of superior hypogastric plexus
- Nerves embedded in the fatty tissue over the bifurcation of the aorta
- Peritoneal incision made laterally over the sacrum and extended caudally for 5 cm to the level of the S3-S4, cranially to the level of aorta
- Identify ureter and common iliac, middle sacral artery, superior hemorrhoidal vessels
- If middle sacral vein injured, be prepared to use packing with bone wax and thumbtacks
- Identify the tissue that would be removed
- If this is bleeding, use thumbtacks and bone wax; you cannot stich it

Presacral vein bleeding like you describe is easily managed by the following trick: fashion a 1 x 1cm piece of rectus muscle, apply it over the bleeding site and hold it in place with a tonsil clamp (not grasping it), and connect the Bovie at 100 watts to the tonsil clamp. Once the entire piece of muscle is carbonized, which may take one or two minutes, it gets totally stuck to the sacrum and the bleeding stops. Repeat prn for all bleeding sites. These are the vertebrobasilar veins.
Fig. 11. Presacral space. (Courtesy of Robert Werkmeister, Dallas, TX; with permission.)

The average distance of the left common iliac vein to the midsacral promontory in this study was 2.7 cm (range 0.9 to 5.2 cm).
FIGURE 5. In laparoscopic sacrocolpopexy, graft material is anchored to the anterior and posterior vaginal walls with a series of permanent sutures. After the graft is affixed to both sides of the vaginal vault, a series of sutures are placed in the anterior longitudinal ligament of the sacrum. The peritoneal incision is then closed over the graft.
Part 2C: Radical Hysterectomy (clinical correlation)

Radical dissection:
- Maylard, Cherney or midline incision
- Open anterior leaf inferiorly before going medially
- Open paravesical space digitally, staying lateral to obliterated umbilical artery, carry it down to levator muscle
- Open pararectal space, ureter is displaced medially
FIGURE 46.21 A: Opening the muscular wall of the breast capsule after incision. Manual bipolar coagulation of glandular tissue.
FIGURE 45.22. A: Extending the incision in the anterior leaf of the broad ligament to the vaginal orifice, between the layers of the right uterosacral ligament. B: Exposure of the uterine vessels with the anterior Leaf of the broad ligament attached to public lip and uterine wall

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Fig 16-31. Wertheim radical hysterectomy. The presacral, paravesical, and paravaginal spaces are opened exposing the cardinal ligament and the uterine artery. A space is developed between the umbilical ligament and the utero-ovarian artery proximal to the site of the first accessory vaginal artery. The bladder fornix is taken down, removing the bladder pillar. The uterine artery is ligated at its origin, lifted upward, and dissected from the cardinal ligament and vesicouterine tunnel (see Fig 16-32).

FIGURE 16-32. A. Intraabdominal structure located about the ovary to the rectouterine fatty tissue or central mesentery of the bowel ligament; note suture marks, arrow, and superior surface of ovary. B. Diagrammed in opened peritoneum.
Fig. 10-34. Wertheim radical hysterectomy. The uterus is pulled forward and traction placed across the posterior cul-de-sac with a sponge stick. As the peritoneal reflection is incised, air is pulled into the subjacent areolar tissue, helping to dissect and identify the correct plane. Once the correct plane is entered, the peritoneal incision is extended laterally to or across the uterosacral ligaments.
Types of hysterectomy

![Image of hysterectomy diagram]

**TABLE 46.5.**
Comparison of Extent of Resection for Surgical Procedures to Treat Early-Stage Cervical Cancer

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Cervical Conization</th>
<th>Total Abdominal/Vaginal Hysterectomy</th>
<th>Modified Radical Hysterectomy</th>
<th>Radical Abdominal Hysterectomy</th>
<th>Radical Vaginal Trachelectomy</th>
<th>Radical Vaginal Hysterectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervix uteri</td>
<td>Partially removed</td>
<td>Completely removed</td>
<td>Completely removed</td>
<td>Completely removed</td>
<td>Majority removed</td>
<td>Completely removed</td>
</tr>
<tr>
<td>Corpus uteri</td>
<td>Preserved</td>
<td>Completely removed</td>
<td>Completely removed</td>
<td>Completely removed</td>
<td>Preserved</td>
<td>Completely removed</td>
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<tr>
<td>Ovaries and tubes</td>
<td>Preserved</td>
<td>Preserved</td>
<td>Preserved</td>
<td>Preserved</td>
<td>Preserved</td>
<td>Preserved</td>
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<tr>
<td>Parametria and paracolpos</td>
<td>Preserved</td>
<td>Preserved</td>
<td>Removed at level of ureter</td>
<td>Removed lateral to ureter</td>
<td>Partially removed</td>
<td>Partially removed</td>
</tr>
<tr>
<td>Uterine vessels</td>
<td>Preserved</td>
<td>Ligated at level of cervical internal os</td>
<td>Ligated at level of ureter</td>
<td>Ligated at origin from hypo-gastric vessels</td>
<td>Descending cervicovaginal branch ligated</td>
<td>Removed at level of ureter</td>
</tr>
<tr>
<td>Uterosacral ligaments</td>
<td>Preserved</td>
<td>Ligated at uterus</td>
<td>Divided midway to rectum</td>
<td>Divided near rectum</td>
<td>Partially removed</td>
<td>Partially removed</td>
</tr>
<tr>
<td>Vaginal cuff</td>
<td>Preserved</td>
<td>None removed</td>
<td>1–2 cm removed</td>
<td>≥2 cm removed</td>
<td>1–2 cm removed</td>
<td>≥2 cm removed</td>
</tr>
</tbody>
</table>
**Part 2D: Dissect out the ureter and identify its course**

- **Abdominal ureter**
  - 15 cm long
  - renal pelvis->descents over psoas muscle from lateral to medial (is crossed anteriorly by ovarian vessels but higher runs dorsal to ovarian vessels)->enters pelvic brim at bifurcation of common vessels over the sacroiliac joint (medial to ovarian vessels)
  - left ureter is obscured by sigmoid at the level of the brim

- **pelvic ureter**
  - 15 cm long
  - descents pelvic sidewall post to ovarian fossa (lateral to the sacrum, next to the ventral border of the greater sciatic notch immediately ventral to the internal iliac artery; lies medial to its branches)->crosses cardinal ligament under uterine artery from poster-lateral to antero-medical 1.5 cm lateral to the cervix at the level of internal os->continues anteromedially to insert into bladder tangentially->crosses within bladder (tunnel of the cardinal ligament; anterior bladder pillar, web or tunnel of Wertheim) for 1.5 cm and enters bladder cavity in lateral aspect of trigone over the vaginal fornix

- **blood supply is peritoneal arterioles, vessels that it passes**
  - cephalad to the pelvic brim it enters from the medial side (from renal artery, gonands, aorta), so dissect it from the lateral side
  - below the pelvic brim it is reverse (from lateral side: iliacs, uterine and vesicle arteries)

- **blood supply to the bladder:**
  - superior vesical artery from internal iliac (obliterated umb)
  - inferior vesicle artery from internal iliac or internal pudendal art)
most common site of ureteral injury (in descending order)

- ligating IP with BSO (lateral pelvic sidewall)
- ligating uterines (lateral to cervix under cardinals)
- near uterosacral
- insertion into bladder wall (rad hyst, or closing/oversawing the vault)

most common procedure: TAH
most common “activity” attempt to obtain hemostasis
most common time of diagnosis: 50/50 intra and postop
most common long term sequelae: none
most common type: obstruction (others are crushing, ligation, transaction, angulation with secondary obstruction, ischemia, resection)

Distances to the ureter:
- Ureter to IP -- 1cm
- Ureter to Uterine -- 1.5-2.3cm
- Ureter to Uterosacral -- 0.9cm
- Ureter to anterior repair plication sutures--0.9cm
- **Uterosacral ligament suspension**
- ureteral kinking during uterosacral ligament suspension
  - since ureter and ligament diverge cephalad, take out distal and most lateral sutures first in case kinking is encountered. No stenting is needed if that relieves the issue. Replace the sutures and do cysto again
  - incidence of kinking as high as 11%
• **What is McCall’s culdoplasty?**
  If laxity or enterocele is noted intraop at the time of the VH, it is recommended that a McCall culdoplasty be performed at the time of hysterectomy as a prophylactic procedure to reduce the chance of apical prolapse in the future. The McCall procedure not only reduces the redundant cul de sac (internal sutures), it also provides apical support to the vagina (external sutures)

  • **External McCall sutures:**
    o absorbable suture placed from vaginal apex near midline to
      o uterosacral ligament
      o then reefing the posterior cul-de-sac peritoneum
      o to opposite uterosacral ligament and
      o back through the vaginal apex close to the initial suture
  
  • **Internal McCall sutures:**
    o 2-3 non-absorbable sutures placed proximal to external McCall
      o suture
      o starting at uterosacral ligament
      o reefing the posterior cul-de-sac peritoneum
      o to opposite uterosacral ligament

  • Internal McCall sutures are tied first
  • The vaginal cuff is closed
  • External McCall suture are tied last
Anatomic Considerations
Apical Compartment

Relationship of the Ureter to the Uterosacral Ligament

Uterosacral "Ligament"

Cervix

Rectum

Ureteric course diverges from the ligament as it courses cephalad

Photo: James L. Raders MD
Part 3 Deep pelvis and Pelvic sidewall

Part 3A: Open Pelvic sidewall

Fig. 4-46. Side view of the lateral pelvic anatomy. The vesicocervical space and the superior part of the vesicovaginal space have been developed. Note the relationship of the ureter to the bifurcation of the common iliac artery, the hypogastric artery, the uterine artery, and the uterosacral ligament.
a. Enter the pelvic sidewall by opening the broad ligament cephalad from the round ligament
b. Extend the peritoneum vertically in the direction of the ovarian vessels and ureter
c. Identify the psoas muscle and the iliac vessels (medial to the muscle edge) – see if you can find the genitofemoral nerve
d. Identify the branching of the external and internal iliac vessels
e. Identify the obturator vessels as they go towards the obturator canal
f. Identify the ovarian artery and ureter as they cross the common iliac artery
g. By retracting the iliacs you can find the obturator internus muscle
Part 3B: Practice Surgical maneuvers for PPH:

**Task:** practice the following maneuvers on your cadaver (please remove the suture so that others can try after you are done)

- **Uterine artery ligation: O Leary stitch**
  - Deliver the uterus
  - Ligation of artery and vein in the LUS 2-3 cm below the level of the uterine incision
  - Absorbable suture placed 2-3 cm medial to the uterine vessels thru the myometrium (in order to obliterate any intramyometrial ascending branches) and lateral to the vessels thru the broad ligament
  - Most beneficial if bleeding from LUS placentation site, LUS extensions, or uterine artery laceration

- **B-lynch**
  - Placing vertical suture 3 cm below uterine incision to 3cm above the incision on the right side, then passing it over the fundus and passing it thru horizontal in the posterior uterus at the same level as anterior suture, then over the fundus, then on the left 3 cm above to 3 cm below, then tie 2 ends

- **Hypogastric artery ligation**
  - Decreases pulse pressure by 85%
  - Open peritoneum over common iliac artery, parallel and just medial to the ovarian vessels, exposing internal surface of the posterior leaf of the broad ligament
  - Identify ureter and reflect it medially
  - Expose bifurcation
  - Open sheath over internal iliac artery longitudinally
  - 2cm below bifurcation to avoid post branch (skin and gluteus ischemia)
  - 2 2.0 silk sutures are used (permanent)
  - need bilateral ligation, 50% -80% effective
  - **place right angle clamp from lateral to medial to grasp the suture underneath the artery to avoid external iliac vein**
  - can use Babcock to elevate the artery during this passage
  - risks: laceration of iliac vein, ligation of external iliac artery, ureteral injury
  - **vein is medial and inferior to the artery**
Figure 1. Grasp and elevate the uterus with the left hand and tilt it to expose the vessels.

Figure 2. A coronal view of lower uterine segment is shown. Insert the suture into the substance of the cervix without entering the uterine cavity and medial to the blood vessels.

Figure 3. The ligature, 2 to 3 cm inferior to the uterine incision, includes 2 to 3 cm of myometrium in the suture.
Identification of the ureter and superior vesical artery. The peritoneal reflection anterior to the uterus is incised and the bladder reflected inferiorly with sharp dissection. The ureter is identified on the medial aspect of the broad ligament during the development of the perivesical and perirectal spaces, as is the superior vesical artery. Courtesy of William J. Mann, Jr, MD.
Figure 19-8 Gabbe Hypogastric artery ligation. Approach to the hypogastric artery through the peritoneum, parallel and just lateral to the ovarian vessels, exposing the interior surface of the posterior layer of the broad ligament. The ureter will be found attached to the medial leaf of the broad ligament. The bifurcation of the common iliac artery into its external and internal (hypogastric) branches is exposed by blunt dissection of the loose overlying areolar tissues. Identification of these structures is essential. A and B, To
Part 3C: **Internal ileac artery branches**

- Follow pages 143-145 from Grant’s dissector
- Venous return:
  - Parallels arteries
    - Exception: left gonadal vein empties into left renal vein

**Identify:** **Hypogastric artery branches**

- Abdominal aortic branches above bifurcation
  - Superior mesenteric
    - Middle colic (transverse colon)
    - Right colic (jejunum and ileum)
    - Ileocolic (distal ileum, appendix, cecum)
  - Renal
    - Inf suprarenal (adrenals)
    - Renal divisions (kidney)
  - Gonadal
    - Ovary
  - Inf. Mesenteric
    - Left colic (descending colon)
    - Sigmoid
    - rectal

- **Common iliac**
  - external iliac:
    - -inferior hypogastric
    - -femoral
  - internal iliac=hypogastric
    - posterior division
      - -sup gluteal
      - -ileofemoral
      - -lateral sacral
      - aberrant [-inf gluteal]
    - anterior division
      - obturator
        - aberrant obturator artery could come external iliac and cross the pelvic brim
      - -umbilical
      - -superior vesical (arises from inferior surfaces of umbilical artery and goes to superior lateral aspect of the bladder)
      - -inferior vesical
        - -vaginal
        - -uterine
          - identify ureter underneath (“water under the bridge”)

---

**Where to give Pudendal nerve block** (see Gabbe for pics)
- 10 cc 1 % lido each side, aspirate prior to injection to make sure not in the artery
- just below the spine into the ligament
- some prefer going more posterior to avoid aberrant hemorrhoidal artery
- practice pudendal block on your cadavers
- internal pudendal
  - inferior to ischial spine, can get injured in SSLF
- inferior gluteal: superior-lateral and posterior to the ischial spine, can get injured in SLLF
- inferior, middle hemorrhoidal/rectal

- Blood supply to the ureter is peritoneal arterioles, vessels that it passes
  - cephalad to the pelvic brim it enters from the medial side (from renal artery, gonads, aorta), so dissect it from the lateral side
  - below the pelvic brim it is reverse (from lateral side: iliacs, uterine and vesicle arteries)
- Blood supply to the bladder:
  - superior vesical artery from internal iliac (obliterated umb)
  - inferior vesicle artery from internal iliac or internal pudendal
Vascular Supply to Pelvic Structures

- Kidney - renal
- Ureter – renal/aorta/iliac
- Bladder – superior and inferior vesical
- Urethra – internal pudendal
- Uterus – internal iliac
- Vagina – internal iliac – internal pudendal
- Labia majora – femoral – deep ext pudendal/perineal
- Clitoris – internal pudendal
- Rectum – internal iliac – middle rectal/IMA – sup rectal
- Anus – internal pudendal – inferior rectal
Part 4: Neuronatomy

- identify Pelvic nerve Plexus (p 144-145 of the dissector)

Part 4A: Summary of nerve and organ innervation

- **Somatic: motor +sensory Lumbosacral Nerve Plexus**
  - Lumbar plexus
    - Iliohypogastric
      - S: lower abdomen, pubis
      - M: lower abd wall
    - Ilioinguinal
      - S: upper thigh, upper labia majora
      - Travels thru inguinal canal
    - Lateral femoral cutaneous
      - S: ant/lat upper leg
    - Genitofemoral:
      - S: ant thigh, labia majora
  - Femoral:
    - S: ant/med leg
    - M: psoas, iliac, knee extensors
  - Obturator:
    - M: high abductors
  - Sciatic:
    - S: post thigh
    - M: lower leg

- **Sacral**
  - Sciatic (same as above)
  - Posterior femoral cutaneous perineal branch
    - S: perineum and post labia
  - Pudendal nerve from S2-S4
    - Branches:
      - Perineal
      - Vulvar
      - Dorsal nerve of clitoris
      - Branch to rhabdopshincter (urethral) and to anal sphincter
        - Major M+S nerve to the perineum
        - Anal wink reflex: requires intact levator ani nerve and pudendal nerve (both afferent and efferent) and connect to the higher brain centers
  - Levator ani nerve: S3-S5
    - To levators
  - Nervi erigente: to autonomic plexus (parasympathetic)
• **Autonomic** (important in micturition)
  o Celiac and Superior mesenteric plexus (kidney, ureter)
  o **Superior hypogastric:**
    ▪ Mostly sympathetic
    ▪ Lumbar roots
    ▪ Action: Bladder neck closure
    ▪ Becomes **hypogastric nerves** (sympathetic)
      - Combine with pelvic nerves (paraS) and erigente (paraS from sacral plexus) to become **IHP (inferior hypogastric/pelvic) plexus**, located lateral to rectum
        o IHP is responsible for most of autonomic control of the pelvis
        o If pt has urinary retention after major pelvic surgery, either IHP or pelvic nerves might have been damaged (ie after protectomy)
  
• **Innervation of the bladder:**
  o Sympathetic: T10-L2 via hypogastric nerve (trigone), IHP (inf hypogastric plexus)
  o Parasympathetic: S2-4
    ▪ Pelvic nerve (bladder body)
  o Somatic: S2
    ▪ Pudendal N (external sphincter)
  
• **Innervation of genitalia:**
  o Somatic: pudendal S2-S4
    ▪ terminal branches is
      - **the dorsal nerve of the clitoris** (DNC) and the
        o DNC is purely sensory
        o Course is controversial: runs to the crura under the inferior pubic symphysis prior to ascending to the pubic ramus and proceeding within the suspensory ligament toward the glands
        o Clinical correlation is that TOT sling trocars can damage it if coming too close to the ramus
      - **perineal nerve**
        o sensory to the labia major and minora, introitus, distal urethra, perineal sin
        o motor to the external urethral sphincter
        o pelvic floor muscles
  
  ▪ Inferior rectal nerve (3rd branch of pudendal nerve) provides innervation to peri-rectal skin, anal sphincter, part of the muscularity of the post. Pelvic floor
  ▪ Part of labia major is innervated by the anterior branches of Ilioinguinal nerve
  o Autonomic NS:
paraS fibers from the pelvic nerve and IHP (inf hypogastric plexus) are responsible for the sexual response

cavernous nerves

- The cavernous nerves carry the autonomic innervation to the erectile tissue of the clitoris and bulbs. While the DNC is visible to the naked eye, the fibers of the cavernous nerves are too small to identify without magnification. These sympathetic and parasympathetic fibers arising from the caudad thoracic spinal segments and the sacral spinal segments innervate the vessels and smooth muscle of the erectile and nonerectile vascular tissue of the vulva.

Vaginal innervation:
- The uterovaginal plexus also includes parasympathetic motor fibers from sacral roots that enter the pelvis directly, as well as sympathetic motor fibers that enter from the sympathetic chain. The vaginal introitus is supplied by sensory fibers of the pudendal nerve. Contrary to many texts, the lower two thirds of the vagina is not somatically innervated; only the introitus and the first 1–2 cm of the distal vagina appear to have somatic sensation.

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Nerve Supply to Pelvic Structures

- Kidney – celiac trunk
- Ureter – celiac trunk
- Bladder – from IHP
- Urethra – ext sphincter – pudendal (somatic)/IHP
- Uterus – from IHP
- Labia Majora – ilioinguinal/perineal/genitofemoral
- Vagina – pudendal/IHP
- Clitoris – pudendal – dorsal nerve of clitoris/IHP
- Rectum – from IHP
- Anus
  - Ext anal sphincter – pudendal – inf rectal N (somatic)
  - Int anal sphincter – pelvic N – IHP (autonomic)

IHP = inferior hypogastric plexus
Fig. 2.12  General pattern of genital innervation. The somatic innervation of the female sex organs is mediated primarily through the pudendal nerve (S2–4). The sympathetic innervation is derived from T10 to T12, and the parasympathetic innervation is derived from S2 to S4. Not shown are autonomic fibers from the pelvic plexus to the erectile tissue of the clitoris and bulbs (based on drawing by Robert Holmberg, Seattle, WA).
Superior hypogastric plexus

Right hypogastric nerve

Inferior hypogastric plexus: middle rectal, uterovaginal, vesical

Uterovaginal plexus

vesical plexus

Nerve to levator ani
Nerves devised by sensory and motor component:

- **Motor (primary motor)**
  - Femoral- hip flexion, adduction, knee extension
  - Obturator--adduction, no sensory
  - Sciatic-hip extension, knee flexion, no sensory
    - Common perineal
      - foot dorsiflexion, foot eversion
      - sensory-lateral calf, dorsal foot
    - Tibial
      - foot plantar flexion, foot eversion
      - toes, planar foot surface

- **Sensory**
  - Iliohypogastric mons, lateral labia, upper inner thigh
  - Ilioinguinal groin, symphysis
  - Genitofemoral upper labia, ant superior thigh
  - lateral femoral-ant and post lat tight
  - femoral-ant and med thigh, med calf
  - sciatic no sensory
  - pudendal
Part 4 B: Clinical Correlation: Nerve injuries and prevention

- **Common Peroneal nerve (lateral tibia)**
  - Pressure from lateral part of the Allen’s
  - Motor deficit: produces foot drop
  - Usually resolves spont in 3-6 mo

The typical clinical presentation of common peroneal neuropathy at the fibular neck is acute foot drop (difficulty dorsiflexing the foot against resistance or gravity). Patients describe the foot as limp; there is a tendency to trip over it unless they compensate by flexing the hip higher when walking, producing what is called a “steppage” gait. Patients may also complain of paresthesias and/or sensory loss over the dorsum of the foot and lateral shin (superficial peroneal nerve territory). In one study, 79 percent of 103 patients with common peroneal neuropathy complained of sensory loss; pain was relatively infrequent, affecting only 17 percent [4].

Examination typically reveals weakness in foot dorsiflexion and foot eversion (deep and superficial peroneal nerve- innervated, respectively), with normal inversion and plantar flexion (posterior tibial nerve). Sensory disturbance is confined to the dorsum of the foot, including the web space between digits 1 and 2 and the lateral shin. Reflexes are normal.
- **Sciatic nerve**
  - External hip rotation and incomplete knee flexion
    - Max stretch when hip is flexed and knee is extended
    - Knee flexion weakness and dorsiflexion
    - Sensory sx: plantar foot
  - **Mode of injury**
    - Catastrophic hemorrhage (deep mattress sutures)
    - Pelvic exenteration
    - SSLF
    - Stretch with candy cane stirrups

- **Femoral n**
  - Compression of self-retaining retractor in thin pts over the psoas muscle
  - Can also happen from extensive hip abduction in candy canes; trapped under inguinal ligament
  - 8% of abdominal procedure
  - 90% resolve spont
  - Sensory def over ant/med thigh
  - Weakness of hip flexion and dorsiflexion

- **Femoral Neuropathy**
  - Stretch injury vs direct injury vs prolonged compression (most common)
    - Vaso nerorum is obstructed resulting in ischemic neuropathy
  - Symptoms
    - Motor
      - Inability to flex at hip or extend at knee
      - Absent patellar reflex
      - Cannot do “straight leg raise”
• Sensory
  o Anteriomedial thigh paresthesia
  o Medial thigh paresthesia

**Same principles for Allen Stirrups**

- Not overflexed at knee and hip
- Ankle and knee in line with contralateral shoulder

**Proper patient positioning**

Vaginal surgery: high lithotomy

- Hip flexion = 60 degrees
- Knee flexion = 60 degrees to 120 degrees

**Femoral Nerve Injury**

- Weak quadriceps
- Difficulty in knee extension, thigh abduction, hip external rotation
- Cannot stand from a seated position
- Fall during ambulation attempts

- Stretching of nerve over inguinal ligament
• **Ilioinguinal and Iliohypogastric (see pics in part 1)**
  o sensory nerves
  o results from entrapment into abd incision closure
  o sx are pain and burning
  o dx by lidocaine block
  o Ilioinguinal and Iliohypogastric Neuropathy
    ▪ Injured when Pfannenstiel incision extends beyond rectus abdominis muscle
    ▪ Nerve Entrapment Syndrome
      ▪ Sharp, burning pain from inc site radiating to suprapubic, labial and thigh areas
      ▪ Parasthesia over nerve distribution
      ▪ Relief with local anesthesia
    ▪ Onset can be immediate or after months
    ▪ Sx worsened with valsalva and stretching
    ▪ Sx relieved with hip flexion and stooping
    ▪ Tx with weekly local anesthetic or more permanent neurolysis (70% cure)
  ▪ **Clinical correlation:**
    • The Ilioinguinal nerve enters the abdominal wall between the internal and external oblique muscles and is > 3.1 cm medial / 3.7 cm inferior to ASIS.
    • The Iliohypogastric is lateral to the Ilioinguinal nerve (2.1 cm medial / 0.9 cm inferior to ASIS). Injury to these nerves can result in burning pain at the incision site that radiates to the suprapubic, thigh, and labial areas.

The Iliohypogastric nerve arises from T12-L1, innervates the lower Transversus abdominus and internal oblique muscles as it courses between them, and then supplies cutaneous sensation to a small region just superior to the pubis.

• To reduce the chance of injuring these nerves, place trocars medial and superior to the ASIS and use 5 mm trocars (instead of 12mm) in these areas

• **Lateral Femoral Cutaneous Neuropathy**
  o Same mechanism as femoral neuropathy
  o Lateral thigh parathesthesia
  o The lateral femoral cutaneous nerve arises from L2-4, travels posterior to the inguinal ligament at the iliac crest, and supplies cutaneous sensation to the lateral and anterior mid thigh

• **Genitofemoral Neuropathy**
- Runs along ventral surface of psoas muscle and lateral to the external iliac artery in the pelvis
- The genitofemoral nerve arises from L1-2 descending on the fascial surface of the psoas major muscle next to the ureter. The genital branch enters the inguinal canal to supply sensation to the labia majora and inner thigh. The femoral branch supplies sensation to the proximal thigh about the femoral triangle.
- Injury most likely to occur during
  - removal of large pelvic mass adherent to sidewall
  - external iliac LND
  - Psoas hitch
  - Pfannenstiel incision
- Sensory loss of ipsilateral mons, labia majora and skin over femoral triangle
- Pain in mons or upper vulva, responding to nerve block
  - lower abd incision or LSC trocar placement inferior to ASIS
  - repair is required if possible

- **Obturator n**
  - paravag repair
  - rad hysterectomy
  - TOT
  - Inability to adduct hip and internal rotation, lateral sensory def

- **Obturator Neuropathy**
  - Injured during retroperitoneal surgery (LND) and lateral cystocele repair (while line, paravag repair—most cephalad stitches)
  - Sensory loss upper medial thigh
  - Motor weakness in hip adductors
  - “nun’s nerve” (cannot close legs)
  - management of injury:
    - immediate microsurgical repair and PT
    - good prognosis if recovered
• PT is effective

• **Tibial nerve**

• Vaginal Surgery-risk of injury
  o Femoral Neuropathy
    - Indirect femoral compression through lithotomy positioning
    - Excessive hip flexion and abduction and external hip rotation
  o Sciatic and Peroneal Neuropathy
    - Rare, ~ 0.3% and due to stretch injury during lithotomy
    - Associated with extended knees and external hip rotation
    - Prolonged hyperflexion of thighs
    - Common peroneal is most commonly compressed LE injury
      - Runs across lateral head of fibula
      - Presents with foot drop and lateral calf paraesthesia
  o Pudendal Neuropathy
    - Associated with SSLF and suture entrapment
    - Presents with gluteal pain and perineal paraesthesia
    - Treated with removal of suture
<table>
<thead>
<tr>
<th>Nerve</th>
<th>MOA</th>
<th>Surgery</th>
<th>Deficit: motor</th>
<th>Deficit: sensory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral</td>
<td>Retractor compression, hip hyperflexion (candy canes)</td>
<td>Exlap TAH</td>
<td>Hip flexion, knee extension, Weak knee jerk</td>
<td>Sensory loss/parasthesia labia, anterior and medial thigh</td>
</tr>
<tr>
<td>Obtrurator</td>
<td>Surgical damage</td>
<td>LND Endometriosis Paravaginal repair</td>
<td>Thigh adduction</td>
<td>Sensory loss/parasthesia inner thigh</td>
</tr>
<tr>
<td>Common Peroneal</td>
<td>Compression at fibular neck</td>
<td>Any prolonged time in lithotomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tibial</td>
<td>Same</td>
<td>Same</td>
<td>Weak plantar flexion</td>
<td>Loss of sensation overpost calf and bottom of the foot</td>
</tr>
<tr>
<td>Sciatic</td>
<td>Suture Stretching</td>
<td>SSLF Exaggerated Lithotomy (&quot;straight leg&quot;)</td>
<td>Hamstring weakness Weakened ankle reflex Normal knee reflex</td>
<td>Lower leg but not medial calf and foot arch</td>
</tr>
<tr>
<td>Pudendal</td>
<td>SSLF</td>
<td></td>
<td>Gluteal pain Perineum</td>
<td></td>
</tr>
<tr>
<td>S1-S4 nerve roots</td>
<td>Uterosacral ligament fixation</td>
<td></td>
<td>Buttock and post thigh</td>
<td></td>
</tr>
<tr>
<td>Ilioinguinal Iliohypogastric</td>
<td>Transverse fascial incision</td>
<td></td>
<td>Incision area to labia or thigh</td>
<td></td>
</tr>
<tr>
<td>Genitofemoral</td>
<td>-Pelvic lymph node dissection -Psoas hitch</td>
<td></td>
<td>sensory: ant thigh, labia major</td>
<td></td>
</tr>
</tbody>
</table>
Part 5: Pelvic Diaphragm and Levator Ani muscles
Pages 145-147 in the dissector, use the hemi-pelvis

- What is pelvic floor? It has 2 components:
  - endopelvic fascia (viscerofasical layer)
  - muscular layer (levator ani muscles)

DeLancy Levels of pelvic support:

- Level 1: apical, cardinal/uterosacral ligament complex
- Level 2: lateral, paravaginal attachments-endopelvic fascia
- Level 3: distal fusion; perineal membrane/body
  - perineal body: what is it and what does it attach to?
    - consists of connective tissue and to which attach:
      - external anal sphincter,
      - bulbospongiosis,
      - superficial and deep transverse perineal muscles
      - anterior fibers to the levator ani
      - posterior fibers to endopelvic fascia
Pelvic fascia and ligaments

- Cervix
- Uterosacral ligament
- Cardinal ligament (transverse cervical or Mackenrodt's ligament)
- Horizontal portion of vagina
- Arcus tendineus fasciae pelvis
- Distal (vertical) portion of pubocervical fascia supports urethra and U-V junction and provides backstop against which urethra is compressed during straining

DeLancey levels of vaginal support

Level I consists of the cardinal and uterosacral ligaments, and suspends the vaginal apex. Level II consists of the endopelvic fascia connections to the arcus tendineus fascia pelvis, which attaches the vagina to the aponeurosis of the levator ani. Level III consists of the perineal body and includes interlacing muscle fibers of the bulbospongiosus, transverse perinei, and external anal sphincter.

**Pelvic floor musculature:**
- iliacus
- Psoas
- Obturator internus
- Piriformis
- coccygeus
- levator ani muscles:
  - puborectalis
  - pubococcygeus
  - iliococcygeous
  - innervated by sacral roots and pudendal nerve
- intrinsic urethral Rhabdosphincter
- Compressor urethrae/urethovaginalis
- External anal sphincter
Fig. 6. Innervation to the striated urethral and external anal sphincter muscles. (Courtesy of Lindsay Oksenberg, Dallas, TX; with permission.)
Part 6: Eternal genitalia and perineum (P 134-137)

1. Remove skin as directed in figure 5.26.
2. Identify superficial structures:
   a. Colle’s fascia (superficial perineal fascia)
   b. Muscles of the superficial pouch
      i. Ischiocavernosus
      ii. Bulbospongiosis, superficial transverse perineal muscles
      iii. Bulb of the vestibule and greater vestibular bulb
3. Identify superficial structures
   a. Urethra
   b. External urethral sphincter
   c. Deep transverse perineal muscle
   d. Branches of pudendal artery and nerve
Nerves of the female perineum

Dorsal nerve of clitoris
Perineal branch of posterior femoral cutaneous nerve
Deep branch of perineal nerve
Superficial branch of perineal nerve
Perineal nerve
Ischial tuberosity
Pudendal nerve
Genital branch of genitofemoral nerve
Anterior labial branch of ilioinguinal nerve
Inferior anal (rectal) nerves

Pudendal block

Vaginal approach
- **Clitoris**
  - Innervation:
    - Sensory: dorsal nerve of clitoris which is branch of pudendal nerve
    - Genital response to arousal: mediated by cavernosal nerve from IHP (inferior hypogastric plexus)
PART 7: Understanding Trocar Passes of Mid-urethral Slings

Urethral anatomy:
Voluntary control of the external urethral sphincter is through the corticospinal pathway connecting the frontal cortex of the brain with the pudendal nucleus (Onuf's nucleus) in the ventral horn of the sacral spinal cord. Thus Onuf's nucleus is involved in contraction of the external urethral sphincter.
Part 7A: Perineal and Groin Dissection

- Incise the groin fold on one side of your patient.
- Dissect to the muscles in the medial compartment of the thigh.
- Strip the subcutaneous tissue from the muscles so that you can identify insertions into the symphysis and the inferior pubic ramus.
- Identify the adductor longus, brevis and Magnus muscle.

On the hemi-pelvis, practice placement of TOT and TVT slings and examine their relationship to the anatomic structures nearby structures.

Part 7B: TVT pass

Task: Use TVT needle and mesh to place the sling on the hemi pelvis
  a. Make a 2 cm incision in the vaginal mucosa under the midurethra
  b. Sharply dissect the periurethral tissue bilaterally in the direction of the pubic symphysis
  c. Place the TVT trocar and visualize its passage through the Space of Retzius

- Technique of TVT retropubic approach
- Use rigid guide to minimize risk of injury to urethra (note: remember to place a guide wire and deviate it to the side you are working on. That motion will deviate urethra AWAY from the side you are working on)
- Direct needle toward skin incision aiming for the shoulder
- Avoid lateral location:
  - external iliacs, obturator, femoral, inferior epigastric vessels
- Avoid superior location: bowel
- Guide under the symphysis
- Cysto post procedure
In a cadaveric study of TVT trocar placement, the mean distance from the trocar to obturator vessels was 3.2 cm (range 1.6-4.3 cm) to the superficial epigastric vessels was 3.9 cm (range 0.9-6.70 to the inferior epigastric vessels was 3.9 cm (range 1.9-6.6 cm) to the external iliac vessels was 4.9 cm (range 2.9-6.2 cm).


**Part 7C: Trans-obturator sling pass**

**Task:** use Monarch outside-in approach on the hemipelvis. Identify nearby anatomy as outlined below.

- Using the midurethral incision, extend your periurethral dissection to the inferior pubic ramus
- Use the obturator trocar to pierce the obturator membrane and exit at the groin
- Note the relationship to the **groin muscles** already dissected
- See if you can find the **branches of the obturator artery** through the obturator foramen, and note the relationship of the trocar to the foramen

- **Technique of TVT-O outside in monarc approach**
  - Incision is lateral to the clitoris on the inferior edge of the adductor longus tendon
  - Goes thru
    - Obturator foramen, around ischiopubic ramus
- Gracilis, adductor brevis, underneath or thru obturator externus, obturator membrane, periurethral connective tissue, into opened vagina
  - 2.3 cm away from the neurovascular bundle as it exits obturator canal
  - position the needle at 45 degree angle so that it penetrates membrane perpendicularly
Part 7D: SSLF (sacrospinous ligament fixation):

Task: Identify sacrospinous ligament and point to where sutures would be placed thru the ligament and thru the vagina. Identify pudendal vessels, rectum and sciatic nerve in relation to the suture.

- **Coccygeus-sacrospinous ligament complex** (ligament overlying coccygeus muscle which has a large fibrous component)
  - Sacrotuberous ligament is under it
  - Posteriorly: gluteus maximus and ischial rectal fossa
  - Sciatic nerve: superior and lateral
  - Superior vasculature
    - Inferior gluteal a/v and hypogastric venous plexus
    - Vaginal venous plexus, rectal venous plexus
    - All drains into internal iliac vein
    - Bleeding there can be problematic
  - Coccygeus-sacrospinous ligament complex (ligament overlying coccygeus muscle which has a large fibrous component)
  - Sacrotuberous ligament is under it
  - Posteriorly: gluteus maximus and ischial rectal fossa
  - Sciatic nerve: superior and lateral
  - Superior vasculature
    - Inferior gluteal a/v and hypogastric venous plexus
    - Vaginal venous plexus, rectal venous plexus
    - All drains into internal iliac vein
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  - Sciatic nerve: superior and lateral
  - Superior vasculature
    - Inferior gluteal a/v and hypogastric venous plexus
    - Vaginal venous plexus, rectal venous plexus
    - All drains into internal iliac vein
    - Bleeding there can be problematic
  - Coccygeus-sacrospinous ligament complex (ligament overlying coccygeus muscle which has a large fibrous component)
  - Sacrotuberous ligament is under it
  - Posteriorly: gluteus maximus and ischial rectal fossa
  - Sciatic nerve: superior and lateral
  - Superior vasculature
    - Inferior gluteal a/v and hypogastric venous plexus
    - Vaginal venous plexus, rectal venous plexus
    - All drains into internal iliac vein
    - Bleeding there can be problematic

- **Technique of SSLF**
  - If anterior and posterior repair is needed, to anterior repair first (it reduces the risk of cystotomy)
  - If enterocele is present, close it 1st
  - Break thru the rectal pillar (it separates rectovaginal space from the right perirectal space), lateral to the enterocele sac at the level of the ischial spine, by mobilizing rectum medially
  - In the perirectal space, palpate the spine
  - Identify superior edge of the complex
  - Remove connective tissue bluntly and mobilize the complex laterally
  - Place Briesky-Navratil retractors (rectum medially, bladder superiorly)
  - Where to place the suture
    - 2 fingerbreadths medial to the ischial spine, 2nd suture 1 cm medial to the 1st
    - put traction on sutures to make sure they do not pull thru
      - Pass Capio needlex2
    - Fixing it to the apex
      - Pulley stitch: use permanent suture on the underside of vagina as it is not exposed
      - If vagina is short or greater length is desired, use delayed absorbable suture to pass thru the vaginal epithelium (2.0 vicryl)
    - Make sure there is no suture bridge (do rectal exam)
    - After that do post repair if needed
    - Leave packing in for 24 hrs

- **Which vessels are at risk for injury during SSLF?**
  - *Pudendal*
  - *Inferior gluteal*
  - *Venous plexus*


To examine the current clinical problem of life-threatening hemorrhage during sacrospinous vaginal vault suspension, define a
management solution, and validate current anatomic knowledge of the area involved.

METHODS:

Ten cadaveric female pelves were dissected from a posterior gluteal approach and from an abdominal approach. The vascularity of the region of the sacrospinous ligament was mapped.

RESULTS:

There are multiple and varied collateral vascular supplies and anastomoses in the region of the sacrospinous ligament and buttock, including: 1) superior gluteal, 2) inferior gluteal, 3) internal pudendal, 4) vertebral, 5) middle sacral, 6) lateral sacral, and 7) external iliac via the circumflex femoral artery system. Anastomoses occurred in all pelves examined. The frequency of each type of anastomosis varied from 20-100%.

CONCLUSION:

Surgical ligation of the internal iliac artery would not likely curb massive hemorrhage during sacrospinous ligament fixation, except in certain cases of internal pudendal vascular injury. The inferior gluteal artery is probably the most commonly injured vessel in sacrospinous ligament suspension because of its location. Inferior gluteal vessel injury should be approached by the use of packing and vascular clips or packing and arterial embolization. These latter approaches should be of primary consideration in the control of hemorrhage at the time of sacrospinous ligament fixation.
Part 8: Colpoproctotomy/4th degree laceration repair

- Sharply create a full-thickness defect between posterior vagina and rectum
- Appreciate the anatomy, especially the rectal mucosa, internal and external anal sphincters, perineal body and rectovaginal septum, and extent of vaginal epithelial defect
- Start with the deepest layer – close the rectal mucosa with absorbable suture to the level of the anal skin
- Imbricate the internal sphincter – smooth muscle, often appears as a condensation of connective tissue.
- Identify and develop the planes around the internal sphincter. There is some controversy regarding end-to-end versus overlapping repair, especially in the obstetric arena, but development of these planes is important either way.
- Perform anal sphincter repair of your choosing
- Repair the rectovaginal septum. We feel this is important to do before closing the vaginal epithelium.
- Restore the connection between the rectovaginal septum and the perineal body/anal sphincter. This up-to-down repair is often overlooked, and may result in distal rectocele, perineal descent and other forms of dysfunction
- Close the vaginal epithelium nearly to the forchette
- Crown sutures of your choosing are employed here to restore the side-to-side integrity of the perineum, but care should also be taken to include an up-to-down component as well
- Complete the vaginal and perineal skin closure.
Part 9: Repair of Injuries

Part 9A: Getting yourself out of trouble in the bladder

Cystotomy repair
- Close the bladder injury with 3-0 delayed absorbable suture (chromic or vicryl)
  - first layer is continuous to approximate the vesicle mucosa; the orientation of the repair should be determined by reducing the tension on the repair.
  - second layer is continuous or interrupted and is used to imbricate the muscularis over the mucosal closure
  - use non-overlapping suture lines
- May leave pelvic drain in place
- Foley for 7-14 days (takes pressure off repair while it is healing)
  - Cystogram before removal is prn

Creating a cystotomy to evaluate for Bladder injury
- Place a Foley catheter
- Identify the bladder
  - Make an approximately 4cm incision in the bladder dome (at the extraperitoneal portion) with a knife
    - This can be done by advancing a Foley balloon to the dome and incising to the balloon, or by grasping the bladder with two Allis clamps and incising between them
  - Identify the ureters, trigone, and interureteric ridge
  - Advance a stent retrograde into one of the ureters about 15 cm; advance the other side out of the urethra, next to the Foley
  - Close the bladder injury with 2-0 delayed absorbable suture (chromic or vicryl)
    - First layer is continuous to approximate the vesicle mucosa; the orientation of the repair should be determined by reducing the tension on the repair.
    - Second layer is continuous or interrupted and is used to imbricate the muscularis over the mucosal closure

During abdominal surgery, suprapubic telescopy can be used to confirm bladder and ureteral integrity. A cystoscope is placed through an intentional cystotomy, around which a purse string suture is placed. This suture is then used to close the cystotomy at the conclusion.

A surgeon sometimes wants to make an intentional incision in the bladder to visualize the bladder. This could be secondary to: 1) suspected suture penetration or ureteral injury is suspected 2) need for stent placement.

Usually use a 5-6 French stent. Stents are usually scored at centimeter marks and each 5cm.
**Ureteral Injury**

- **Anatomy of the ureter**
  - The anatomy of the ureter, especially the pelvic portion, is essential knowledge for a gynecologist. Identify the ureter at the pelvic brim and follow its course to the bladder.
  - The ureter enters the pelvis by crossing the iliac vessels where the common iliac divides into the external and internal portion. At this division the ureter lies medial to the anterior division of the hypogastric artery and is attached to the peritoneum of the pelvic sidewall. It runs posterior to the ovarian arteries, but within the peritoneal sheath so is commonly clamped at IP takedown. It courses lateral to the uterosacral ligament and enters the parametrium (cardinal ligament complex) approximately 1.5 cm from the cervix, runs in front of the vagina and enters the bladder base.

If ureter is damaged within 4-5 cm of uretero-vesical junction, **REIMPLANT**

If ureter is damaged closer to pelvic brim, **REANASTOMOSE**

If you need to decrease tension on your repair, use **PSOAS HITCH or BOARI FLAP**
• General management principles:
  o Ligation:
    ▪ Remove the suture and observe ureter for viability; if viable, place stent if not do ureterostomy or reimplantation
  o Transection/severe crush injury
    ▪ Intraop recognition: immediate repair
    ▪ Postop recognition: controversial
      • <POD7: stent or immediate repair
      • >POD7: stent, nephrostomy tube, delayed repair 3-6 months
  o stent placement:
    ▪ possible in 20-50% of cases, successful in 73%
    ▪ contraindications due to high risk of failure: multiple prior surgeries, radiation
    ▪ keep stent in for 6-12 weeks, f.u with imaging
  o other options
    ▪ transureteroureterostomy
    ▪ ileal ureteral substitution
    ▪ nephrectomy
  o how omental flap works:
    ▪ easily mobilized into deep pelvis
    ▪ well-vascularized
    ▪ good lymphatic drainage
    ▪ easy epithelialization on its surface
    ▪ vascular supply from right and left gastro-epiploic arteries (right preferred), distal branches of the gastro-duodenal and splenic arteries
  • placement of prophylactic ureteral stents does not prevent injury, only allows for improved recognition
  • Post op recognition:
    o Present on POD5 on average
    o Diagnosis:
      ▪ CT urogram (preferred)
      ▪ Retrograde cystogram
      • Can place stents at the same time but need to go to OR

Ureterovaginal fistula
• Onset 1-4 weeks
• Double dye test
• CT urogram, retrograde pyelogram, or anterograde pyelogram after nephrostomy tube placement
• If ureter is continuous on retrograde pyelogram, attempt stent placement for 4-6 weeks
  o Rpt imaging after removal
  o Success rate is 35-47%
  o If have persistent fistula will need repair
• Timing is controversial (early vs. delayed)
  o Most require ureteroneocystotomy
Ureteroureterostomy
- general principles:
  - mobilize ureter while preserving blood supply
  - debride ureter
  - spatulated tension free, water tight anastomosis
  - anastomosis over stent
  - leave IP drain
  - consider omental flap
  - use absorbable sutures

  - Locate the ureter that you have stented
  - Transect the ureter at a location more than 5cm from its insertion into the bladder. At this point you may want to retract the stent slightly, or you can leave it in for the repair.
  - Mobilize the ureter for a tension free end-to-end anastomosis. Remove any damaged tissue.
  - You will likely want to use suture (silk or something similar) to retract and tag ureters
  - Proximal and distal ends of the ureter are spatulated (see diagram) – spatulate ureters at opposite sides of the ureter (one at 12 o’clock and one at 6 o’clock)
  - Place 4-0 or 5-0 absorbable suture at right angles to the cut edges. After first suture is tied, place second and third suture 1-2mm apart. Tie these sutures. The remainder of the sutures are placed and tied
Ureteroneocystotomy

- Goals of reimplantation:
  - avoid tension on the anastomosis (use Psoas hitch as described below)
  - Create a submucosal tunnel that will maintain an anti-reflux mechanism.
    - 2 techniques
      - intravesical
        - direction superior and medial to native orifice
        - avoid lateral wall (risk of kinking)
      - extravesical submucosal tunneled anti-reflux anastomosis
- Mobilize the stented ureter as far distally as possible
- Transect the ureter within 5 cm of its insertion to the bladder. Tag proximal end with a suture.
- Choose a spot for reimplantation that will create a tension free anastomosis, preferably near the trigone.
- Using a tonsil clamp or something similar, create a puncture cystotomy
- Create a 1.5-2 cm submucosal tunnel with a right angle clamp (see diagram below)
- Bring the transected ureter through the cystotomy and then through the tunnel.
- Spatulate the end of the ureter and suture it circumferentially. The first stitch should be full thickness, while the rest can be through the bladder mucosa only. Use 4-0 or 5-0 interrupted vicryl.

- **Psoas Hitch**
  - This is used to gain length for a successful ureteroneocystotomy if you need extra length to achieve a tension free anastomosis
    1. Distal 1/3 of the ureter up to pelvic brim
    2. Good for small contracted bladder
  - Mobilize the bladder fully on one side by incising the anterior parietal peritoneum from the lower abdominal wall and displace the bladder from the symphysis
  - Use a finger to bring the mobilized side of the bladder to the psoas muscle and suture it in place.
    a. Avoid genitofemoral nerve
    b. Use PDS suture
  - Reimplant the ureter as described above
After being asked to review cases with ureter damage and having re-implanted the ureters in my own patients, I have learned that there are no clear recommendations regarding the time of ureter repair. There are multiple studies, given most of them retrospective (it would be hard to imagine a prospective study for this) – that challenge this assumption and show that the outcomes are the same, whether immediate or delayed ureter repair/re-implantation is performed.

Urologists usually quote the reasons for delayed repair are infection, co-morbidities, etc. Urinoma is quoted as one of the worst offenders, making repair difficult and causing a lot of local inflammation, thus compromising the repair and causing the fibrosis of the ureter – again, all this is a “historical” notion with no much data to support the claim.

Repair after the pelvic radiation is the “nightmare” that most surgeons I know are trying to avoid – to answer the question, I would perform the ureteroneocystotomy prior to pelvic radiation.

Below are the articles that might shed some light on this issue (many thanks to Dr Borin, my colleague):


Li, Jingquan; Chen, Zhaoyan; Zhu, Qingguo; Zhao, Yanjun; Wang, Haiping; Liu, Wei. Early Repair of Pelvic and Abdominal Nonsurgical Surgery-Induced Iatrogenic Ureteral Injuries in Three Distinct Waiting-for-Repair Time Periods. The American Surgeon, Volume 78, Number 11, November 2012 , pp. 1270-1275(6).

Vadim Morozov,
University of Maryland.
Disclosure: proctor for Intuitive, consultant for Covidien.

W
**Part 9B: Getting yourself out of trouble in the Bowel**

**Small bowel repair**
- Identify the small bowel and create a serosal tear
- Repair the serosal tear in one layer using interrupted 3-0 silk (or 3.0 vicryl) seromuscular sutures (Lembert sutures).
- Create a full thickness longitudinal enterotomy to the small bowel wall
- Repair the enterotomy in a transverse fashion to avoid bowel stricture
- Repair the enterotomy in 2 layers using interrupted full-thickness 3-0 vicryl or PDS sutures for the inner layer and 3-0 silk Lembert sutures for the outer layer.
- Resect a portion of the small bowel: create a window between the bowel and the mesentery using a hemostat in an avascular area and pass a GIA stapler through the window. Fire the stapler and repeat on the distal end of the resection. Ligate the mesentery with 3-0 vicryl ligatures between Kelly clamps.
- Create a stapled side-to-side anastomosis in the small bowel: Place the two bowel loops side to side and stabilize them with silk stay sutures at the anti-mesenteric border. Create an opening in the antimesenteric corners of the stapled edges of the small bowel loops and insert a GIA stapler in the lumen. Fire the stapler to create a side-to-side-functional-end-to-end anastomosis. Fire a TA stapler across the remaining defect. Close the mesenteric defect with a running 3-0 vicryl suture.
- The same principles apply to the repair/anastomosis of the colon.

**Notes for the boards:**
- Make sure you close the enterotomy in a way that the lumen is not narrowed
  - Suture lines should be perpendicular to the long axis of the bowel to prevent narrowing of the bowel lumen.
  - Large defects can sometimes be closed with a stapling device, or resection with reanastomosis may be necessary
- In a small bowel, enterotomy smaller than 2 cm can be closed w/o resection; over 2 cm resection will probably be needed
- In large bowel, you can probably get away with larger size enterotomy w/o resection
- How to do bowel resection w/o stapler (if not avail):
  - [Image of surgical procedure]
Part 9 C: Appendectomy (Telinds)

- Grasp mesosalpinx near the tip of the appendix with Kelly
- Support appendix with Babcock
- Ligate mesosalpinx with 2.0 vicryl or clamp and ligate with hemostats/kellys if it is edematous and cannot be taken in several bites
- Some ligate accessory branch of post cecal artery by passing one suture thru the musculature of the cecum at the base of the appendix
- Place packs around the appendix to isolate it from the rest of the field
- Double clamp at the base, amputate with scalpel
- Double ligate appendecial stump with 2.0 vicryl
- The stump can be cauterized or inverted with purse string suture (not done by most people)
**FIGURE 41.6.** Technique of open appendectomy. 

**A:** The appendix is elevated by a Babcock clamp and the mesoappendix is ligated. Alternatively, small clamps may be used to clamp, cut and tie the mesoappendix. 

**B:** The operative field is isolated with gauze packs and the appendix is cross-clamped and divided between the two closely placed clamps. 

**C:** The stump of the appendix is ligated with a 2.0 absorbable ligature. 

**D:** The stump is usually cauterized and covered with the adjacent mesoappendix.
Part 9D: Vesicovaginal Fistula Repair

- Create a cystotomy, or open a previously repaired cystotomy
- Create a vesico-vaginal fistula with a Kelly clamp approximately 1-2 cm above the trigone
- Stent the ureters retrograde for identification
- Extend the cystotomy to the fistula tract
- You may want to tag the bladder edges for retraction
- Sharply dissect the vagina from the back of the bladder (counter traction on the bladder will facilitate this – you may want to place pack in the vagina to help with vaginal traction)
- Excise the fistula tract
- Close the vaginal opening with interrupted 2-0 absorbable sutures, usually double layer closure if possible
- Close the bladder with running or interrupted 3-0 absorbable suture, double layer closure if possible

Performing an omental J-flap

- dissect the omentum from its attachment to the transverse colon but leave it attached to the stomach.
- Make a J-shaped incision approximately 4 cm inside the lateral border of the omentum adjacent to the edge of the stomach, down past the most distal and lateral termination of the mesenteric vessels within the omentum
- Rotate the flap to where you want it placed in the pelvis
- For vesico-vaginal fistulas, tack the omental flap to either the vagina or bladder, making sure that it interposes the area of the fistula on both organs
Site specific defect repair

**Anal Sphincter Complex**

- **Puborectalis muscle**
  - Part of Levator ani muscle
  - Anorectal angle
- **Internal anal sphincter**
  - Continuation of circular smooth muscle
  - Provides 70-85% of resting tone
- **External anal sphincter**
  - Skeletal muscle
  - Provides squeeze pressure
  - ~25% of anal canal resting pressure

Adapted from Netter’s Atlas of Human Anatomy
Ob/Gyn resident physicians from all four years were objectively evaluated while repairing a 4th degree perineal laceration model and more than 80% failed to repair the internal anal sphincter, but all did repair the rectal mucosa and the external anal sphincter. Because of work hour reductions, greater amount of knowledge/procedures to learn, and because perineal laceration repair may not be taught well, many resident physicians do not receive experience with repair of 4th degree lacerations and do not feel comfortable repairing them. The internal anal sphincter muscle accounts for 70-80% of the resting tone of the anal sphincter.

Feedback Form
1. What I liked about today:

2. What I did not like about today

3. What I would like to be changed in the future:

4. During which year of training do you think lab should be done in the future (it is only available in April)?