Morbidity and Mortality
Hernia Repair

Kings County Hospital
August 18, 2006
Joelle Pierre
Case Presentation

- xx y/o male with h/o ESRD presented to Kings County Hospital for repair of a right inguinal hernia

- Labs pre-op: Hct 43.1, PT: 11.8, PTT 31.6

- Hemodialysis: 1 day pre-op

- Pt underwent an uneventful right inguinal hernia repair with patch and plug system and was discharged home.
Course

- POD #1: Pt received hemodialysis with 3,000U of heparin
- POD #4: Pt returned to the ER complaining of swelling to the right inguinal region.
  - Hct: 35
  - PT 11.4, PTT 22.0
  - Pt had an AXR and CT Scan of the Abdomen
Course continued

- Pt was admitted for observation and IV atbxs
- Hematoma was stable and the swelling decreased
- Hct stabilized at 30
- Pt was discharged home on PO atbxs
Complications of Inguinal Hernia Repair

August 18, 2004
Inguinal hernia repair: hemianarrophy

- Most commonly performed general surgical operation
- Men > women 12:1
- Etiology: increased abdominal pressure: chronic constipation or cough, heavy lifting
- Weakness of the abdominal wall
Goal of the inguinal hernia repair:
- restore the abdominal wall
- without recurrence
- With the least amount of operative and postoperative discomfort

The inguinal hernia repair has evolved as new procedures were developed to improve the outcome.

Most notably inguinal hernia repairs have evolved from tension to tension free repairs:
- Facilitated by an increased understanding of the anatomy of the region.
Anatomy

“The anatomy of the inguinal region is misunderstood by surgeons at all levels of seniority.”
Anatomy of the Inguinal Canal

Anterior: external oblique fascia along the entire length with contribution from the internal oblique fascia at the lateral one third.

Posterior: fusion of the transversalis fascia and the transversus abdominis fascia.

Inferior (floor): the inguinal ligament and its shelving edge and medially the lacunar ligament of Gimbernat.

Superior (roof): the arch formed by the internal oblique and transversus abdominis muscle (conjoint tendon).
Inguinal ligament (Poupart’s ligament): This is the condensed lower portion of the external oblique fascia and extends from the anterior superior iliac spine to the pubic tubercle. Its medial third has a free edge, whereas the lateral two thirds are attached to the iliopsoas fascia.

Pectineal ligament (Cooper’s ligament): This is a strong ligament attached to the pubic ramus and formed jointly from the aponeurosis of the internal oblique, transversus abdominis, and pectineus muscles.

Iliopubic tract (Thompson’s ligament): This is the condensed part of the transversalis fascia and extends from the pectineal ligament medially, forms the inferior border of the internal ring and the anterior wall of the femoral sheath, and attaches laterally to the iliopubic arch (medial thickening of iliopsoas fascia).
Contents of the Inguinal Canal

**Male**

- **Spermatic cord**
  - Ilioinguinal, genital branch of the genitofemoral nerve, sympathetic nerves
  - three arteries
    - are the spermatic artery from the aorta,
    - the artery to the vas deferens from the superior vesicle,
    - cremasteric artery from the deep epigastric artery.
  - the vas deferens
  - the pampiniform venous plexus
  - the lymphatic channels

- The cord has three coverings
  - the outer external spermatic fascia—external oblique fascia
  - the middle cremasteric muscle layer—internal oblique muscle
  - the inner internal spermatic fascia—and transversus fascia,

**Female**

- Round ligament of the uterus
- Ilioinguinal nerve
- Genital branch of the genitofemoral nerve
History

1871 – Marcy closed the inguinal ring and tranversalis fascia

- **Lucas-Championnierre Method**

A decade following Marcy, the Lucas-Championnierre method involved slitting the external oblique aponeurosis to expose the inguinal canal and, under direct vision, dissecting and ligating the hemia sac.
Bassini

- **Father of the modern herniorrhaphy**
- **A successful repair depended on the reconstruction of underlying abdominal wall.**
- **Thus the first to dissect and reconstruct the inguinal canal to restore the functional anatomy**
- **He repaired the transversalis fascia using a 3 layered technique**
- **Stressed the importance of opening the external ring and dissecting the cremasteric fibers**
Halstead

- Added a fourth layer to the repair by
  reapproximating the external oblique to the
  shelving edge of the inguinal ligament.
Mc Vay

- Surgeon and anatomist
- Observed that the transversus abdominus muscles and the transversalis fascia insert into the Cooper ligament
- Applied the stitches to the Cooper ligament
- Required relaxing incisions into the ligament
- Pt had a slow recovery time
Shouldice

- 1945 – multilayered repair imbricating the full thickness of the transversalis fascia to the inguinal ligament
  - Imbricating the full thickness of the transversus arch – fascia, muscle and internal oblique – to the inguinal ligament
  - Then adding an overlying double layer of transversus and internal oblique aponeurosis to the undersurface of the external oblique aponeurosis
  - “Vest over pants”
  - An unusual feature of the procedure is the routine sacrifice of the lateral cremasteric bundle, a structure that contains the external spermatic vessels and the genital branch of the genitofemoral nerve.
    - Shouldice surgeons have not reported any ill effects related to this step. The minor sensation loss that results from dividing that nerve has not proven to be a substantial or longstanding disability.
  - Pt Discharge – 48 – 72 hours post operative
Progress?

- Recurrence rates 10-15% with Bassini, Halstead and McVay to 1-2% with Shouldice repairs.

However

- These were all considered tension repairs and resulted in postoperative pain and extensive patient disability.
1950’s: introduced a better understanding of the anatomy of the abdominal wall in the groin.

Need to protect the anatomic defect - femoral triangles - in order to have a successful repair.

Rives and Stoppa developed the posterior preperitoneal approach to hernia repairs.
In 1958 – Usher et. al. described a hemia repair using Marlex mesh.

- The mesh was sutured to the undersurface of the medial margin of the defect and to the shelving edge of the inguinal ligament.
- Tails created from the mesh encircled the spermatic cord and were sutured to the inguinal ligament.

Stoppa and later Nyhus used a posterior approach.

- The mesh was placed between the transversalis fascia and the peritoneum.
Lichtenstein

- Popularized the use of mesh, coining the term "tension free repair"
  - Uses non-absorbable sutures and a prosthetic flat mesh to reinforce the canal floor
  - Do not need general anesthesia and can be performed on an outpatient basis
  - But: no posterior support and no protection of the femoral canal
Gilbert

- Wanted to reduce the chance of injuring the nerves and the spermatic cord. His goal was to direct his repair to the hemia sac and the defect in the internal ring.
- Described a sutureless repair where he used a self made cone shaped piece of mesh to repair indirect hemias.
Rutkow and Robbins

Used it to repair both direct and indirect hernias

- Started as an umbrella plug held together by a suture
- Led to the development of the PerFix plug (C.R. Bard)
- Patch and Plug system: an onlay patch, which can be used with or without sutures, is placed over the posterior wall and around the spermatic cord lateral to the internal ring.
- The patch is there to strengthen the direct space
**Gilbert – 1990’s**

- Then used the inguinal ring to access the preperitoneal space through an open anterior approach
- Led to the development of the Prolene Hernia System (PHS – Ethicon)
- 3 in 1 system consisting of an underlay patch, an overlay patch and an interconnecting ring
The underlay mesh is placed via the inguinal ring in the preperitoneal space and is not sutured.

The overlay mesh is sutured.

The interconnector reduces the likelihood of mesh migration.

Reduced rates of recurrence!

- because of coverage of the lateral triangle of the groin where recurrence can occur at the point between the mesh and the weaker adjacent tissue.
Complications?
### Complications of inguinal hemia repair

<table>
<thead>
<tr>
<th></th>
<th>Operative</th>
<th>Early</th>
<th>Later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incision</td>
<td>Bruising, hematoma</td>
<td>Infection</td>
<td>Chronic sepsis &amp; sinus formation</td>
</tr>
<tr>
<td>Scrotum</td>
<td>Genital edema</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>orchitis/atrophy</td>
<td></td>
<td></td>
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<tr>
<td>Technique</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>open:</td>
<td>Nerve injuries and injury to vas</td>
<td>Hydrocele</td>
<td>recurrence and pain</td>
</tr>
<tr>
<td>Laparoscopic:</td>
<td>As above and Vascular</td>
<td></td>
<td>port site hernias</td>
</tr>
<tr>
<td></td>
<td>injuries, Visceral injuries</td>
<td></td>
<td>recurrence pain</td>
</tr>
<tr>
<td>Systemic</td>
<td>General/local anesthesia</td>
<td>Chest infection</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Urinary retention</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Venous thrombosis</td>
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</tbody>
</table>

Complications

- Recurrence
  - 10-15% to 1.5% at the Shouldice clinic
  - 1% with mesh repairs

- Infection

- Mesh removal

Wound infection?

- The possibility of wound infections was a concern because the introduction of a foreign body into a clean case.
- Shouldice clinic – 1-2%
- 3-9% reported by Bailey et al – hospital vs community surveillance
- Usual culprits – *Staphylococcus aureus* and *epidermidis*.
- Prophylactic antibiotics
# Prophylactic Antibiotics

Table 3. Studies addressing the problem of wound infection and the routine use of antibiotics in open hernia repair with mesh

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Infection (%)</th>
<th>Conclusions</th>
</tr>
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<tbody>
<tr>
<td><strong>Hernia specialists</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lichtenstein</td>
<td>10000</td>
<td>0</td>
<td>No comment</td>
</tr>
<tr>
<td>Kurzer et al</td>
<td>2906</td>
<td>1.3</td>
<td>Not necessary</td>
</tr>
<tr>
<td>Shulman et al</td>
<td>3019</td>
<td>0.5</td>
<td>Not necessary</td>
</tr>
<tr>
<td>Robbins &amp; Rutkow</td>
<td>1563</td>
<td>0.4</td>
<td>Not necessary</td>
</tr>
<tr>
<td>Gilbert</td>
<td>1044</td>
<td>0.9</td>
<td>Not necessary</td>
</tr>
<tr>
<td><strong>Nonspecialists</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gilbert &amp; Felton</td>
<td>1834</td>
<td>0.8</td>
<td>Not necessary</td>
</tr>
<tr>
<td>Shulman et al</td>
<td>16,068</td>
<td>0.6</td>
<td>Not necessary</td>
</tr>
<tr>
<td><strong>Prospective randomized studies</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lazorthes et al</td>
<td>153 vs 155</td>
<td>4.6 vs 0.0</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Taylor et al</td>
<td>280 vs 283</td>
<td>8.9 vs 8.8</td>
<td>Not necessary</td>
</tr>
<tr>
<td>Yerdel et al</td>
<td>133 vs 136</td>
<td>9.0 vs 0.7</td>
<td>Mandatory</td>
</tr>
</tbody>
</table>
Management of wound infection

- Worse complication is infection of the mesh.
- Care has to be taken with superficial wound infections not to expose the underlying mesh even if the wound needs to be opened for drainage.
- With a true mesh infection the mesh can be seen floating in a pool of pus and surrounded by a thick fibrous capsule.
- Presents at around 4 months post op with groin sepsis.
- Mann et al. of Scotland suggested that the incidence is probably 1 in 1000 and Yerdel reports an incidence of 1% of meshes requiring removal.
- But there is little literature describing this to be a huge problem and mesh is used in cases with increased chances for infection such as strangulated bowel and the repair of parastomal hernias.
Chronic groin pain

- According to some population based studies 1/3 of patients complain of pain 12 months or more after the repair.

- Neuralgic inguinodynia
  - Hyperesthesia along the dermatome
  - Exquisite pain at the site of the a neuroma or trapped nerve - patients describe a pain like an electric shock
  - Careful technique preserving the ilioinguinal and iliohypogastric nerve
  - particularly when closing the aponeurosis of the external oblique in the creation of the new external ring.

Treatment – reexploration with division of the three groin nerves.
Laparoscopic repair

- Described initially by Ger, Shultz et al, Corbitt and Filipi et al
  - Placing a piece of mesh in the preperitoneal space
  - Either extraperitoneal or transabdominal approach
    with or without tacking sutures
Complications

Laparoscopic repair –

- Small bowel obstruction
- Injury to the epigastric vessels or obturator artery,
- Internal hemia,
- Bladder or visceral perforation,
- Infarcted omentum
- Port site hemia
- Higher recurrence rates
Laparoscopic Repair

Advantages:
- Less post-op pain,
- Earlier return to work
  - 14 vs 21 days

But:
- High cost
- Steep learning curve
- More serious possible complications
- General anesthesia
Laparoscopic led to an increased adoption of the open preperitoneal approach.

Preperitoneal vs LHR:
- Return to work
- 10.3 days vs 12.6 days - not statistically significant
- Less complications