Progressive Pneumoperitoneum for the Repair of Massive Inguinal Hernias

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ACGME Core Competencies

- Patient Care
- Medical knowledge
- Practice Based Learning & Improvement
- Interpersonal & Communication Skills
- Professionalism
- Systems based practice
Case presentation

- 74 y/o male presented to surgery clinic with a massive right inguinal hernia, that became progressively larger over the past 20 years.
- Intermittent right groin pain.
- Urinary incontinence.
- Progressive impairment of activities of daily living (ambulation).
- PMH- Alzheimer's disease recently diagnosed
- Meds- ASA
- PSH- denies
- Allergies- NKDA
Physical Exam

- Abdomen
  - Scaphoid, soft, nontender, nondistended.

- Right groin
  - Massive right inguinal hernia with scrotum extending to knee caps.
  - Hernia nontender.
  - Scrotum does not transilluminate.

- Left groin- no palpable hernias.

- Labs – WNL
Abdomen and Pelvis CT Scan

Contrast: CONTRAST
Gantry: 0°
FoV: 498 mm
Time: ms
Slice: 3 mm
Pos: 516.3
FFS

F: C
MAS: 275
140 kV
Image no: 319
Image 955 of 1560

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Case Presentation

- 74 y/o male with massive right inguinal hernia with loss of intraabdominal domain, affecting ADL.

- Standard reduction and primary repair
  - Abdominal compartment syndrome.
  - Respiratory distress.
  - Hernia recurrence.

- Progressive Preoperative Pneumoperitoneum
  - Insufflation of ambient air into peritoneal cavity in order to accommodate herniated viscera at time of hernia repair.
**Progressive Preoperative Pneumoperitoneum**

- Peritoneal dialysis catheter placed and one liter of air was insufflated into the abdomen.
- During each clinic visit (every 2 – 3 days for a 20 day period) approximately one liter of ambient air was introduced to the abdominal cavity via the dialysis catheter.
  - Pt tolerated procedure well. Denied abdominal pain, n/v or dyspnea.
- Pt admitted for bowel prep prior to RIH repair.
Right inguinal hernia repair

- Long right inguinal incision.
- Massive inguinal hernia extending to right scrotum.
  - Right colon and loops of small bowel within sac
  - Contents of spermatic cord were identified and isolated.
- Contents of the hernia were reduced to the abdomen after incision on the anterior abdominal wall, lateral to internal ring.
  - Residual hernia sac was resected.
Right inguinal hernia repair

- Vas deferens and testicle were placed in the scrotum.
- The hernia defect extended from the pubic tubercle, towards the internal ring including the entire inguinal floor.
- Proced mesh 4 x 5.5cm (with keyhole for spermatic cord) was secured with 0 Tevdek suture to pubic tubercle, inguinal ligament and superior edge of internal oblique muscle aponeurosis.
Right inguinal hernia repair

- Aponeurosis of external oblique muscle was closed with 2-0 vicryl running sutures.
- Peak airway pressures increased slightly from low 20s to upper 20s. No respiratory distress upon full reduction of herniated viscera.
- Peritoneal dialysis catheter removed via infraumbilical incision.
- Pt was extubated in OR and transferred to SICU.
Post-op course

- **POD #2**
  - Pt started on clears.
  - Abdomen became mildly distended.
  - AXR showed large stomach air bubble.
  - Pt placed NPO. NGT placed.
  - Bladder pressures WNL

- **POD #5**
  - Abdominal distention improved. Pt started on clears.

- **POD #8**
  - Tolerating clears, +flatus, +BM, transferred to floor.

- **POD #9**
  - Advanced to regular diet
Post-op course

- **POD#10**
  - Mild respiratory distress
  - Chest CT positive for PE
  - Pt transferred to SICU and started on heparin drip.
  - AXR showed gastric distention.

- **POD #14** - Abdominal distention persisted
  - CT scan positive for intraabdominal hematoma and 1.5cm pseudoaneurysm of pancreaticoduodenal artery (PDA)

- **POD#15** - angiogram and coil embolization of inferior PDA.

- **POD #16** - Pt started on clears, transferred to floor.

- **POD #17** - Advanced to regular diet.

- **POD #24** - discharged to rehab facility.
Progressive Pneumoperitoneum for the Repair of Massive Inguinal Hernias
Megahernia

- Hernia that exceeds 20 cm in diameter and has lost its right of domicile in the peritoneal cavity for a period of one year.¹
Loss of domain induces

- Impaired venous and lymphatic return from viscera due to compression from the hernia defect.¹
  - Dilation of mesentery and bowel wall edema.
  - Impairs reduction
- Decrease in intraabdominal pressure
  - Decrease capacity of the abdominal cavity
  - Hemidiaphragm lowers altering ventilatory mechanism.
Possible complications of reduction

- Increased abdominal pressure
  - Decreased venous return.
  - Abdominal compartment syndrome.
- Elevation of diaphragm
  - Increased thoracic pressure causing respiratory distress.²
- Dehiscence with hernia recurrence.¹
Alternatives of repair

- Resection omentum and bowel.
  - Increase morbidity/mortality associated with bowel resection.
    - Short gut syndrome - nutritional problems
  - Requires a separate incision.¹

- Phrenectomy (Tournoff - 1950s)
  - Respiratory complications.³
Alternatives of repair

- Creation of ventral hernia (Ziffrin and Womack-1950)\(^4\)
  - Long transverse abdominal incision.
  - Division of abdominal wall except the peritoneum.
  - Reduction and repair of inguinal hernia.
  - Peritoneum protrudes through unsutured fascia (ventral herniation).
  - Closure of fascia (ventral hernia repair) 12 days later.
  - Useful when size of hernia was misjudged pre-op, and when pt develops circulatory or respiratory distress intra-op.
  - Requires a second surgical procedure.
Alternatives of repair

- Preoperative Progressive Pneumoperitoneum
  - Ivan Goni Moreno (1940s)
  - Intraperitoneal injection of oxygen to expand the abdominal cavity before hernia repair, making room to accommodate herniated viscera.
  - First case reported was repair of incarcerated epigastric hernia.\(^5\)
  - Reported 3% recurrance rate in a series of 487 giant hernia repairs.
Alternatives of repair

- **Preoperative Progressive Pneumoperitoneum**
  - Koontz and Graves (1954)
    - Reported successful repair abdominal wall hernias with loss of domicile with this technique.\(^4\)
  - This technique was then applied to inguinal hernia repairs and for repair of omphaloceles. \(^3\)
Preoperative Progressive Pneumoperitoneum

- **Indication**
  - Repair massive abdominal wall hernias with loss of intraabdominal domain. \(^6\)

- **Contraindications**
  - Advanced age and poor general condition.
  - Cardiac decompensation. \(^1\)
Advantages of Preoperative Progressive Pneumoperitoneum

- Stretches the abdominal wall, creating a larger cavity for operative reduction of herniated viscera.
- Stretches the hernia sac causing elongation of adhesions, for an easier dissection.
- Induces preoperative respiratory and circulatory adjustments to the elevation of the diaphragm.\(^5\)
  - Increases tone of diaphragm.
Technique for Establishing Pneumoperitoneum

- Intermittent percutaneous puncture of abdominal wall
  - Spinal needle or a 16-gauge angiocath.
  - Increased risk of bowel perforation.

- Abdominal indwelling catheter
  - Started by Steichen in 1965.
  - Modified Seldinger technique.

- Catheter connected to a 3-way stop-cock attached to a syringe.
Injection of 500 to 1500 ml of ambient air upon the first treatment.

Injection of air is stopped if
- Diffuse abdominal pain
- Lumbar or shoulder pain,
- Dyspnea or palpitations.

Air is withdrawn if discomfort persists.
Total amount of air injected depends on
- size of hernia and abdominal cavity
- presence of adhesions
- individual patient tolerance.  

Air injections every 2 - 5 days for ten days to three weeks prior to surgery.

Insufflations done as outpatient, bed rest not necessary.

Spirometry pre-op.
## Results of Progressive Preoperative Pneumoperitoneum

<table>
<thead>
<tr>
<th>Hernia repairs</th>
<th>Period of pneumoperitoneum</th>
<th>Type of repair</th>
<th>Results and complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ali et al (1975-Washington DC)¹</td>
<td>1 inguinal</td>
<td>19 days via puncture w. a spinal needle</td>
<td>McVay</td>
</tr>
<tr>
<td>Coopwood et al (1987-Tennessee)⁸</td>
<td>1 inguinal, 1 incisional</td>
<td>5-6 days via puncture w. 16G angiocather</td>
<td>Lichtenstein</td>
</tr>
<tr>
<td>Mayagoitia et al (2005-Mexico)⁶</td>
<td>1 inguinal, 11 ventral</td>
<td>9.3 days via indwelling cath</td>
<td>Lichtenstein</td>
</tr>
<tr>
<td>Rodriguez Ortega et al (2005-Spain)²</td>
<td>2 inguinal, 1 umbilical, 1 incisional</td>
<td>1-3 weeks via JP drain</td>
<td>Lichtenstein</td>
</tr>
</tbody>
</table>
Complications of Preoperative Progressive Pneumoperitoneum

- Organ perforation.
- Subcutaneous emphysema.
- Epigastric pain, sensation of gastric fullness.
- Hematoma formation.
- Spontaneous dissection of the gallbladder from the hepatic bed.
- Air emboli.
- Failure to establish pneumoperitoneum (intraabdominal adhesions from previous surgery)
Progressive preoperative pneumoperitoneum is a useful adjunct in the repair of massive inguinal hernias with loss of domain.

- It gradually expands the abdominal cavity and increases in intraabdominal and thoracic pressures, that may prevent abdominal compartment syndrome and acute respiratory distress upon hernia reduction.

- Complications similar to those of pneumoperitoneum for laparoscopic surgery.
1. Indications for preoperative progressive pneumoperitoneum include:
   a) Patient with giant inguinal hernia and poor general medical condition.
   b) Massive abdominal wall hernias with loss of intraabdominal domain.
   c) Strangulated inguinal hernia with evidence of ischemic bowel.
   d) Small reducible inguinal hernias.
2. Loss of intraabdominal domain induces all of the following except:

a) Impaired venous and lymphatic return from viscera due to compression from the hernia defect causing dilation of mesentery and bowel wall edema.

b) Decrease in intraabdominal pressure.

c) Decrease capacity of the abdominal cavity.

d) Elevation of the diaphragm.
3. Possible complications of reduction of massive inguinal hernias include:

a) Increased abdominal pressure and decreased venous return leading abdominal compartment syndrome.

b) Elevation of diaphragm leading to increased thoracic pressure causing respiratory distress.

c) Dehiscence with hernia recurrence.

d) All of the above.
4. Regarding establishment of pneumoperitoneum all are correct except:

a) Injection of air is done via indwelling catheter.
b) Injection of air is stopped when patient complaints of diffuse abdominal pain, lumbar or shoulder pain, dyspnea or palpitations.
c) Injection of air is done on an in-patient basis.
d) Pneumoperitoneum can be effectively instituted from ten days to three weeks prior to surgery.
5. The advantages of Preoperative Progressive Pneumoperitoneum include:

a) Stretching of the abdominal wall, creating a larger cavity for operative reduction of herniated viscera.

b) Stretching of the hernia sac causing elongation of adhesions, for an easier dissection or reduction.

c) Increased tone of diaphragm.

d) Preoperative respiratory and circulatory adjustments to the elevation of the diaphragm.

e) All of the above.
Thank you!