Complicated Acute Appendicitis

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March 2012

Acute appendicitis
• > 250,000 appendectomies/year
• Incidence
  – 86 per 100,000
• Prevalence
  – 7-8% of US population affected in their lifetime (Mayo)

Most common surgical emergency of the abdomen

Complicated acute appendicitis
• gangrene
• perforation
• abscess
• appendiceal mass
• cecal mass
• diverticulitis
• pregnancy
• immunosuppression
• morbid obesity

Gangrenous appendicitis
• represents more advanced disease
• associated with poor tissue quality
• may go unrecognized on imaging

Thin walled, dilated appendix with fecalith, associated fluid and air within the lumen
Gangrenous appendicitis

- associated with increased complication rates
- may have poor tissue quality at site of appendiceal division
- Tools:
  - “no touch” technique
  - margin of healthy tissue
  - partial cecectomy if needed

Perforated appendicitis

- 15-20% of all cases
- 50% in pts <10yrs, >50yrs
- characterized by more severe pain and higher fever

Treatment of perforated acute appendicitis

- broad Abx coverage
- open vs. lap appendectomy

Antibiotic treatment for perforated or gangrenous appendicitis

- Type?
- Duration?

Baron et al, Clin Inf Dis, Oxford 1992
-cultured peritoneal fluid in cases of non-perforated and perforated appendicitis, found 3 vs 9 types of bacteria, respectively

Hoelzer et al, Pediatric Inf Dis J 1999;18:979
-assessed the safety of discontinuing Abx when pts postoperatively have
  - started eating
  - afebrile
  - have a normal WBC
Open vs. laparoscopic appendectomy

- first described by McBurney in 1894
- safe
- expeditious
- first described by Semm in 1983
- allows full exploration of the abdomen
- small incisions
- allows for "no touch" technique
- appendix removed in a bag device

(Semm et al, Endoscopy 1983;15:59)

Cochraine review: Laparoscopic vs. Open Appendectomy

- decreased wound infection rate
- increased intra-abdominal abscess risk
- shorter hospital stay
- shorter return to normal activity and work
- longer duration of surgery
- increased hospital cost
- decreased pain as reported by patients

(Cochraine Database of Systematic Review 2004;18(4):CD001546)

Laparoscopic vs. open appendectomy for perforated appendicitis

- Small, retrospective studies
  - longer duration of surgery in open group, or no difference
  - variable rate of postoperative infections, postoperative ileus
  - Increased conversion to open rate compared to non-perforated cases
- Meta-analysis in WJS 2010
  - Laparoscopic appendectomy “advantageous with regard to surgical site infections, with no increased intra-abdominal infections” (Markides et al, WJS 2010;34(3):2026)

(Appendiceal abscess

- more common in elderly patients
- seen in up to 47% of patients with perforated appendicitis
- controversy: timing of surgery

(Wittmann et al, Principles of Surgery, 6th ed)
Appendiceal abscess

Immediate operation

- shorter duration of illness
- increased risk of bowel injury

Percutaneous drainage

interval operation

- longer duration of illness
- decreased risk of bowel injury
- additional work-up
- no further operation

Appendiceal abscess/phlegmon

I. Immediate surgery is associated with a higher morbidity compared with nonsurgical treatment (odds ratio, 3.3; CI: 1.9-5.6; P < 0.001).

II. After successful nonsurgical treatment, a malignant disease is detected in 1.2% (CI: 0.6-1.7) and an important benign disease in 0.7% (CI: 0.2-11.9) during follow-up.

- The risk of recurrence is 7.4% (CI: 3.7-11.1) (up in 14% in other studies)

(Andersson et al, Ann Surg 2007)

Appendiceal Abscess

CT Scan or Ultrasound

Abscess > 4-6cm

Pleghmon + Small Abscess

Antibiotics

Drainage

Children

Interval Appendectomy

No Improvement

Operate

Adults

Improvement

Regular Diet, Antibiotics

Discharge

Colonoscopy 2-4 weeks

No Neoplasm

Consider Interval Appendectomy

Neoplasm

Staging/ Colectomy

(From Maa & Kirkwood, Sabiston 18th ed)

Tools/tips for perforated/gangrenous appendicitis

- Preoperative planning
- Multiple scopes, endoloops vs staplers
- Pulse lavage, high -flow irrigation system
- Additional ports
- Alternate surgeon positions
- Alternate patient positions
- Conversion vs delayed operation
Complicated acute appendicitis

- pregnancy
- immunosuppression
- morbid obesity

Acute appendicitis during Pregnancy

- most common non-obstetric cause of acute abdomen
- 1:500 to 1:2000 pregnancies
- same incidence as that in non-pregnant women
- occurs in all trimesters

Ohta, JCTM 2001
Mazze, Obstet Gynecol 1991

The diagnosis of acute appendicitis during pregnancy can be challenging

- history and physical
- laboratory analysis
- radiographic studies

All of which are altered in pregnancy!

The Anatomic changes of Pregnancy

* More horizontal stomach
* Transverse colon pushed up
* Small intestines displaced in upper quadrants
* Ascending and descending colon pushed towards flanks

(Baer, JAMA 1932)
Acute appendicitis during pregnancy: diagnosis

- Ultrasound ➔ Sensitive but not specific
- MRI ➔ Emerging technology
- CT scan ➔ Not very specific
- CT scan ➔ Not well studied
- CT scan ➔ Difficult to obtain after hours
- Sensitive and specific
- Teratogenic risk in the first trimester
- 2-fold increase risk in childhood cancer for the fetus

Acute appendicitis during pregnancy: management

- Resuscitation
- Broad-spectrum ABx
- Appendectomy
  - Open vs. laparoscopic

Radiation exposure during Pregnancy

<table>
<thead>
<tr>
<th>Prenatal Radiation Exposure: A Fact Sheet for Physicians</th>
<th>(continued from previous page)</th>
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</thead>
<tbody>
<tr>
<td>Table 3: Potential Health Effects (Other than Cancer) of Prenatal Radiation Exposure</td>
<td>(continued from previous page)</td>
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<tr>
<td>Type of Radiation Exposure and Dose (rads)</td>
<td>Risk of Cataract Formation</td>
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<tr>
<td>0.64-10 rads (5-10 mSv)</td>
<td>Nontarget (e.g., abdominal area)</td>
</tr>
<tr>
<td>Standard pelvic CT (5-10 rad)</td>
<td>Centers for Disease Control, March 23, 2005</td>
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Acute appendicitis during Pregnancy

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Incid</th>
<th>-Appy</th>
<th>Perf</th>
<th>Fetal mort</th>
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<tbody>
<tr>
<td>Mazze et al</td>
<td>1991</td>
<td>778</td>
<td>1:936</td>
<td>36%</td>
<td>6%</td>
<td>1.8%</td>
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<tr>
<td>Uebernueck et al</td>
<td>2004</td>
<td>94</td>
<td>1:499</td>
<td>23%</td>
<td>15%</td>
<td>7%</td>
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<tr>
<td>Tamir et al</td>
<td>1990</td>
<td>84</td>
<td>-</td>
<td>18%</td>
<td>27%</td>
<td>5.9%</td>
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<tr>
<td>Anderson et al</td>
<td>1999</td>
<td>56</td>
<td>1:766</td>
<td>25%</td>
<td>-</td>
<td>7.1%</td>
</tr>
</tbody>
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Whereas nonperforated appendicitis carries a fetal mortality rate of less than 5%, in cases of perforated appendicitis it exceeds 20%.

Laparoscopic Surgery during Pregnancy: Theoretical concerns

- Trocar injury
- CO2 pneumoperitoneum
  - fetal acidosis
  - decreased uterine blood flow

Guidelines for laparoscopic surgery during pregnancy

- Preoperative obstetrical consultation
- Use pneumatic compression devices
- Monitor maternal end tidal CO2/blood gases

Society of American Gastrointestinal and Endoscopic Surgeons, rev 2000
Guidelines for laparoscopic surgery during pregnancy

- Obtain abdominal access with an “open technique”
- Shift the uterus off the inferior vena cava
- Minimize pneumoperitoneum pressures to 8-12 mm Hg

Acute appendicitis in the immunosuppressed

- Physical findings may be mild
- Broad differential
- Enterocolitis/typhilitis not uncommon
- Do not delay operative tx
- Involve patient and Oncologist in the decision
- Outcomes may be poor

Acute appendicitis in the morbidly obese

- Diagnosis can be difficult
- Imaging restrictions based on weight
- Laparoscopic appendectomy associated with shorter LOS and morbidity
- Need to request bariatric equipment
  - bariatric OR, ward beds
  - pressure points padded
  - extra long trocars and instruments


Complicated acute appendicitis

- comprise 1-2% of appendectomies
- appendectomy if small mass (<2cm), not involving the base
- consider cecectomy, hemicolecotomy
- cecal diverticulitis treated medically if dx’d on imaging, treatment is controversial for that dx’d intraoperatively

(Landry et al, Arch Surg 2008;143(7):664)
(Harada et al, Am J Surg 1993;166:666)

Laparoscopic tools for complicated acute appendicitis

- 10 and 5-30 degree scopes
- High pressure pulse-lavage irrigation system
- Open Hasson technique for pregnant patients
- Multi-disciplinary care as needed (OB, Cardiology, Bariatric, Heme-Onc)