Acute Appendicitis: the bad & the ugly

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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
- pregnancy
- immunosuppression
- morbid obesity
- appendiceal mass
- cecal mass
- diverticulitis

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

- 15-28% of all cases
- 50% in pts <10yrs, >50yrs
- characterized by more severe pain and higher fever

Treatment of perforated acute appendicitis

- Antibiotics
- open vs. lap appendectomy
- Irrigation vs suctioning
- drains

Antibiotic treatment for perforated or gangrenous appendicitis

- Yes/No?

- Antibiotic vs placebo for the prevention of postoperative complications after appendectomy
  - RCT, CCT
  - outcome measures: wound infection, intra-abdominal abscess, length of stay, mortality
  - the efficacy of different Abx regimens was not evaluated
  - 45 studies, 9576 patients

The use of antibiotics is superior to placebo for preventing wound infection and intra-abdominal abscess
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

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(9):2026)

(Lim et al, J Korean Soc Coloproctol 2011;27:293)
(Yak et al, JACS 2007;205(1):60)
(Kirshtein et al, WJS 2007;31(4):744)
(Ball et al, Surgical Endoscopy 2004; 18(6):969)
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/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: 0.2-1.1) 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)

Surgical treatment for perforated appendicitis with abscess

- shorter duration of illness
- Lower hospital costs
- increased risk of bowel injury

Early operation

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

Percutaneous drainage interval operation

Early vs Interval appendectomy for children with perforated appendicitis

- 131 children enrolled -64 early (<24hrs) -67 interval (6-8wks)
- Early appendectomy significantly reduced time away from normal activities
- The overall adverse events rate after early appendectomy was significantly lower

Early vs Interval appendectomy for children with perforated appendicitis

<table>
<thead>
<tr>
<th>Event</th>
<th>Early (n=64)</th>
<th>Interval (n=67)</th>
<th>RR Associated With Interval Appendectomy (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any adverse event</td>
<td>19 (30)</td>
<td>27 (39)</td>
<td>1.94 (1.91-2.30)</td>
<td>0.83</td>
</tr>
<tr>
<td>Ileo-intestinal fistulas</td>
<td>12 (19)</td>
<td>26 (38)</td>
<td>1.38 (0.70-2.70)</td>
<td>0.82</td>
</tr>
<tr>
<td>Small bowel obstruction</td>
<td>0</td>
<td>7 (11)</td>
<td>0.00 (0.00-0.00)</td>
<td>0.81</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>0 (0)</td>
<td>5 (8)</td>
<td>0.00 (0.00-0.00)</td>
<td>0.81</td>
</tr>
<tr>
<td>DSS-related adverse event</td>
<td>1 (1.6)</td>
<td>4 (6.0)</td>
<td>0.00 (0.00-0.00)</td>
<td>0.81</td>
</tr>
<tr>
<td>Recurrent appendicitis</td>
<td>0</td>
<td>4 (5.9)</td>
<td>0.00 (0.00-0.00)</td>
<td>0.81</td>
</tr>
</tbody>
</table>

(Blakely et al Arch Surg 2011;146(4):660)
Appendiceal Abscess

- CT Scan or Ultrasound
- Abscess > 4-6cm
- Phlegmon or Small Abscess
- Antibiotics
- Drainage

Children

Adults

Interval Appendectomy

No Improvement
- Fever/Septic
- Abdominal

Improvement
- Regular Diet, Antibiotics
- Drainage
- Colonoscopy 2-4 weeks

No Neoplasm

Consider Interval Appendectomy

Neoplasm

Staging/Colectomy

(From Maa & Kirkwood, Sabiston 18th ed)

Irrigation versus suction for perforated appendicitis


Irrigation versus suction alone during laparoscopic appendectomy for perforated appendicitis: a prospective randomized trial

- 220 patients treated laparoscopically and enrolled
- no difference in the abscess rate, which was 19.1% with suction only and 18.3% with irrigation

The role of routine abdominal drainage

- Allemann P et al Langenbacks Arch Surg 2011;396:63

Prevention of infectious complications after laparoscopic appendectomy for complicated acute appendicitis - the role of routine abdominal drainage

- Case match study of 130 patients
- Uncomplicated appendicitis and diffuse peritonitis excluded
- Patients without drains had fewer complications, shorter LOS

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
- old age
- chronic illness

Acute appendicitis in the immunosuppressed

- physical findings may be mild
- broad differential
- enterocolitis/typhlitis not uncommon
- do not delay operative tx
- involve patient and Oncologist in the decision
- outcomes may be poor

Organ transplantation

HIV/AIDS

Immunosuppressive tx for autoimmune or neoplastic pathology

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

(Chui et al, Pediatr Blood Cancer 2008;50(6):1282)

39yo woman day 12 of tx for relapsing acute lymphoblastic leukemia, with WBC 0.1, PLT count 10k
Complicated acute appendicitis

- comprise 1-2% of appendectomies
- appendectomy if small mass (<2cm), not involving the base
- consider cecectomy, hemicolectomy

Appendiceal carcinoma

- Most common neoplasms of the appendix
- Most often discovered in 4-5th decade of life
- 75% involve distal 1/3rd, less than 10% involve base
- Most tumors are less than 1cm (Moertel et al, NEJM 1987)
- 5 yr survival 94% local, 85% regional mets, 34% distal

Adenocarcinoma of the appendix

- Comprise 0.1-0.8% of appendectomies
- 29% nodal metastases
- Prognosis poor- 5 yr survival about 20% with appendectomy alone, 63% after right colectomy
- Appendectomy sufficient for mucosal lesions with negative margins

Mucinous adenocarcinoma of the appendix

- Rare tumors of the appendix
- Propensity of peritoneal-based metastases, but low nodal metastasis (6-20%)
- Hemicolectomy controversial. Historically accepted, good for staging, several studies showed no statistical difference in survival
Cecal diverticulitis

- Right sided diverticulitis first described by Potier in 1912
- “true” diverticulea
- cecal diverticulitis treated medically if dx’d on imaging, treatment is controversial for that dx’d intraoperatively

(Lissa et al Eur J Gastroenterol Hepatol 2012;24:1254)

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, Surg Onc)