Complicated Acute Appendicitis

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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

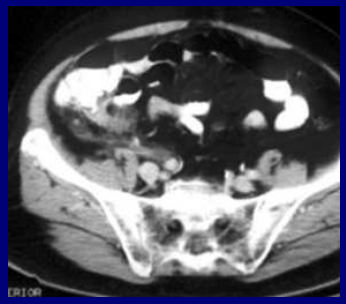
Complicated acute appendicitis

- gangrene
- perforation
- abscess

- pregnancy
- immunosuppression
- morbid obesity

- appendiceal mass
- cecal mass
- diverticulitis

Gangrenous appendicitis

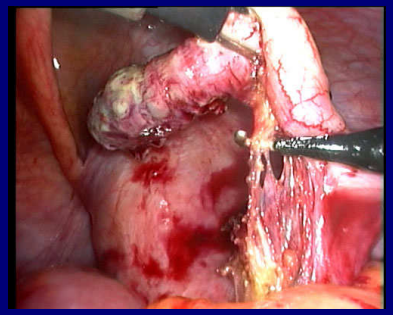


- represents more advanced disease
- associated with poor tissue quality
- may go unrecognized on imaging

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

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

(Yak et al, JACS 2007;205(1):60)

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

THE COCHRANE COLLABORATION®

- 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 Coloprocol 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

Immediate operation

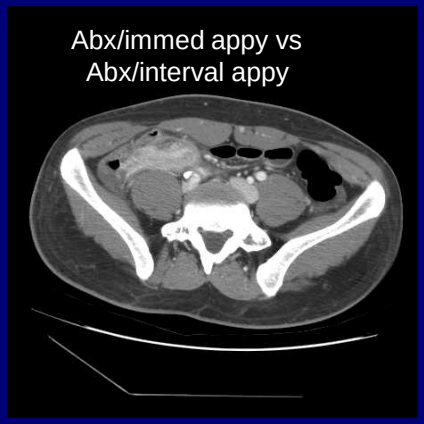
- shorter duration of illness
- increased risk of bowel injury

Percutaneous drainage interval operation

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

Appendiceal abscess/phlegmon

Abx/immed appy vs Abx/interval appy

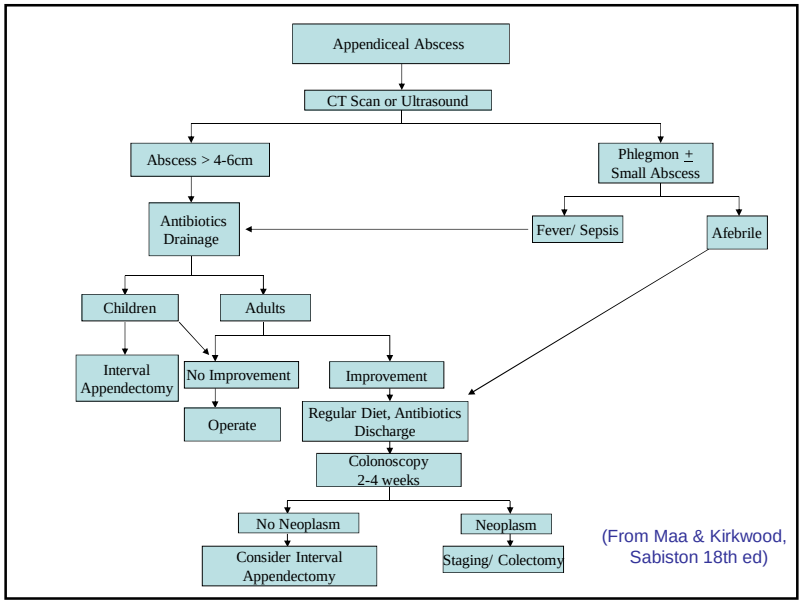


(Andersson et al, Ann Surg 2007)

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)



(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, JCEM 2001
Mazze, Obstet Gynecol 1991

The diagnosis of acute appendicitis during pregnancy can be challenging

- history and physical
- laboratory analysis
- radiographic studies

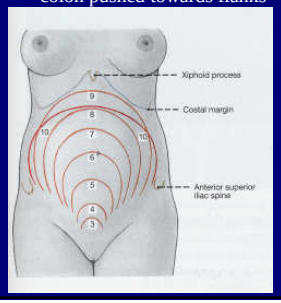
❖All of which are altered in pregnancy!

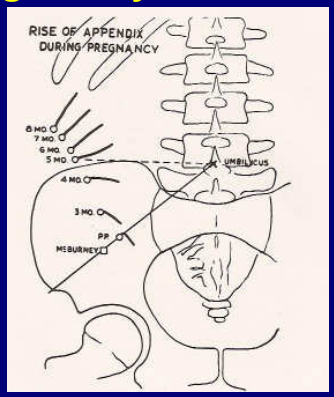
The Anatomic changes of Pregnancy

*More horizontal stomach
*Transverse colon pushed up

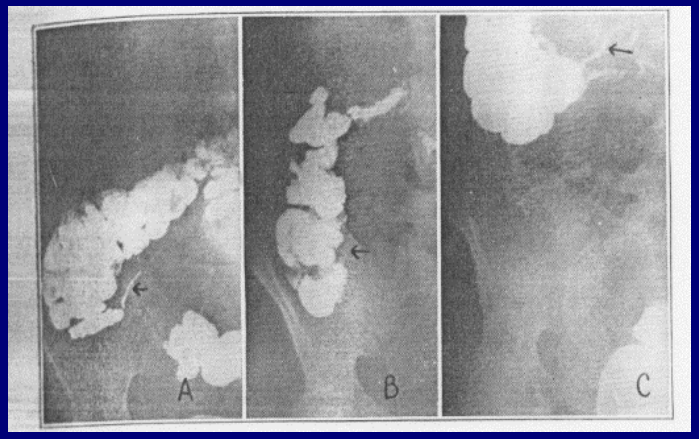
*Small intestines displaced in upper quadrants

*Ascending and descending colon pushed towards flanks





(Baer, JAMA 1932)



3rd month 6th month 8th month

(Baer, JAMA 1932)

Acute appendicitis during pregnancy: diagnosis

- Ultrasound → ❖Sensitive but not specific ❖Not good in 3rd trimester
- MRI → ❖Emerging technology ❖Not well studied ❖Difficult to obtain after hours
- CT scan → ❖Sensitive and specific ❖Teratogenic risk in the first trimester ❖2-fold increase risk in childhood cancer for the fetus

Radiation exposure during Pregnancy

Prenatal Radiation Exposure: A Fact Sheet for Physicians
(continued from previous page)

Table 1: Potential Health Effects (Other Than Cancer) of Prenatal Radiation Exposure

Acute Radiation Dose* to the Embryo/Fetus	Time Post Conception				
	Blastogenesis (up to 2 wks)	Organogenesis (2–7 wks)	Fetogenesis (8–15 wks)	(16–25 wks)	(26–38 wks)
< 0.05 Gy (5 rads)†	Noncancer health effects NOT detectable				
0.05–0.50 Gy (5–50 rads)	Incidence of failure to implant may increase slightly, but surviving embryos will probably have no significant (noncancer) health effects	• Incidence of major malformations may increase slightly • Growth retardation possible	• Growth retardation possible • Reduction in IQ possible (up to 15 points, depending on dose) • Incidence of severe mental retardation up to 20%, depending on dose	Noncancer health effects unlikely	
> 0.50 Gy (50 rads) *The expectant mother may be experiencing acute radiation syndrome in this range, depending on her whole-body dose.*	Incidence of failure to implant will likely be large‡, depending on dose, but surviving embryos will probably have no significant (noncancer) health effects	• Incidence of miscarriage may increase, depending on dose • Substantial risk of major malformations such as neurological and motor deficiencies • Growth retardation likely	• Incidence of miscarriage probably will increase, depending on dose • Growth retardation likely • Reduction in IQ possible (> 15 points, depending on dose) • Incidence of severe mental retardation > 20%, depending on dose • Incidence of major malformations will probably increase	• Incidence of miscarriage may increase, depending on dose • Growth retardation possible, depending on dose • Reduction in IQ possible, depending on dose • Severe mental retardation possible, depending on dose • Incidence of major malformations may increase	Incidence of miscarriage and neonatal death will probably increase depending on dose§

Note: This table is intended only as a guide. The indicated doses and times post conception are approximations.

Standard pelvic CT (5-10 rad) Centers for Disease Control, March 23, 2005

Acute appendicitis during pregnancy: management

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

Acute appendicitis during Pregnancy

Author	Year	N	Incid	-Appy	Perf	Fetal mort
Mazze et al	1991	778	1:936	36%	6%	1.8%
Uebernueck et al	2004	94	1:499	23%	15%	7%
Tamir et al	1990	84	-	18%	27%	5.9%
Anderson et al	1999	56	1:766	25%	-	7.1%

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

Laparoscopic port placement

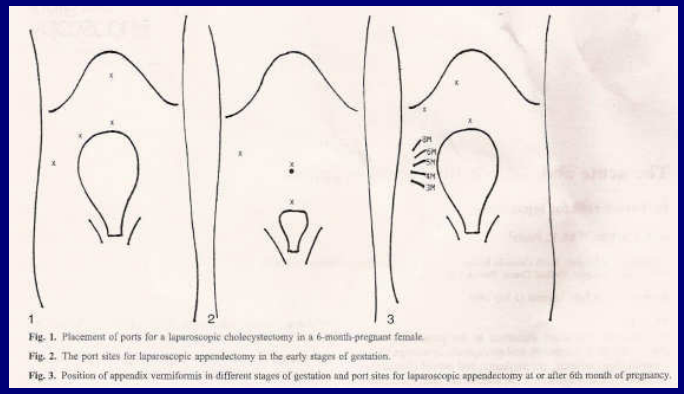


Fig. 1. Placement of ports for a laparoscopic cholecystectomy in a 6-month-pregnant female.
Fig. 2. The port sites for laparoscopic appendectomy in the early stages of gestation.
Fig. 3. Position of appendix vermiformis in different stages of gestation and port sites for laparoscopic appendectomy at or after 6th month of pregnancy.

(Gurbuz et al. Surg Endosc 1997)

Guidelines for laparoscopic surgery during pregnancy

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

www.sages.org

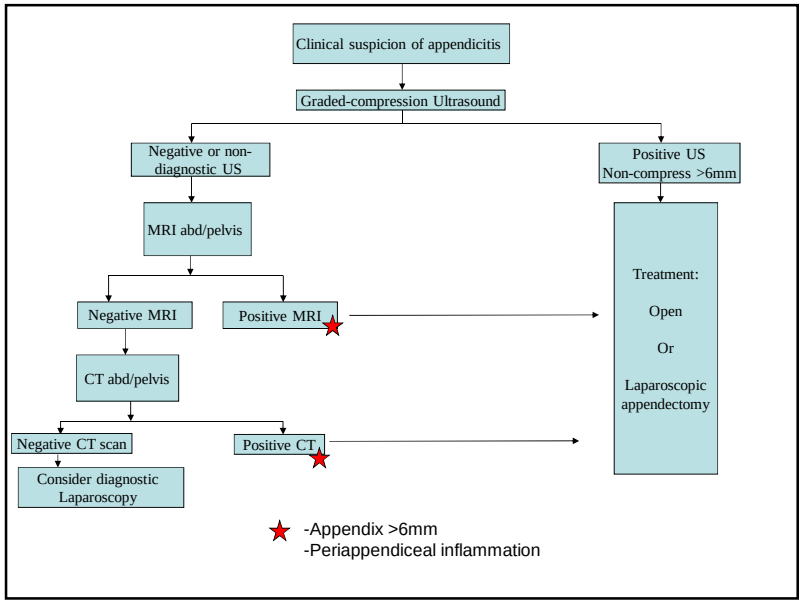
Society of American Gastrointestinal and Endoscopic Surgeons, rev 2000

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 8-12mm Hg

www.sages.org

Society of American Gastrointestinal and Endoscopic Surgeons, rev 2000



Acute appendicitis in the immunosuppressed

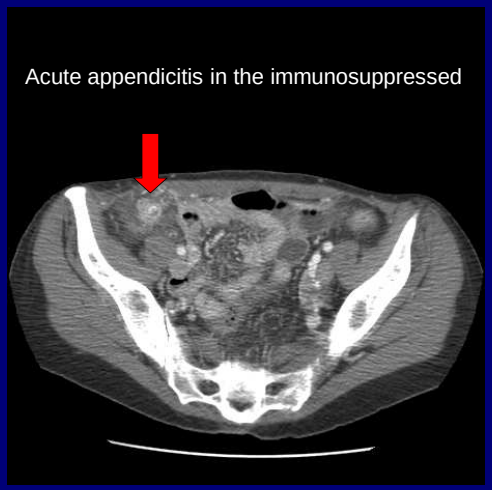
Organ transplantation

HIV/AIDS

Immunosuppressive tx for autoimmune or neoplastic pathology

- 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

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



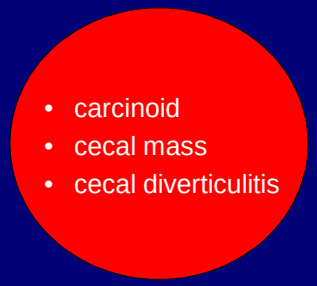
39yo woman day 12 of tx for relapsing acute lymphoblastic leukemia, with WBC 0.1, PLT count 10k

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

(Varela et al, Am J Surg 2008;196(2):218)

Complicated acute appendicitis



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

(Landry el 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)