

2018 Dynamic Practice Guidelines for Emergency General Surgery

Committee on Acute Care Surgery, Canadian Association of General Surgeons

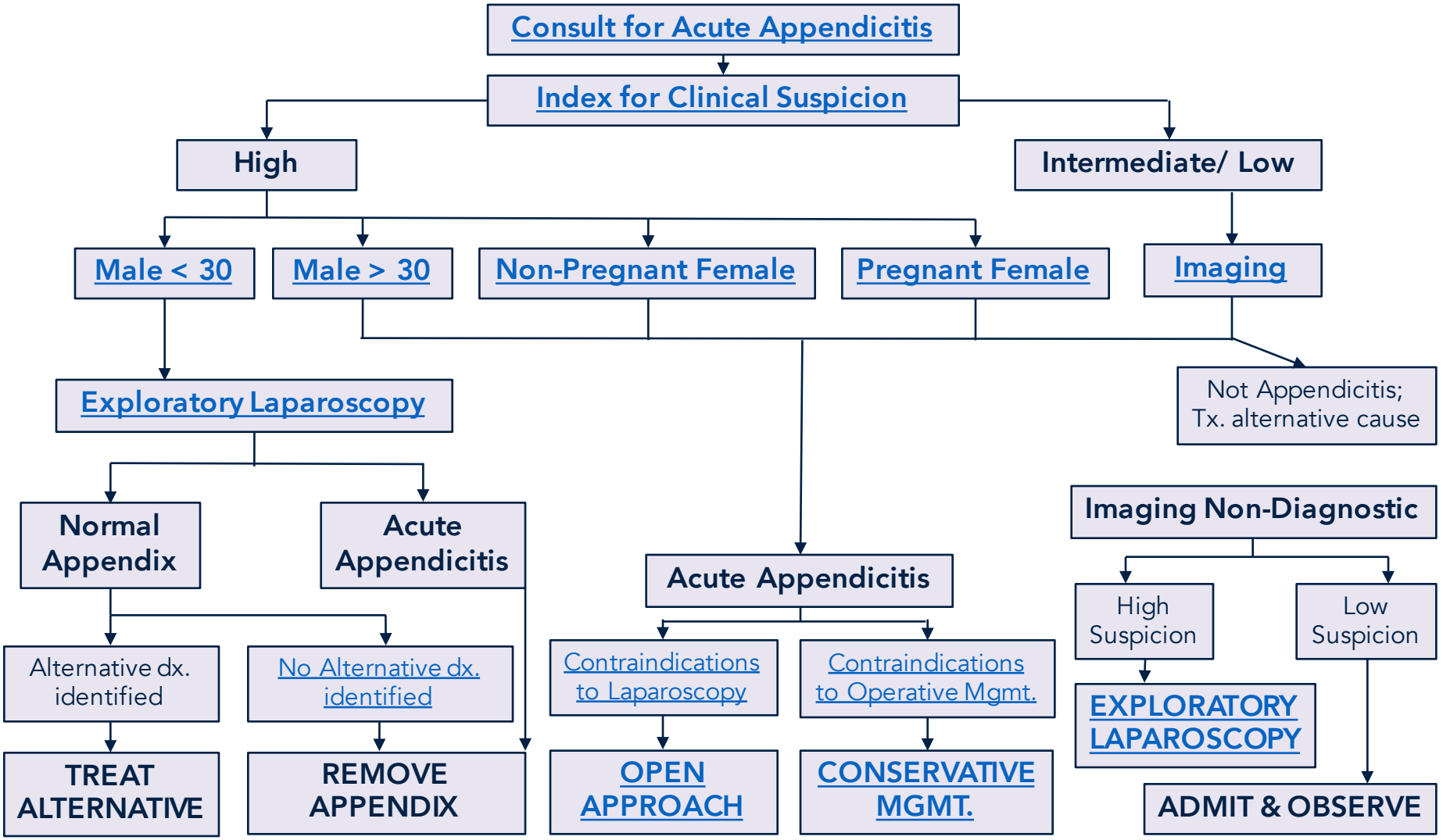
7 ACUTE APPENDICITIS

Dynamic Practice Guidelines for Emergency General Surgery

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Clinical Practice Guideline

ACUTE APPENDICITIS



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HISTORY OF PRESENTING ILLNESS



- Classic Symptoms
  - **Abdominal pain** – initially in epigastrium or periumbilical that migrates to the RLQ
  - **Anorexia**
  - **Nausea and Vomiting**
  - **Low Grade Fever**

PHYSICAL EXAMINATION

- Localized tenderness in the RLQ
- McBurney's Point Tenderness: maximal tenderness 1.5-2 cm from ASIS [anterior superior iliac spine] in straight line from ASIS to the umbilicus (sensitivity 50-94%; specificity 75-86%)
- Rovsing sign: pain the RLQ with palpation of the LLQ (sensitivity 22-68%; specificity 75-86%)
- Retrocecal Appendix
  - Psoas sign: passive extension or active flexion of the hip or causing RLQ pain (sensitivity 13-42%; specificity 79-97%)
- Pelvic Appendix
  - Obturator sign: passively flex the right hip and knee followed by internal rotation of the leg resulting in RLQ pain (sensitivity 8%; specificity 94%)

Wagner, McKinney, Carpenter, 1996 JAMA

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LABORATORY INVESTIGATIONS



- **White Blood Cell (WBC) Count** mildly elevated with a left shift
  - Sensitivity 80%, Specificity 55% [1]

CLINICAL STRATIFICATION SCORING

Alvarado Score for Acute Appendicitis [2]

- Two points awarded for each of the following:
  - RLQ tenderness
  - Leukocytosis > 10,000/mm^3
- One point awarded for each of the following:
  - Migratory RLQ pain
  - Anorexia
  - Nausea or vomiting
  - Rebound tenderness in the RLQ
  - Fever > 37.5 Celsius
  - Leukocyte left shift

Score Legend [3]**:**

Score 0-4: Appendicitis unlikely (Low Clinical Suspicion)

Score 4-6: Recommended CT Scan (Intermediate Clinical Suspicion)

Score ≥ 7: Surgical Consultation (High Clinical Suspicion)

[1]Tehrani, Petros, Kumar et al, 1999 Am Surg

[2]Alvarado, 1986 Ann Emerg. Med

[3] McKay, Shepherd, 2007 Am J Emerg. Med

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MALE < 30 YEARS OF AGE

- Young males can be taken straight to OR if clinical suspicion is high
  - No evidence for age cut-off
  - Some institutions use a cut-off around 30-35 years of age

- A negative appendectomy rate of 15% is considered acceptable [1]

[1] Society for Surgery of the Alimentary Tract (SSAT), 2013 Appendicitis Patient Care Guidelines

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MALE > 30 YEARS OF AGE

- Increasing age is associated with increased incidence of anomalies (appendiceal masses, abscesses, and other alternative diagnoses including colon cancers)

- Pre-operative imaging allows for identification of these unexpected findings before deciding on operative management.

Repplinger, Weber, Pickhardt, et al. 2016 Journal of the American College of Radiology

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NON-PREGNANT FEMALES

- Differential diagnoses for RLQ pain in females is more broad than in males, as such imaging is used primarily to rule out gynecological causes.

- Gynecological causes of RLQ Pain in Females:
  - Ovarian torsion
  - Ovarian mass
  - Uterine fibroids
  - Pelvic Inflammatory Disease

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PREGNANT FEMALES

- Acute appendicitis is suspected in 1 in 500-1,000 pregnancies and confirmed in 800 – 1,500 pregnancies
  - Most common gen. surgical condition diagnosed during pregnancy
- Incidence of Appendicitis
  - 40% of cases occurred during the 2nd trimester vs. 25% in the 1st trimester, and 24% in the 3rd trimester [1]

- **Ultrasound:** first line modality but carries a non-visualization rate of up to 97% is reported in the literature in the 2nd and 3rd trimesters [2]
- **MRI:** next best imaging modality buy up to 30% of MRI cannot visualize appendix in pregnant women [3]

[1] Mourad, Elliott, Erickson, et al. 2000 Am J Obstet Gynecol
[2] Lehnert, Gross, Linnau, et al. 2012 Emerg Radiology
[3] Burke, Bashir, Miller, et al. 2015 Am J Obstet Gynecol

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PREGNANT FEMALES

- Justification to proceed to OR without definitive imaging in pregnant female with high index of suspicion:
    - 24h delay to surgery after presentation in pregnant women can lead to a 66% increase in perforation rate, when compared to those operated on in <24h [1]
    - Uncomplicated appendicitis carries a <5% chance of fetal loss whereas perforated appendicitis with peritonitis carries a fetal loss rate as high as 35% [2]

[1] Tamir, Bongard, Klein, et al. 1990 Am J Surg
[2] McGory, Zingmond, Tillou, et al. 2007 J Am Coll Surg

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IMAGING



Imaging Technique	Descriptors	Sensitivities/ Specificities
Ultrasound	• No radiation • Most accurate in low BMI patients • Often widely available • Technician dependent	Sens: 67 – 100% [1] Spec: 83 – 96% [1]
MRI	• No radiation • Useful in pregnancy when U/S non-definitive • Can identify other intra-abdominal pathology • Takes time to organize and complete	Sens: 94% [2] Spec: 97% [2]
CT Scan	• Some ionizing radiation • Widely available and easily interpreted • Better in higher BMI patients	Sens: 90.4 – 100% [3] Spec: 94% [3]

[1] Lourenco, Brown, Leipsic, et al. 2016 Clin Imaging
[2] Due, Kalb, Arif-Tiwari, et al. 2010 Acad Radiology
[3] Chen, Arad, Chen, et al. 2016 Postgrad Med J

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IMAGING



Imaging	Findings
U/S	• Elongated, blind-ending structure that is fixed and non-compressible with a diameter > 6mm • Increased echogenicity of fat suggest inflammation • Irregular contour and peri-appendiceal fluid suggest perforation
MRI	• Enlarged, blind-ending tubular structure associated with inflammatory stranding in surround fat • Diameter > 6mm, thickening of wall > 1mm and abnormal wall enhancement • Appendicolith
CT Scan	• Diameter > 7 mm, wall thickness > 2 mm and fluid filled appendix are signs of appendicitis • Edema and inflammation are seen as T2 hyperintensity around or within the appendix • In pregnant patients it can be difficult to delineate blind ending tubular due to displacement by the uterus

[1] Rybkin, Thoeni. 2007 Radiology Clin North Am
[2] Tkacz, Anderson, Soto. 2009 Radiology Graphics

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IMAGING

Consider other imaging:

- If Ultrasound is non-diagnostic consider a CT Abdomen
- If CT Abdomen is non-diagnostic reassess clinical suspicion
  - High clinical suspicion = Operate
  - Intermediate/ Low clinical suspicion = Observe

[1] Koo, Kim, Yang, et al. 2013 J Ultrasound Med
[2] Decadt, Sussman, Lewis, et al. 1999 British J Surg
[3] Nikolaidis, Hwang, Miller, et al. 2004 Am J Roentgenol

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OPERATIVE MANAGEMENT

Technical Considerations



Laparoscopic Approach

1. Consent patient appropriately
2. Steps:
    a) Hasson or Veress needle entry
    b) Exploration of abdominal cavity
    c) Can use 3x 5mm ports or 2x 5mm and 1x 12mm (if using stapler)
    d) Medialize cecum, retract appendix at right angle
    e) Divide mesoappendix (cautery + clip artery or staple)
    f) Divide appendiceal base (Endo-loop or staple)
    g) Retrieve appendix in laparoscopic retrieval bag
    h) Inspect for hemostasis
    i) Suction any fluid in Right pericolic gutter / pelvis
    j) Watch ports on removal to ensure no bleeding (especially from inferior epigastric vessels)
    k) Close fascia of port sites >5mm with 0-vicryl
    l) Close skin with interrupted subcutaneous absorbable sutures

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OPERATIVE MANAGEMENT

Contraindications to Laparoscopy

- Absolute:
  - Inability to tolerate General Anesthetic
  - Hemodynamic instability
  - Advanced cardiopulmonary disease
  - Uncorrected coagulopathy

- Relative:
  - Inability to tolerate pneumoperitoneum or hypercarbia (respiratory/ metabolic status)
  - Previous abdominal operations and expected intra-abdominal adhesions
  - Pregnancy *
    - Some evidence of higher rates for pre-term labour and fetal loss in laparoscopic (versus open) appendectomies in pregnant patients; however, literature is inconclusive

[1] Walsh, Tang, Walsh. 2008 International J Surg
[2] Wilasrusmee, Sukra, McEvoy, et al. 2012 British J Surg
[3] Walker, Al Samaraee, Mills, et al. 2014 International J Surg

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OPERATIVE MANAGEMENT

Technical Considerations



Open Approach

1. Consent patient appropriately
2. Steps:
   a) Incision at McBurney's Point or point of maximum tenderness (marked before anesthetic induction)
   b) Bluntly divide external & internal muscle fibers parallel to their directional course
   c) Enter peritoneum
   d) Pull cecum into wound with sponge or Babcock (it may be necessary to divide peritoneal attachments to lateral sidewall to accomplish this)
   e) Identify appendix
   f) Make window at base of appendix
   g) Crush-clamp appendiceal base, suture ligate with absorbable suture; divide appendix above (keep clamp on to avoid spillage)
   h) Suture ligate mesoappendix en masse or dissect out and clip appendiceal artery
   i) Remove appendix
   j) Optional: invaginate stump with purse-string suture
   k) Assess for hemostasis; suction out any purulent fluid
   l) Close wound in layers

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OPERATIVE MANAGEMENT

Contraindications to Operative Management

- Patient Factors:
  - Inability to tolerate General Anesthetic
  - Advanced cardiopulmonary disease
  - Uncorrected coagulopathy

- Phlegmon/ Abscess [1,2]:
  - Lower morbidity with conservative management compared to early operative intervention.

[1] Skoubo-Kristensen, Hvid. 1982 Annals of Surg
[2] Nitecki, Assalia, Schein. 1993 British J Surg

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OPERATIVE MANAGEMENT



Normal Appendix

- Even if the appendix appears normal, early intramural or serosal inflammation can be found on microscopic evaluation
  - Excludes appendicitis from differential if pain recurs

- If the appendix is normal at the time of the OR, it is important to evaluate for other sources of the patient's symptoms (e.g. terminal ileitis, Meckel's, cecal, or sigmoid perforating cancer, gynecological pathology)

[1] Chiargui, Buccianti, Decanini, et al. 2001 Acta Chir Belg
[2] Wang, Reen, Puri. 1996 Lancet

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NONOPERATIVE MANAGEMENT

- Appendectomy in adult non-complicated appendicitis is Standard of Care and advocated by:
  - American College of Surgeons, Society for Surgery of the Alimentary Tract, World Society of Emergency Surgery
- Several European trials have looked at giving antibiotics first in adult uncomplicated appendicitis [1-4]
  - 53% of patients cross-over to the surgery group within 48 Hours
  - 10-37% had recurrent appendicitis within a year
- In complicated appendicitis with evidence of phlegmon or walled-off abscess
  - Antibiotics alone reduces complications of surgery (enterotomy, enterocutaneous fistula, extended resection, and post-op abscesses) [5,6]
- Imaging guided percutaneous drain reduces length of stay and complication rates in patients with walled-off abscesses at presentation.

[1] Wilms, de Hoog, de Visser, et al. 2011 Cochrane Review
[2] Varadhan, Neal, Lobo. 2012 British Med Journal
3 Sallinen, Akl, You et al. 2016 British J Surg
4 Rollins, Varadhan, Neal, et al. 2016 World J Surg
5 Oliak, Yamini, Udani, et al. 2001 Dis Colon Rectum
6 Nitecki, Assalia, Schein. 1993 British J Surg
7 Brown, Abrishami, Muller, et al. 2003 Am Surg