PEDIATRIC GENERAL SURGERY FOR THE PEDIATRICIAN: THE HIGHLIGHTS

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OBJECTIVES

1. Review common surgical conditions encountered by the pediatrician
2. At the end of this session, participants will be able to:

a) Describe management strategies for **perforated appendicitis**
b) Demonstrate appropriate management of **abdominal wall hernias**
c) Demonstrate appropriate management of **undescended testicles**
d) Describe common **gastrostomy tube** complications and troubleshooting strategies

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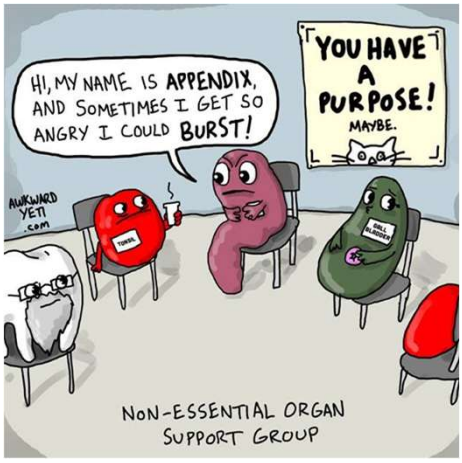
PERFORATED APPENDICITIS

APPENDICITIS



Acute → Suppurative → Gangrenous → Perforated

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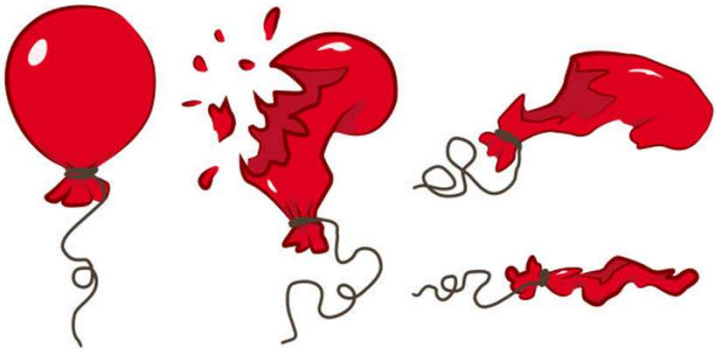
PERFORATED APPENDICITIS



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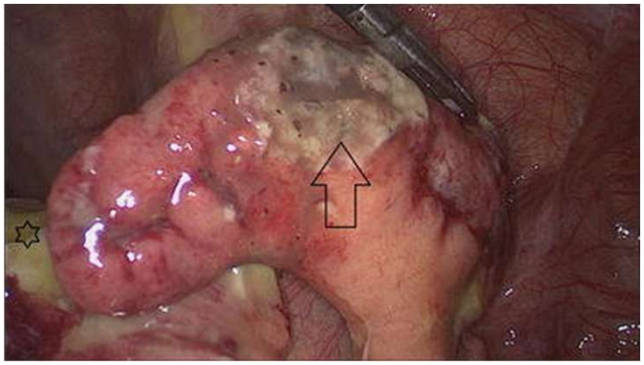
OPERATIVE MANAGEMENT OF PERFORATED APPENDICITIS



Horvath P, Lange J, Bachmann R, Struller F, Königsrainer A, Zdichavsky M. Comparison of clinical outcome of laparoscopic versus open appendectomy for complicated appendicitis. Surgical endoscopy. 2017 Jan;31:199-205.

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NON-OPERATIVE MANAGEMENT OF PERFORATED APPENDICITIS

Suzuki T, Matsumoto A, Akao T, Matsumoto H. Interval appendectomy as a safe and feasible treatment approach after conservative treatment for appendicitis with abscess: a retrospective, single-center cohort study. Updates in Surgery. 2023 Dec;75(8):2257-65.

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SUMMARY: PERFORATED APPENDICITIS

- Appendicitis occurs on a spectrum and progression from acute to perforated is gradual
- Early perforation operative management
- Late perforation non-operative management + interval appendectomy

Ein SH, Langer JC, Daneman A. Nonoperative management of pediatric ruptured appendix with inflammatory mass or abscess: presence of an appendicolith predicts recurrent appendicitis. *J Pediatr Surg*. 2005;40(10):1612-5.

Grabowski J, Lee SL. Appendicitis. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2022.

Henry MC, Gollin G, Islam S, et al. Matched analysis of nonoperative management vs immediate appendectomy for perforated appendicitis. *J Pediatr Surg*. 2007;42(1):19-23; discussion 23-4.

Narsule CK, Kahle EJ, Kim DS, et al. Effect of delay in presentation on rate of perforation in children with appendicitis. *Am J Emerg Med*. 2011;29(8):890-3.

Taylor M, Emil S, Nguyen N, et al. Emergent vs urgent appendectomy in children: a study of outcomes. *J Pediatr Surg*. 2005;40(12):1912-5.

Yardeni D, Hirschl RB, Drongowski RA, et al. Delayed versus immediate surgery in acute appendicitis: do we need to operate during the night? *J Pediatr Surg*. 2004;39(3):464-9; discussion 464-9.

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ABDOMINAL WALL HERNIAS

UMBILICAL HERNIA

Shastri N, Gilmer L. Periumbilical swelling in an infant. Am Fam Physician. 2008;77(8):1151-1152

Snyder CL, Soffer S. Umbilical Hernia [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2020. [cited 2024 November 05].

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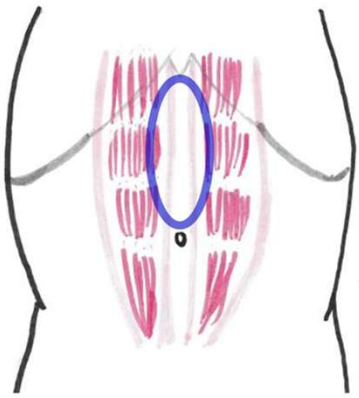
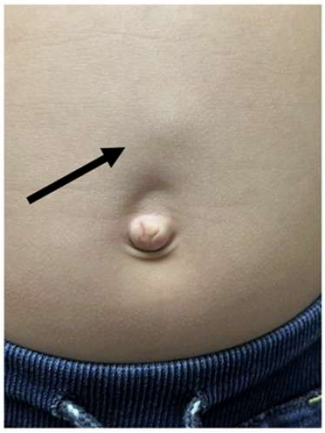
EPIGASTRIC HERNIA





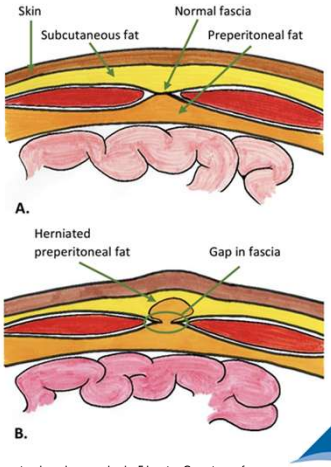


Image credit: Carl-Christian Jackson, MD

Jackson CC. Editors Hollinger LE, Taylor JA. Epigastric Hernia. Patient and family information, brought to you by the Education Committee of APSA. 2023 September

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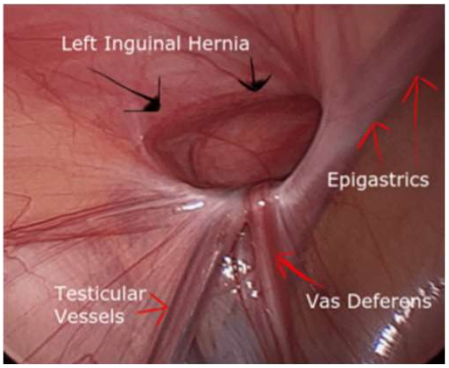
INGUINAL HERNIA



Emil S. Abdominal Wall Hernias. *Clinical Pediatric Surgery*.Taylor & Francis; 2019.

Inguinal Hernia [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2020. [cited 2024 November 05]. Available from: https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia.

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RISK OF INCARCERATION

- The majority of incarcerations occur within the first year of life
- 50% occur within the first 6 months of life
- Incidence previously thought to be up to 30%

JAMA | Original Investigation

Effect of Early vs Late Inguinal Hernia Repair on Serious Adverse Event Rates in Preterm Infants
A Randomized Clinical Trial

HIP Trial Investigators

JAMA. 2024;331(12):1035-1044. doi:10.1001/jama.2024.2302

4% in late repair group
(>55 weeks PMA)
vs
1% in early repair group
(prior to NICU discharge)

Blakely ML, Krzyzaniak A, Dassinger MS, Pedroza C, Weitkamp JH, Gosain A, Cotten M, Hintz SR, Rice H, Courtney SE, Lally KP. Effect of early vs late inguinal hernia repair on serious adverse event rates in preterm infants: a randomized clinical trial. JAMA. 2024 Mar 26;331(12):1035-44.

Inguinal Hernia [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2020. [cited 2024 November 05]. Available from: https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia.

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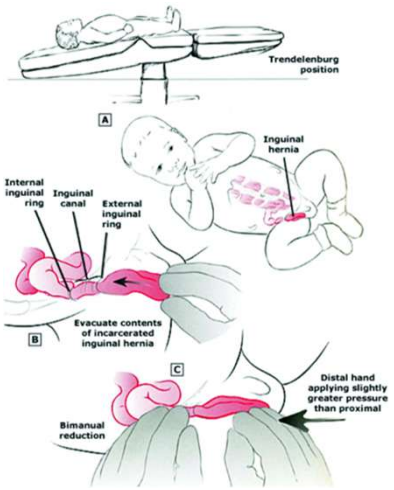
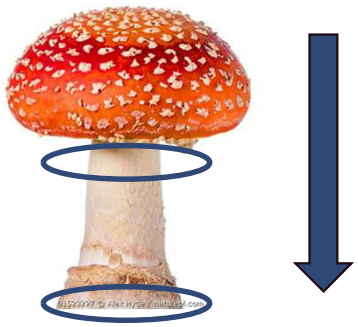
MANUAL REDUCTION OF INCARCERATED INGUINAL HERNIA





Quirt JS, Fecteau A. Hernias—Epigastric, Inguinal and Incisional. Pearls and Tricks in Pediatric Surgery. 2021:113-23.

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SUMMARY: HERNIAS

Hernia Type	Recommendations
Epigastric	Referral at diagnosis
Umbilical	Referral at school age (4-5 years old)
Inguinal	Referral at diagnosis

Emil S. Abdominal Wall Hernias. *Clinical Pediatric Surgery*.Taylor & Francis; 2019.

Hall DE, Roberts KB, Charney E. Umbilical hernia: what happens after age 5 years? *J Pediatr*. 1981;98(3):415-7.

Inguinal Hernia [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2020.

Snyder CL, Soffer S. Umbilical Hernia [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2020.

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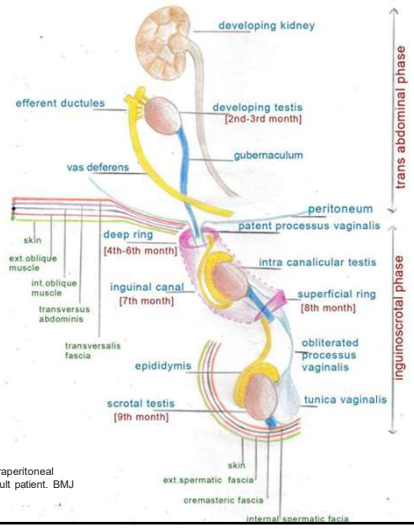
UNDESCENDED TESTICLES

TESTICULAR DESCENT



Gopinathan A, Ramachandran B, Ramalingam S, Kannan P. Laparoscopic totally extraperitoneal exploration of intra-abdominal testis, orchidectomy and inguinal hernia repair in an adult patient. BMJ Case Reports CP. 2023 Nov 1;16(11):e255925

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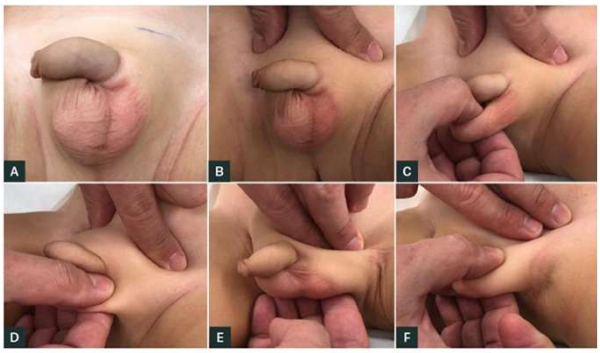
PHYSICAL EXAM



Yeap E, Nataraja RM, Pacilli M. Undescended testes: What general practitioners need to know. Australian Journal of General Practice. 2019 Jan;48(1/2):33-6.

	Definition	Management
Undescended testis	Testis undescended at birth	Orchidopexy
Ascending testis	Testis descended at birth with subsequent ascent	Orchidopexy
Retractile testis	Normal variant; intermittently within scrotum	Annual clinical surveillance until puberty

Taghavi K, Chin A, Radhakrishnan J. Cryptorchidism [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2022.

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GUIDELINES

Group	Recommended age for orchidopexy
AUA (2014)	Between 6 and 18 months of age
EAU (2021)	Between 6 and 18 months of age; Ideally by 12 months of age
CUA (2017)	Between 6 and 18 months of age
BAPS (2015)	Between 6 and 18 months of age
APSA (2022)	Between 6 and 12 months of age

Gates RL, Shelton J, Diefenbach KA, Arnold M, Peter SD, Renaud EJ, Slidell MB, Sømme S, Valusek P, Villalona GA, McAteer JP. Management of the undescended testis in children: an American pediatric surgical association outcomes and evidence based practice committee systematic review. Journal of pediatric surgery. 2022 Jul 1;57(7):1293-308

Taghavi K, Chin A, Radhakrishnan J. Cryptorchidism [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2022. Available from: https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829144/all/Cryptorchidism.

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SUMMARY: UNDESCENDED TESTICLES

- Main reasons for orchidopexy are to maintain fertility and decrease malignancy risk
- Most guidelines recommend that orchidopexy be performed between 6 – 18 months of age, ideally by 12 months of age
- Refer patients if testicle(s) have not descended by 6 months of age

Gates RL, Shelton J, Diefenbach KA, Arnold M, Peter SD, Renaud EJ, Slidell MB, Sømme S, Valusek P, Villalona GA, McAteer JP. Management of the undescended testis in children: an American pediatric surgical association outcomes and evidence based practice committee systematic review. Journal of pediatric surgery. 2022 Jul 1;57(7):1293-308

Taghavi K, Chin A, Radhakrishnan J. Cryptorchidism [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NaT*. American Pediatric Surgical Association; 2022.

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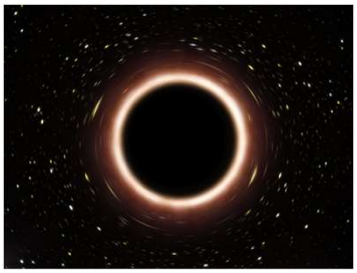
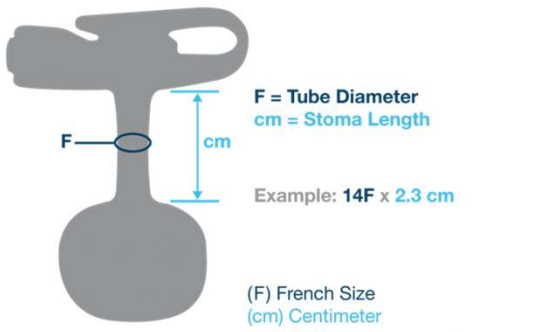
GASTROSTOMY TUBES



GASTROSTOMY TUBE ISSUES

https://capitalmedicalsupply.ca/products/1-mic-key-low-profile-gastrostomy-feeding-tube



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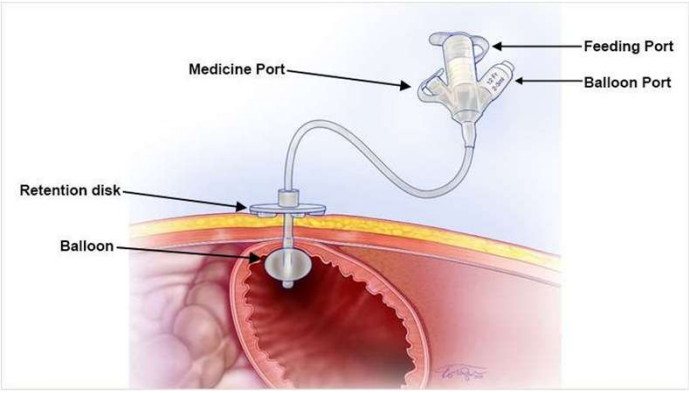
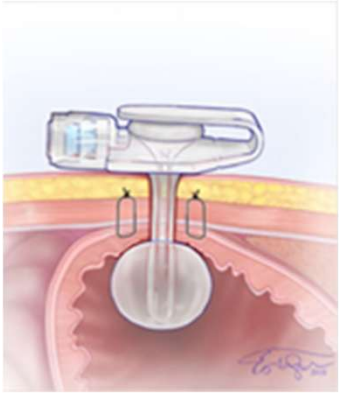
LONG TUBES & LOW-PROFILE TUBES





https://www.chop.edu/treatments/gastrostomy-tubes

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LEAKAGE

Boeykens K, Duysburgh I, Verlinden W. Prevention and management of minor complications in percutaneous endoscopic gastrostomy. BMJ Open Gastroenterology. 2022 Jul 1;9(1):e000975

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HYPERGRANULATION TISSUE

http://www.bcchildrens.ca/health-info/coping-support/tube-feeding

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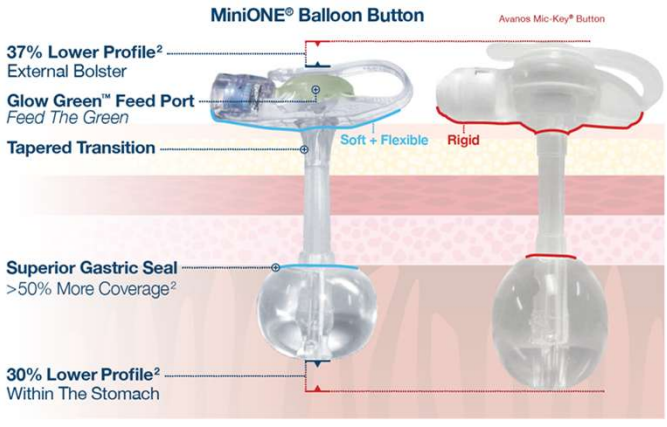
DIFFERENT TYPES OF LOW-PROFILE TUBES



https://www.appliedmedical.net/enteral/minione/balloon/

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SUMMARY: G-TUBES

- For an established gastrostomy (i.e. >4-6 weeks after surgery)
  - Check the balloon
  - Is the length appropriate? – too long vs too short
  - Check the skin – excoriation, hypergranulation tissue

Jarboe MD, Speck K, Demehri F, Alder AC, Black T, Guner Y. Enteral Access [Internet]. In: Hirschl RR, Powell DD, Waldhausen JJ, editors. *Pediatric Surgery NoT*. American Pediatric Surgical Association; 2022. [cited 2024 November 05]. Available from: https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829032/all/Enteral_Access.

Pediatric Home Tube Feeding. Island Health. Revised 06-Jun-2024. https://intranet.islandhealth.ca/clinical_resources/patient_education/Documents/pediatric-home-tube-feeding.pdf.

QUESTIONS?

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