

# You've Got A Friend In Me: The Pediatrician & the Pediatric Surgeon

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# Disclosures

- None



# Learning objectives

1. Identify timing of referral for common elective general surgery problems
2. Counsel and reassure families on general surgical issues that have prolonged healing or needing ongoing monitoring
3. Discern various imaging modalities for workup of general surgical issues
4. Learn of latest operative techniques/approaches to common general surgical issues
5. Engage in counseling and management of post-surgical recovery, healing, activity restrictions beyond the immediate post-operative period



## Common outpatient surgical topics

- Hernias
- Thoracic disease
- Colon & anal problems
- Breast masses
- Abdominal masses
- Pilonidal disease
- Vascular malformations
- Post-surgical issues



**Hernias:  
Inguinal, Umbilical, Epigastric**

# Management of Inguinal Hernia in Infants

- Found incidentally, groin bulge
- Differential: Hydrocele, undescended testicle, inguinal hernia, lymph node
- Clinical diagnosis
- Imaging studies not necessary
- Ask family to take a photo or video of the bulge prior to seeing surgeon
- Referral at time of discovery
- Surgical repair: open vs laparoscopic

# Laparoscopic vs Open Inguinal Hernia Repair in Children

## Operative Time



Lap = Open (unilateral)

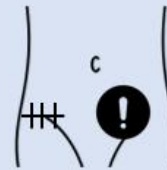
Lap < Open (bilateral)

## Recurrent Hernia



Lap = Open

## Metachronous Hernia



Lap < Open

## Overall Complications



Lap = Open



## Laparoscopic Advantages

1. Shorter operative time for bilateral hernias
2. Decreased rate of metachronous hernia
3. Visual confirmation of type of hernia
4. Visual inspection of bowel during incarcerated hernias
5. Easier repair of recurrent open hernias

## Open Advantages



1. May be performed with locoregional anesthesia
2. Feasible in resource limited settings
3. May facilitate repair in complex or large hernias
4. Avoids the very small risks of laparoscopy (i.e., gas embolism, bowel injury, etc.)

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



**Table 1. Baseline Characteristics of Infants by Early vs Late Inguinal Hernia Repair Group**

	Infants, No. (%) <sup>a</sup>	
	Early inguinal hernia repair (n = 163) <sup>b</sup>	Late inguinal hernia repair (n = 157) <sup>c</sup>
Gestational age at birth, wk		
Median (IQR)	26 (25-28)	26 (24-28)
Mean (SD)	27 (3)	27 (3)
Gestational age		
<28 wk	103 (63)	104 (66)
≥28 wk	60 (37)	53 (34)
Age		
Median (IQR), d	80 (61-112)	82 (64-104)
Postnatal, mean (SD), wk	12 (5)	12 (5)
Postmenstrual, median (IQR), wk	39 (37-42)	39 (37-41)
Birth weight, median (IQR), g		
	835 (615-1072)	810 (660-1010)
Sex		
Male	141 (87)	133 (85)
Female	22 (13)	24 (15)
Race <sup>d</sup>		
Asian	5 (3)	3 (2)
Black	49 (28)	51 (31)
Native Hawaiian or Other Pacific Islander	1 (0.6)	0
White	99 (58)	101 (61)
Unknown	18 (10)	11 (7)
Ethnicity <sup>d</sup>		
Hispanic	28 (16)	26 (16)
Non-Hispanic	135 (78)	135 (81)
Unknown	9 (5)	5 (3)
Born at participating medical center <sup>e</sup>		
	98 (60)	92 (59)
Prior to enrollment		
Apnea requiring intervention <sup>f</sup>	137 (85)	122 (79)
Bronchopulmonary dysplasia <sup>g</sup>	82 (50)	78 (50)
Bradycardia requiring intervention <sup>h</sup>	72 (44)	70 (45)
Inguinal hernia incarceration	2 (1)	3 (2)
Intraventricular hemorrhage (grade 3 or 4) <sup>i</sup>		
	11 (7)	11 (7)
Diagnosis of inguinal hernia made by a pediatric surgeon rather than a neonatologist		
	115 (71)	112 (71)

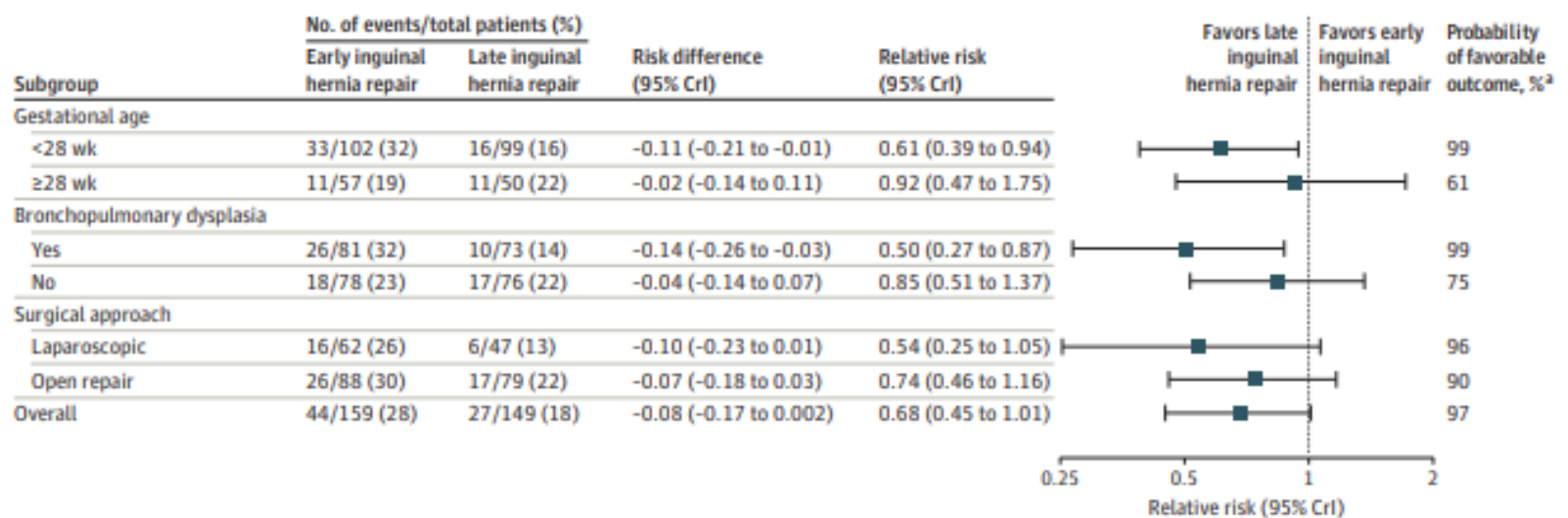
<sup>a</sup>Unless otherwise indicated, excludes 0 infants for each group because of missing data.

<sup>f</sup>Included definition: initiation of oral feeds, oxygen saturation >95%.

Table 3. Serious Adverse Events Experienced by Infants in the Early vs Late Inguinal Hernia Repair Group

	Serious adverse event, No. (%) <sup>a</sup>	
	Early inguinal hernia repair (n = 159) <sup>b</sup>	Late inguinal hernia repair (n = 149) <sup>c</sup>
Apnea requiring intervention <sup>d</sup>	28 (17.6)	9 (6.0)
Prolonged intubation (>48 h)	6 (3.8)	0
Bradycardia requiring intervention <sup>e</sup>	5 (3.1)	4 (2.7)
Cardiopulmonary resuscitation	4 (2.5)	4 (2.7)
Stridor	3 (1.9)	1 (0.7)
Death	2 (1.3)	3 (2.0)
Pneumonia	2 (1.3)	0
Regional anesthesia toxicity	1 (0.6)	0
Unplanned reintubation	0	1 (0.7)
Cardiac arrest	0	3 (2.0)
Inguinal hernia		
Incarceration <sup>f</sup>	2 (1.3)	6 (4.0)
Recurrence	2 (1.3)	1 (0.7)
Reoperation	2 (1.3)	3 (2.0)
Intraoperative injury to adjacent structure	2 (1.3)	0
Wound disruption	0	1 (0.7)
Surgical site infection	1 (0.6)	2 (1.3)
Other event	1 (0.6) <sup>g</sup>	2 (1.3) <sup>h</sup>

Figure 3. Subgroup Analyses of Serious Adverse Events Experienced by Infants in the Early vs Late Inguinal Hernia Repair Groups





# Management of Inguinal Hernias in Adolescents

## PRIMARY REPAIR

Adolescents with inguinal hernias have indirect defects (>90% of the time)

- ✓ Repair with high ligation
- ✓ Open or laparoscopic
- ✗ No mesh for primary repair
- 🔥 “Burning” of peritoneum with laparoscopic approach

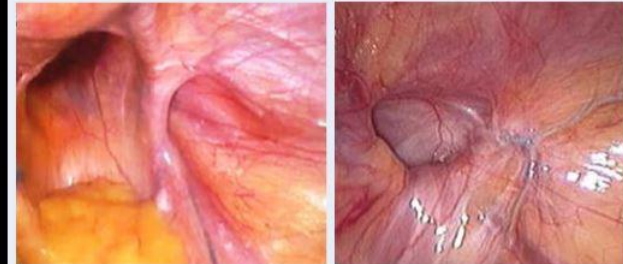
Recurrence is <6% with open or laparoscopic high ligation

## SPECIAL SITUATIONS

Situation	Management
Obesity	<i>No change</i>
Female	<i>Close internal ring +/- divide ligament</i>
“Sports Hernia”	<i>Rest, physiotherapy, and rehabilitation</i>
Direct hernia	<i>Open tissue repair</i>
Femoral hernia	<i>Open tissue or laparoscopic mesh repair</i>

## RECURRENT REPAIR

Consider diagnostic laparoscopy to understand type of recurrence



*Unrepai redirect, pantaloon, or femoral hernia*      *True recurrence of indirect hernia*

Type of surgery for recurrent hernia depends on mechanism, but consider tissue or mesh repair

# Umbilical hernias

- Incarceration is rare
- Enlargement of defect is rare
- Need to feel the fascia defect to know size
- Skin bulge of hernia not indicative of defect size
- Surgical repair at 4-5 years old

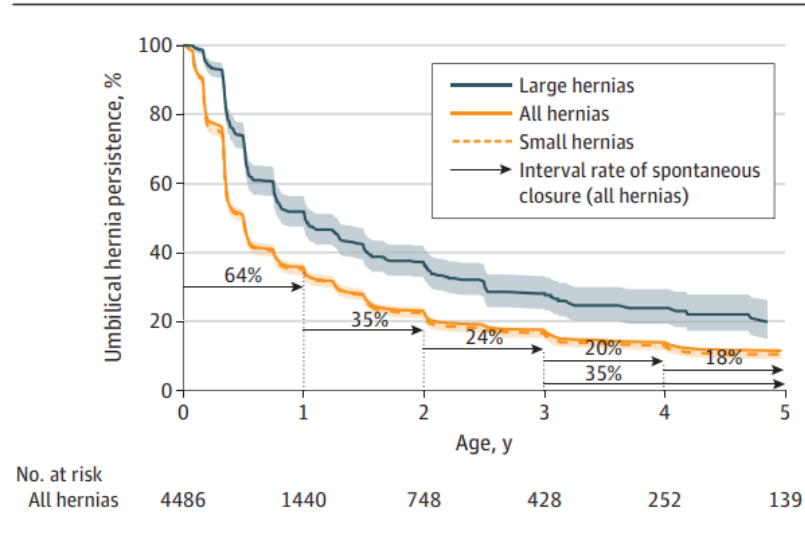
# Age and Probability of Spontaneous Umbilical Hernia Closure

Katherine He, MD, MS<sup>1</sup>; Dionne A. Graham, PhD<sup>2</sup>; Louis Vernacchio, MD, MSc<sup>3</sup>; Jonathan Hatoun, MD, MPH, MS<sup>3</sup>; Laura Patane, MPH<sup>3</sup>; Shannon L. Cramm, MD, MPH<sup>4</sup>; Shawn J. Rangel, MD, MSCE<sup>5</sup>

» Author Affiliations | Article Information

JAMA Pediatr. 2024;178(5):497-498. doi:10.1001/jamapediatrics.2024.0087

**Figure. Kaplan-Meier Estimates of Spontaneous Umbilical Hernia Closure in Children During the First 5 Years of Life**



Interval rates of spontaneous closure represent probability of closure after further observation for hernias that persist at a given age. The shaded areas represent 95% CIs for persistence rates among children with small and large hernias. Hernias were categorized as small if they were described as “small” or measured 1 cm or less, and large if described as “large” or measured greater than 1 cm.

**Table. Probabilities of Future Spontaneous Closure Based on Most Recent Age When an Umbilical Hernia Was Documented and Different Observation Periods**

Most recent age when umbilical hernia documented, y	Interval probability of spontaneous closure with further observation by age observed to, %				
	1 y	2 y	3 y	4 y	5 y
<b>All hernias</b>					
0 (Birth)	64.3	76.9	82.4	86.0	88.6
1		35.4	50.9	60.7	68.0
2			23.9	39.2	50.4
3				20.0	34.8
4					18.4
<b>Small hernias<sup>a</sup></b>					
0 (Birth)	64.8	77.5	83.3	86.8	89.5
1		36.1	52.5	62.6	70.1
2			25.7	41.4	53.2
3				21.2	37.0
4					20.1
<b>Large hernias<sup>a</sup></b>					
0 (Birth)	48.2	62.8	71.9	76.1	80.2
1		28.1	45.7	53.9	61.7
2			24.5	35.9	46.7
3				15.0	29.4
4					16.9

<sup>a</sup> Hernias were categorized as small if they were described as “small” or measured 1 cm or less, and large if described as “large” or measured greater than 1 cm.

# Epigastric Hernias

- Clinical diagnosis
- U/S can help if unsure of diagnosis
- Repair electively any time after diagnosis
- Usually small (2-4 mm) defect at fascial with protruding pre-peritoneal fat

**Thoracic**





# Management of Congenital Lung Lesions



## NEONATAL OUTCOMES

The CPAM-volume ratio (CVR) is a useful predictor of neonatal outcomes



**CVR < 1.0**

- ↓ risk of perinatal morbidity
- ↓ risk of postnatal intervention

## BENIGN FEATURES

Use the acronym "CPAM" to remember which features are associated with benign disease

Clinical	Asymptomatic
Pathology	Extralobar sequestration, bronchial atresia
Age	Prenatal diagnosis
Misc.	DICER1-, size <3 cm

## MALIGNANT FEATURES

Some features should increase suspicion for malignancy (Pleuropulmonary Blastoma)



1. Macrocytic
2. Postnatal detection
3. No systemic feeding vessel

**Check for DICER1 mutation!**

Kunisaki, S: Top Educational Content (TEC) Talk 1- Lung Lesions. *American Pediatric Surgical Association 2022 Annual Meeting.*

This visual abstract was created by: Su Yeon Lee, Minna Wieck

APSA Visual Abstracts



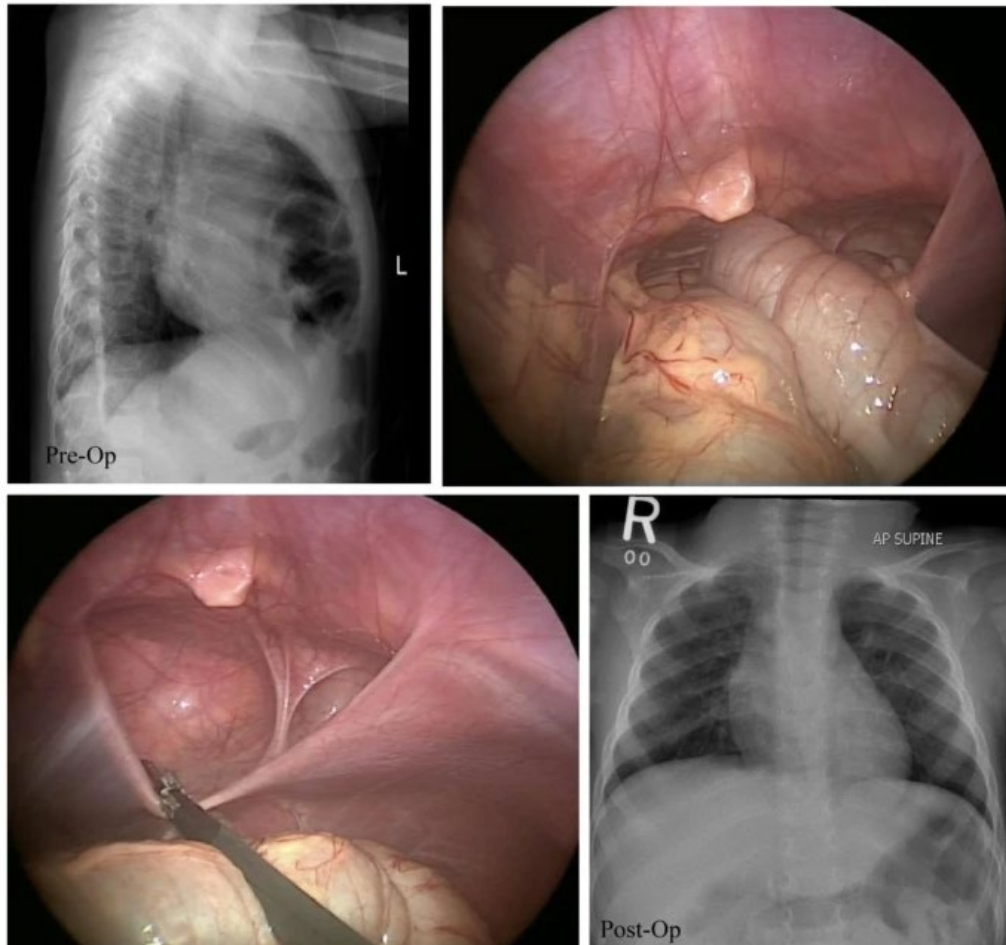


# Hiatal / Diaphragmatic Hernias

- Incidentally found – respiratory symptoms, GI issues
- CXR initial study, CT can help delineate anatomy



# Diaphragmatic Hernias



# Colon & Perianal Issues

# Infant perianal abscess/fistula-in-ano

- Often lateral
- Sitz baths if no fluctuance
- If fluctuant – I&D
- Surgery: fistulectomy/fistulotomy to open entire abnormal anal crypt
- Time-limited disorder, usually resolved by 12 months old

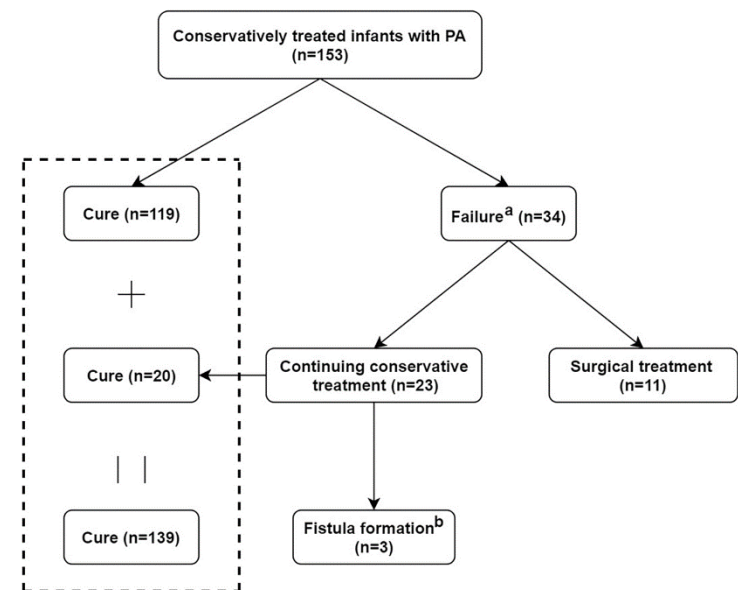


Article | [Open access](#) | Published: 27 October 2023

## Natural course of perianal abscess in infants: a real-world study

[Wanbin Yin](#), [Yansen Li](#), [Jingfeng Zhang](#), [Yang Jiao](#), [Wenju Pei](#), [Xiangjun Xu](#), [Mingfeng Fan](#), [Juan Xu](#), [Yue Zhou](#), [Shuai Wang](#) ✉ & [Yanhua Wei](#) ✉

[Scientific Reports](#) **13**, Article number: 18416 (2023) | [Cite this article](#)



# Management of Idiopathic Rectal Prolapse

## WORKUP

### Physical Examination

- Partial vs full-thickness
- Partial = mucosa only
- Rule out rectal polyp

### Manage Underlying Cause

- Constipation (28%)
- Diarrhea (20%)
- Cystic Fibrosis (4%)
- Neuro or anatomic (24%)

### Reasons to Consider Surgery

- Failed medical management
- Age >4 years
- Prolapse for >1 year or bleeding if age <4 years

## SCLEROTHERAPY

### Technique

- Submucosal injections
- Four quadrants
- **Avoid anterior midline**
- Dentate up to 2-4 cm

### Agents



*Ethanol (70-98%)*

- ✓ Low recurrence
- ✓ 2-11% complications



*Phenol*

- ✓ Complications, 1 death
- ✓ **Not recommended**



*Hypertonic saline (15-30%)*

- ✓ Low recurrence

*D50 (50% Dextrose)*

- ✓ Higher recurrence
- ✓ No complications

## OPERATIVE

### Indications

- Failure of sclerotherapy
- Full-thickness prolapse
- Age >4 years

### Anal Circlage

- #1 PDS tied over Hegar dilator
- 90% success (23% if >1 attempt)

### Transanal Rectopexy

- Suture from inside rectum through sacrococcygeal junction

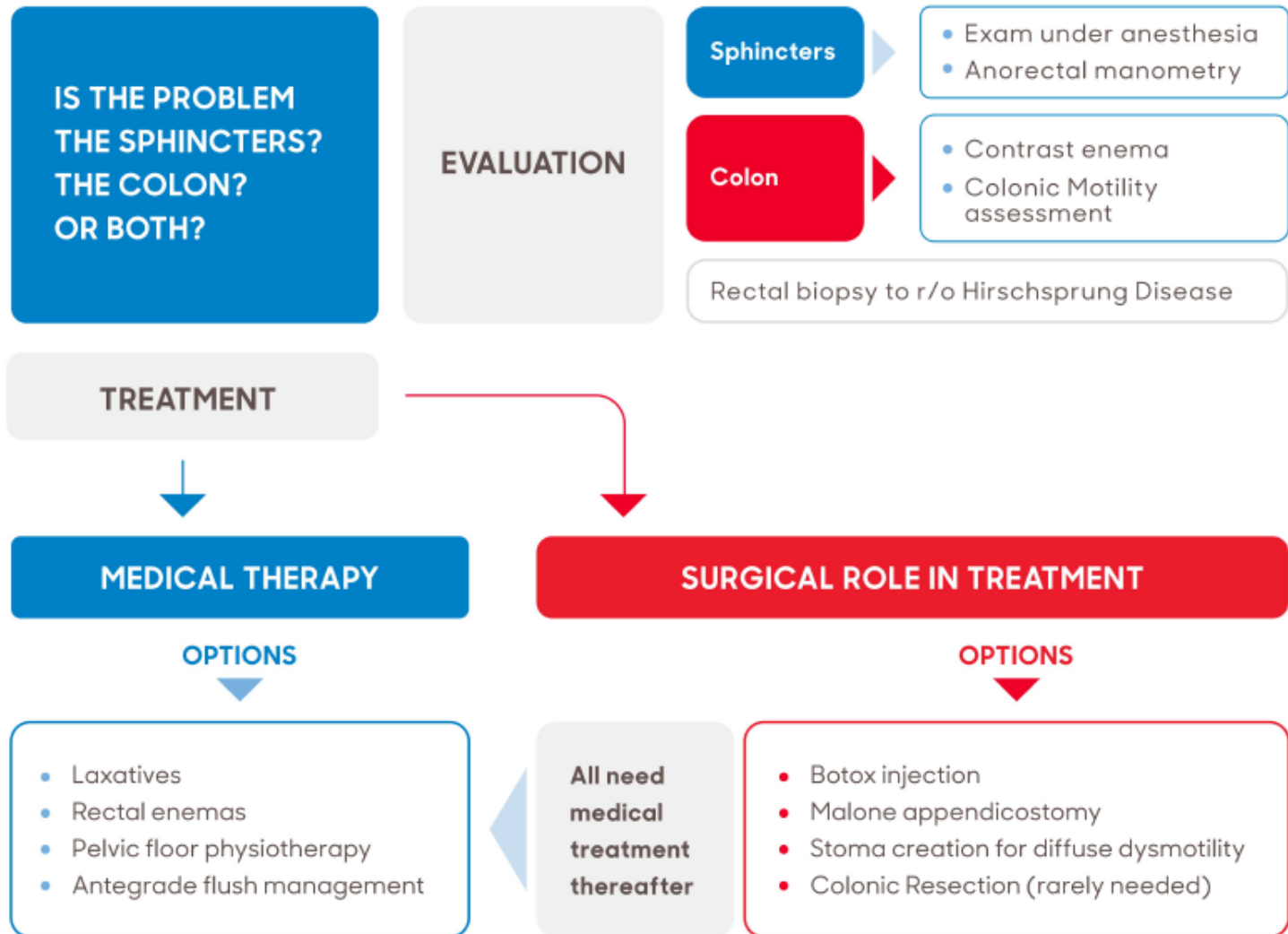
### Transabdominal Rectopexy

- Retrorectal dissection
- Suture rectum to sacral fascia x3

### Resection

- Typically transabdominal rectosigmoid resection

# Constipation



# Breast Mass

# Breast Mass

- History: When noticed, changes over time, nipple discharge, size/mobility, symptoms
- Family Hx: Breast or other cancers, BRCA
- Differential: Mastitis, Fibroadenoma, Phyllodes
- Labs: none
- Imaging: H&P most important, U/S most helpful, mammogram not used, BI-RADS not validated in children
- Biopsy typically not needed



## MC breast mass in adolescent females: Fibroadenoma

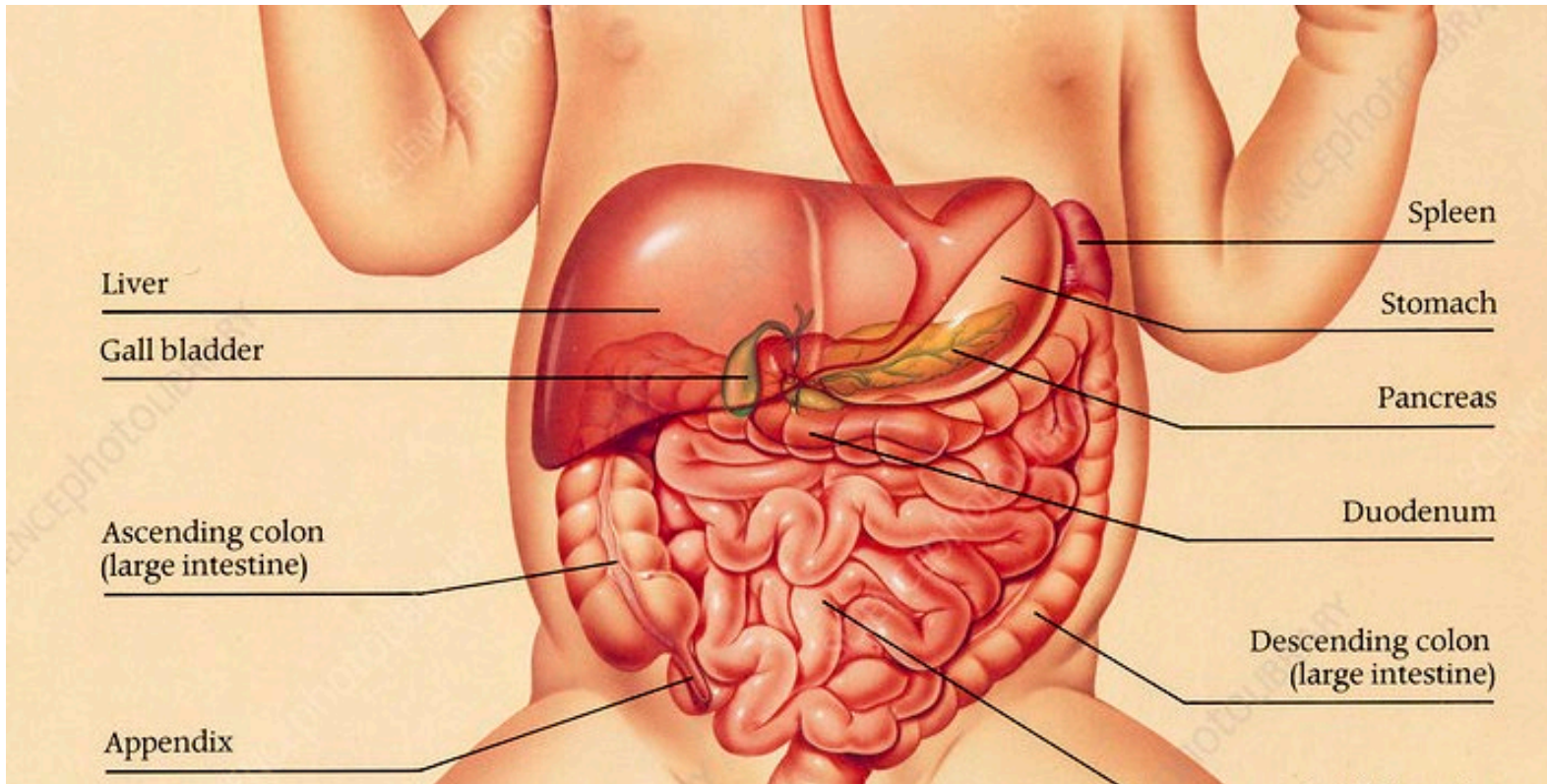
- Well-circumscribed, asymptomatic, may get larger prior to menstruation
- Counseling very important! Even with excision, these lesions CAN RECUR / NEW ones can form
- Monitor with annual exams

### Surgery:

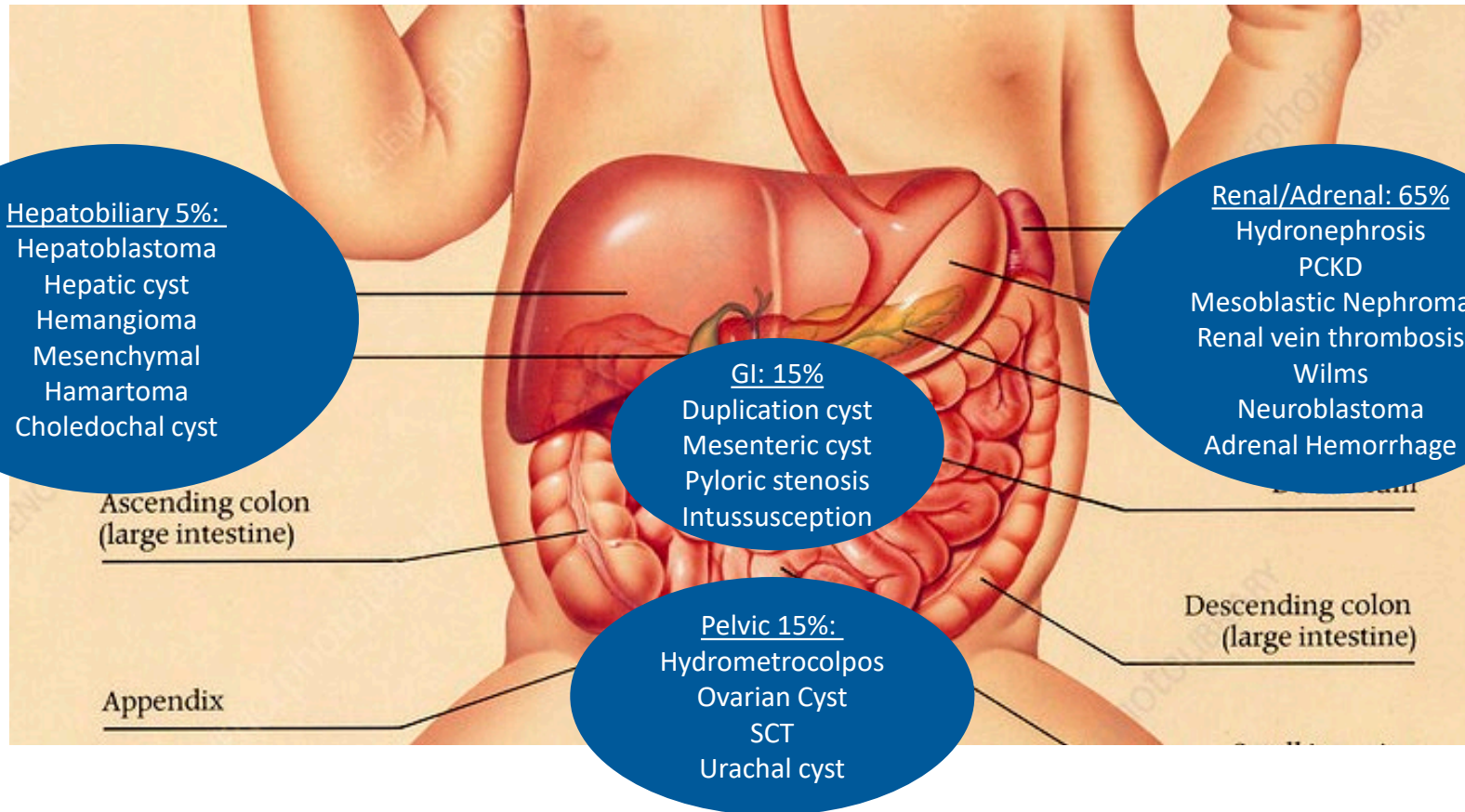
- Indications: Growing in size, symptoms, >5 cm, atypical features on imaging/exam, family anxiety
- Enucleation through peri-areolar or sub-mammary incision
- Margin of normal tissue
- If phyllodes suspected, then enucleation with 1 cm margins

# Abdominal Masses

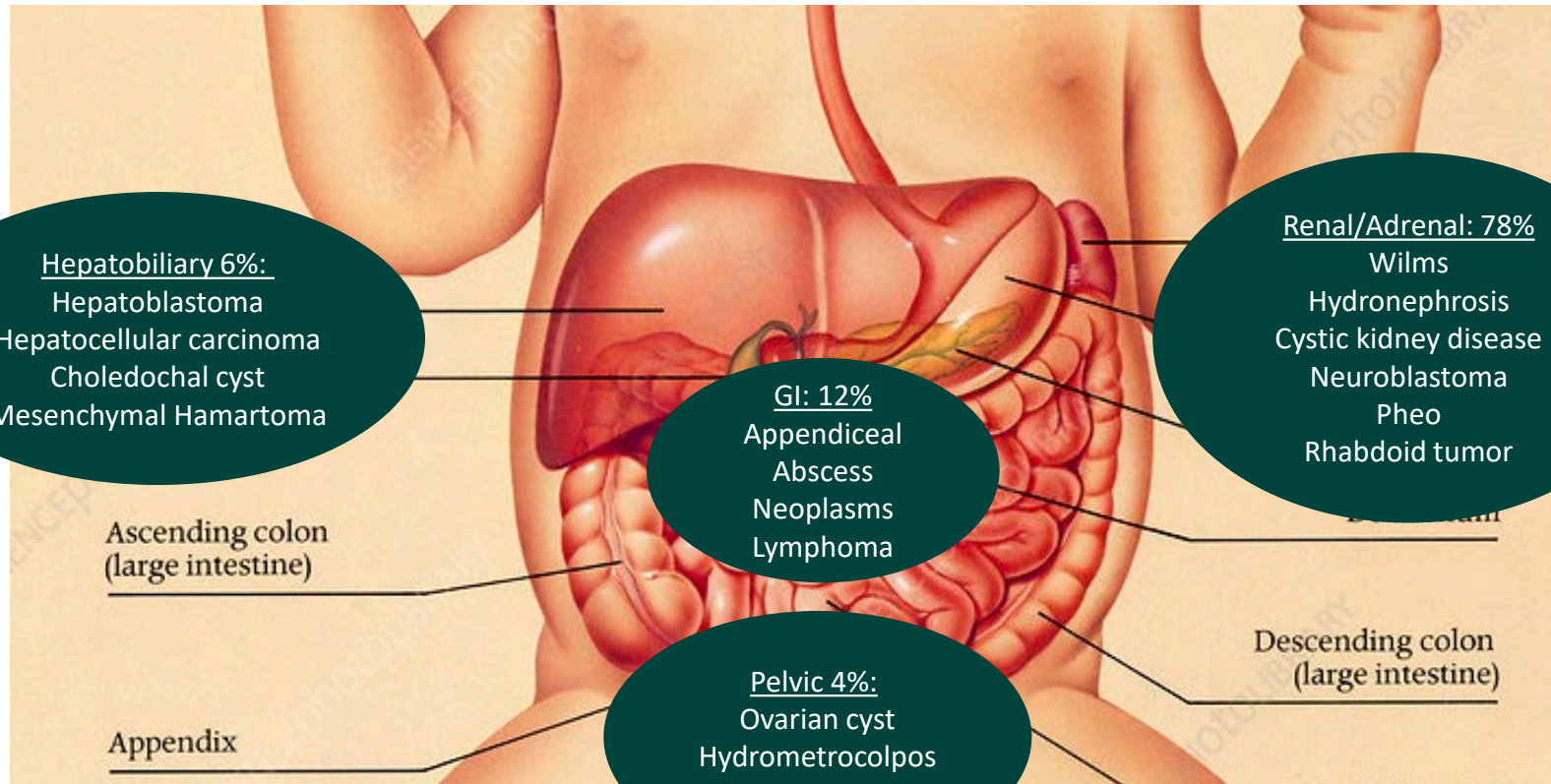
# Differential by age: Newborn/Infant



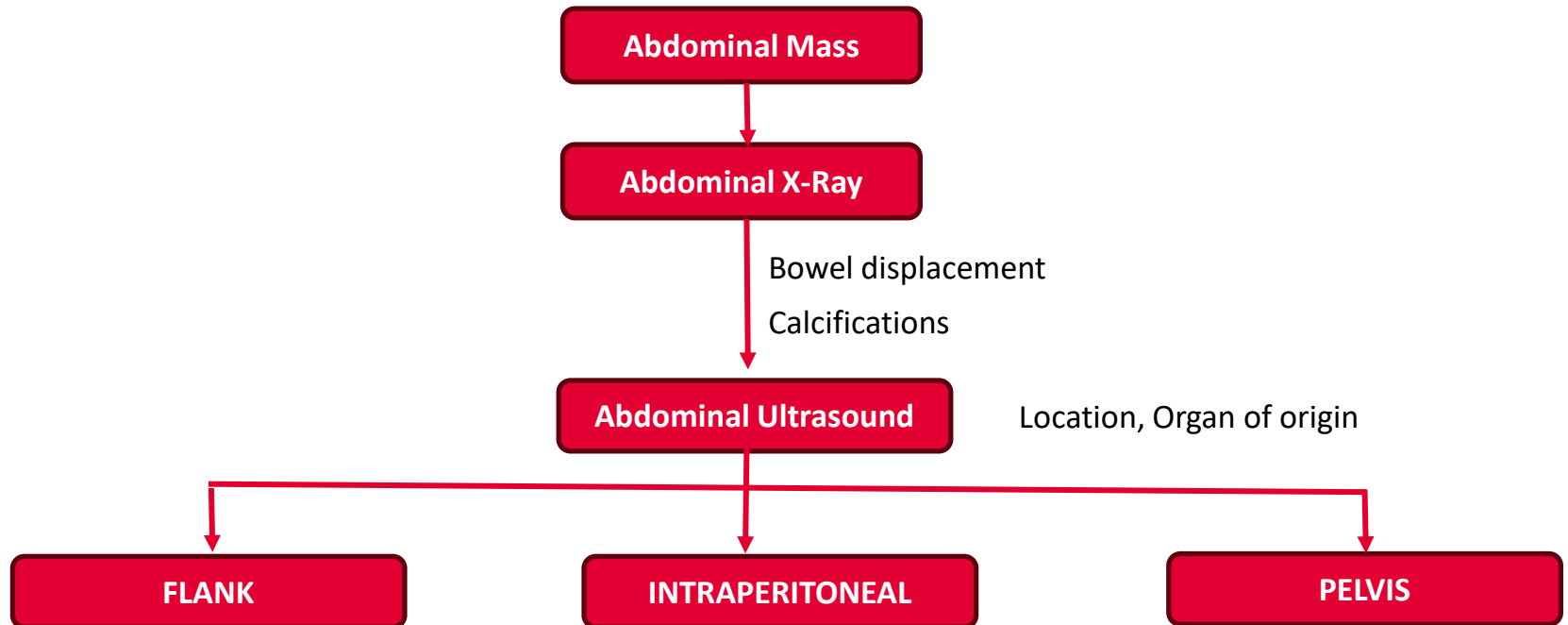
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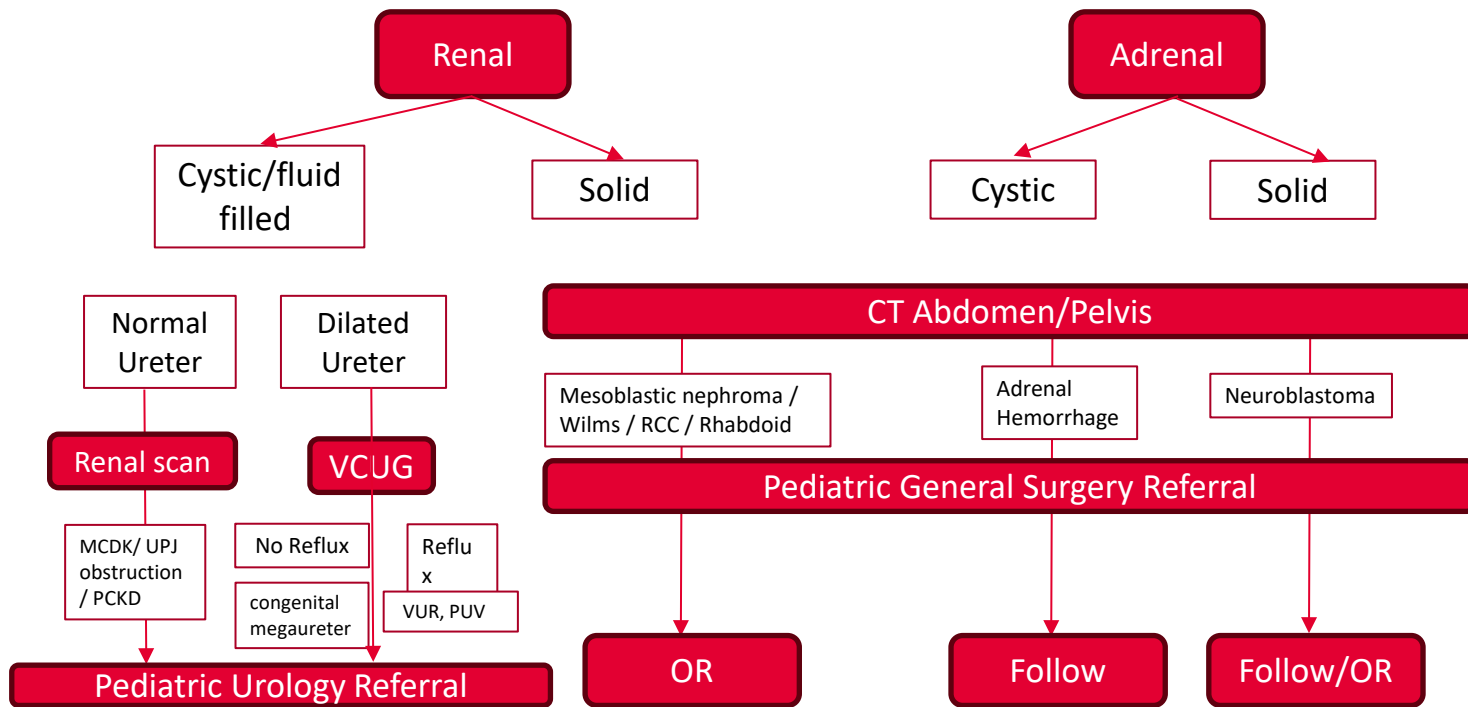
# Differential by age: Children/Adolescents



# Approach to the abdominal mass

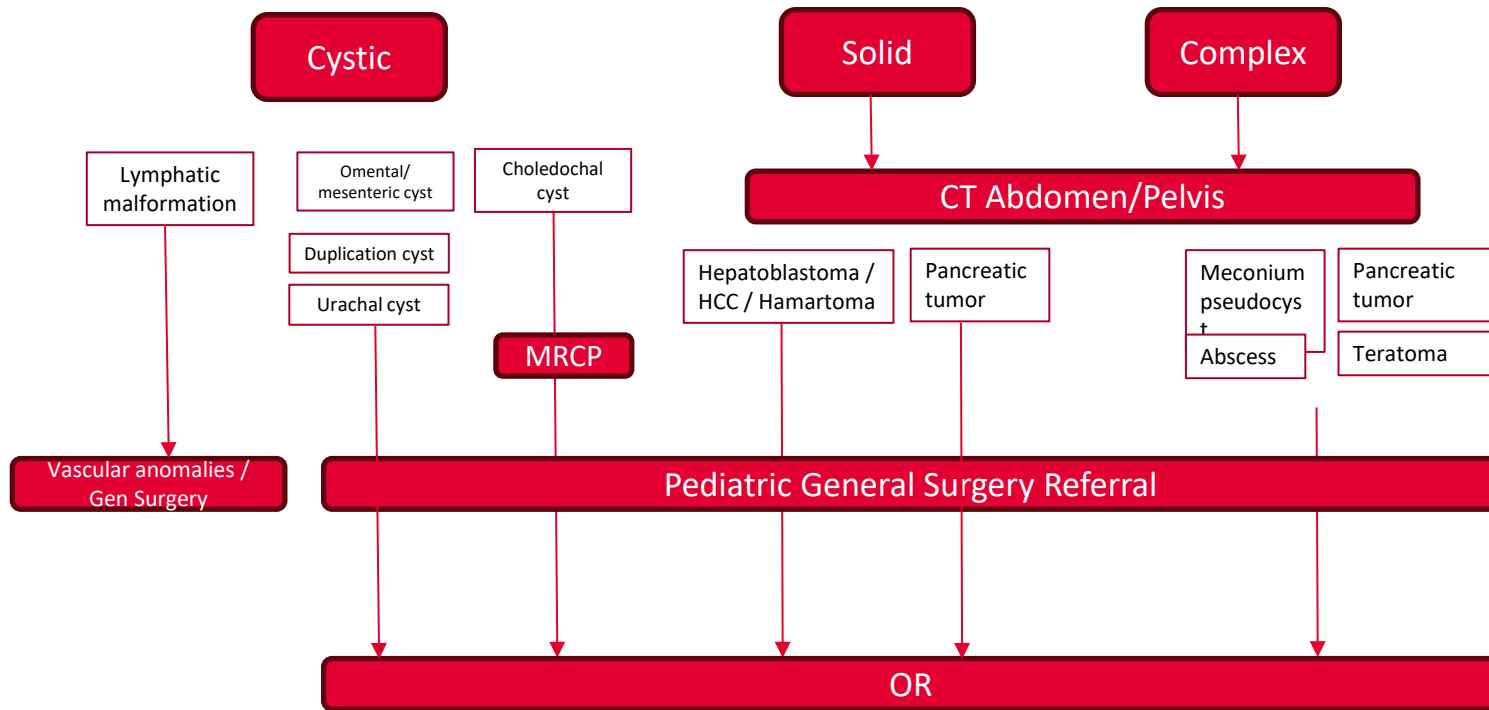


# Flank



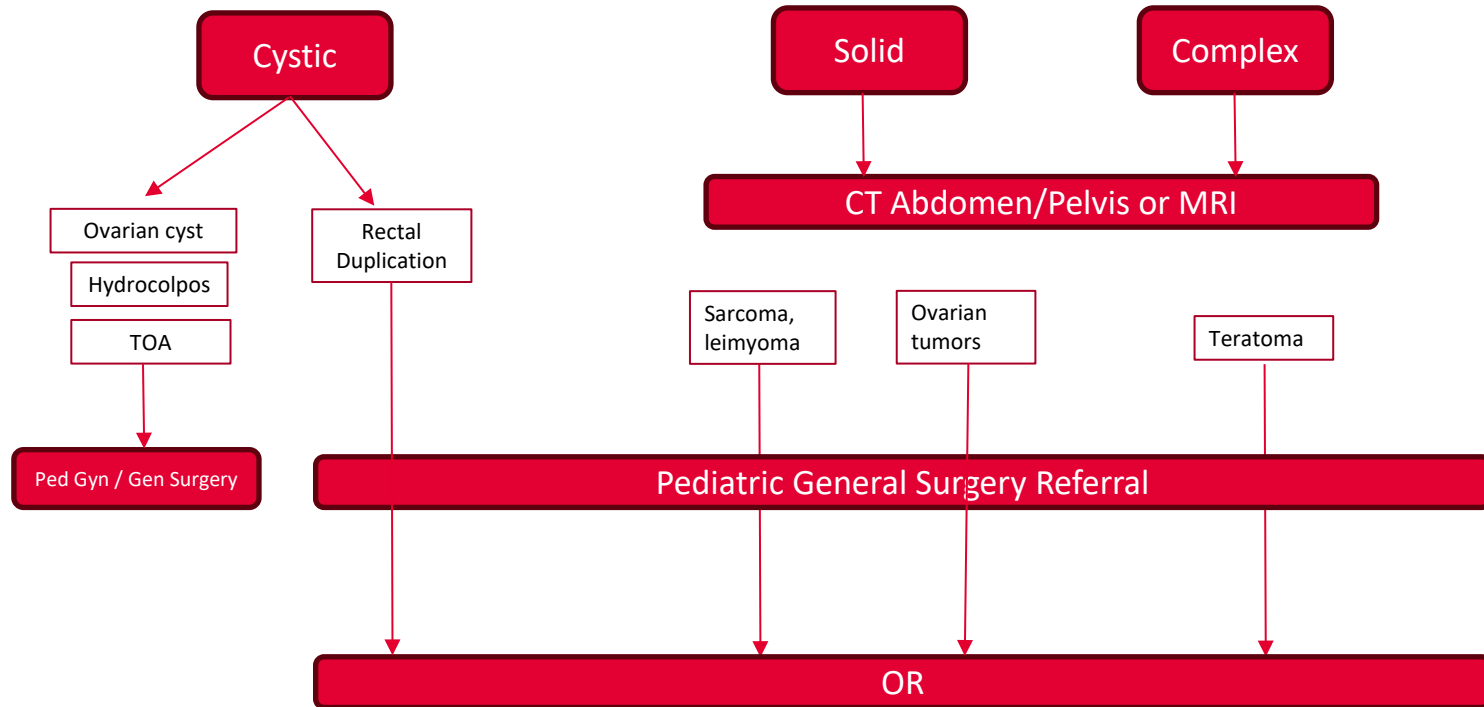


# Intraperitoneal





# Pelvic



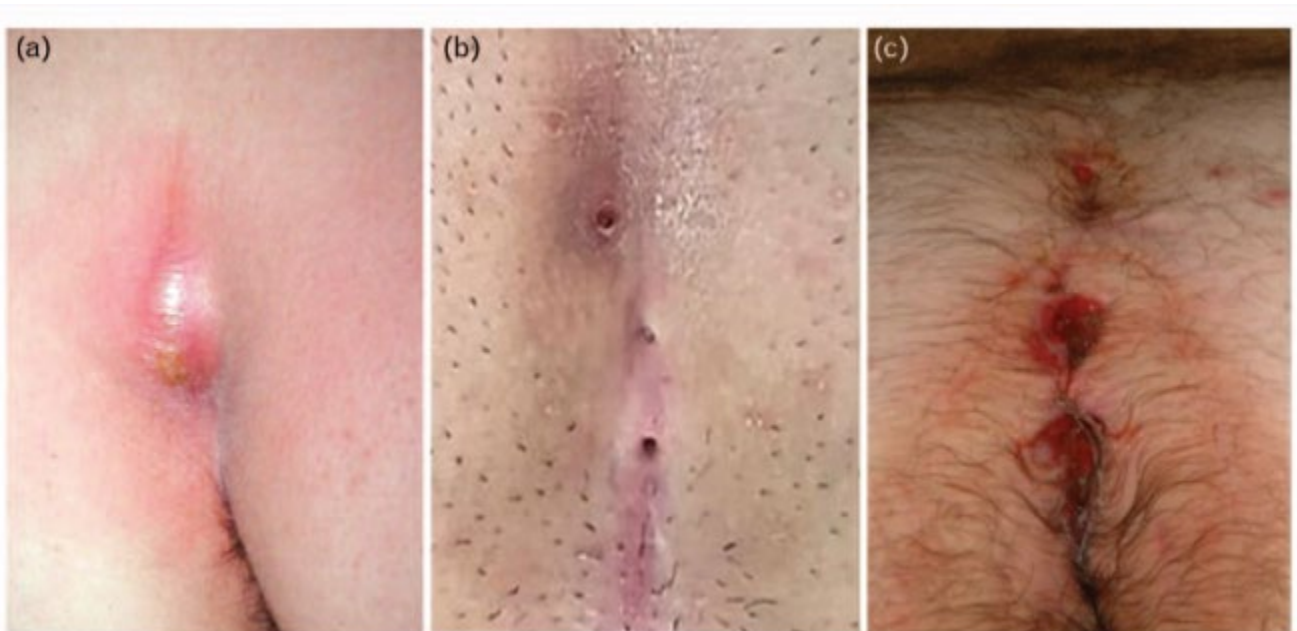
# Basic surgical concepts

- Complete resection is typically goal (R0 resection)
- Certain tumors okay for R1 resection
- Biopsy first step in certain tumors (e.g. neuroblastoma)
- Preoperative imaging key in surgical planning
- Avoid tumor rupture
- Sample lymph nodes in select cases
- Leave clips if plan is for radiation
- Placement of ports at same time may be efficient

# Pilonidal Disease

# Pilonidal Disease

- Inflammatory condition in gluteal cleft of buttocks
- Multiple factors: pubertal hormones, tears in hair follicles
- Presentation: Abscess, nonhealing wound, asymptomatic pit

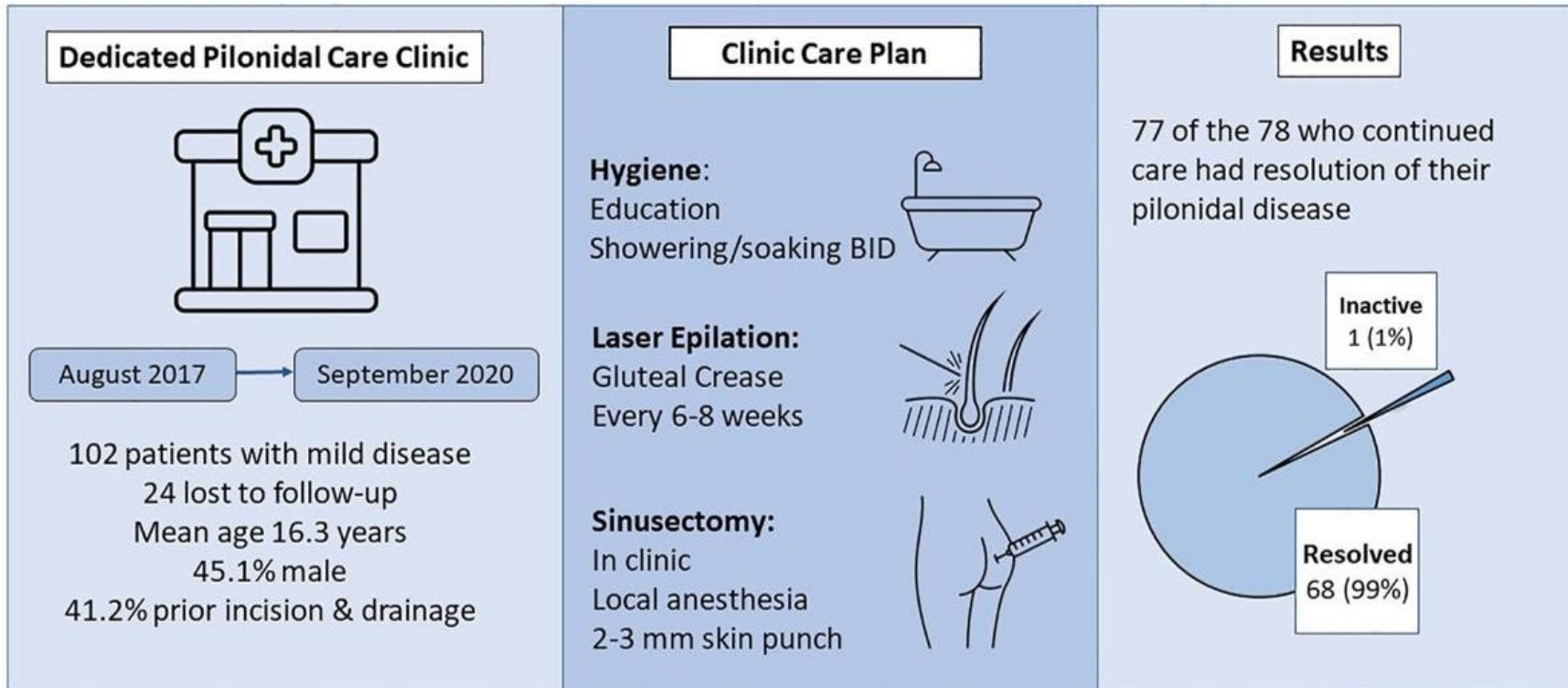


# Pilonidal disease management

- I&D for acute abscess, pain
- Antibiotics to cover aerobes & anaerobes
- Typically heal within 3-5 weeks
- Keep clean with showers and sitz baths
- Hair removal considered
- Indications for surgery: recurrent pilonidal abscesses

## Article of Interest:

# Resolution of Mild Pilonidal Disease in Adolescents Without Resection



Check et al. J Am Coll Surg, November 2022



# Advantages of Minimally Invasive Pilonidal Excision (MIPE)

## Technically Fast and Easy



Skin punch biopsy for pit excision



Removal of hair and granulation tissue



Irrigation with peroxide, open healing

**Low Recurrence/SSI Rates**

## Rapid Recovery/Better QoL



Back to school sooner

Fewer analgesics



Back to activities/sports sooner

## Recurrent/Persistent disease?

Failure of conservative treatment  
(including limited excision/sinusectomy)



Wide/En bloc excision (options)

1. Off-midline closure (Karydakis, Limberg, Bascom)
2. Tension-free midline closure
3. Open/secondary healing

# Vascular malformations



# Hemangioma

Benign proliferative vascular tumor

## Congenital

## Infantile

Develop



Develop



Regress postnatally

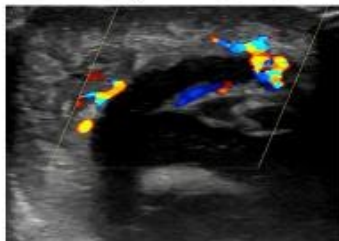
Proliferate then regress

Soft, Singular, Halo

Soft, Multiple



Well defined, mixed echogenicity



# Vascular Malformation

Congenital dysmorphogenesis of the vessels

## Lymphatic

## Venous

## Arteriovenous

Develop



Develop



Most Develop



Can fluctuate in size

Grow proportionally over time

Grow proportionally over time

Can flare with illness

Enlarge with



or



Compressible

Can feel



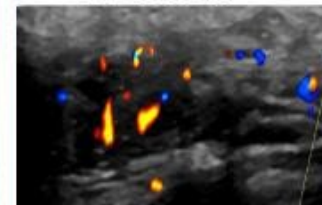
Soft



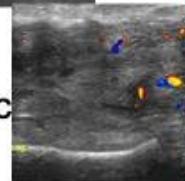
Macrocystic



Slow flow



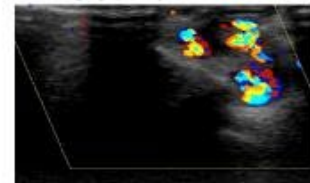
Microcystic



Pulsatile



Fast flow



# Hemangiomas



Infantile hemangioma:

- Progress in first 1-3 months, plateau, then involute
- Usually reach final size within 3 mo but can be up to 1 year
- Involution can take up to 5-7 years
- Propranolol
  - Sensitive areas or functional areas (face, lips, nose)
  - Ulceration
  - Large lesions

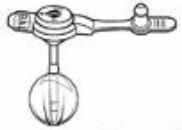
# Vascular malformations

	Evaluation	Imaging
Capillary malformation	<ul style="list-style-type: none"> <li>•Location can suggest underlying abnormalities</li> <li>•Spine abnormalities</li> <li>•Ophthalmic / trigeminal nerve dermatomes – eval for Sturge-Weber syndrome (ocular, leptomeningeal anomalies)</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
Lymphatic malformation	<ul style="list-style-type: none"> <li>•Superficial LMs can leak fluid or blood</li> <li>•Spontaneous hemorrhage -&gt; expansion, pain, inflammation</li> <li>•Infection</li> <li>•GI LMs -&gt; bacterial translocation, protein loss</li> </ul>	<ul style="list-style-type: none"> <li>•U/S</li> <li>•MRI</li> </ul>
Venous malformation	<ul style="list-style-type: none"> <li>•MC symptom = pain</li> <li>•Phleboliths can be uncomfortable</li> <li>•Acute expansion due to hemorrhage</li> <li>•&gt; 10 cm can alter coagulation profiles, risk of thromboembolism</li> </ul>	<ul style="list-style-type: none"> <li>•U/S</li> <li>•MRI</li> <li>•Venography</li> </ul>
AV malformation	<ul style="list-style-type: none"> <li>•Pain, ulceration, heart failure</li> </ul>	<ul style="list-style-type: none"> <li>•Doppler U/S</li> <li>•MRI</li> <li>•Angio</li> </ul>

# Vascular malformations

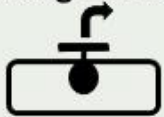



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# Common post-surgical issues



# Gastrostomy Tube Troubleshooting












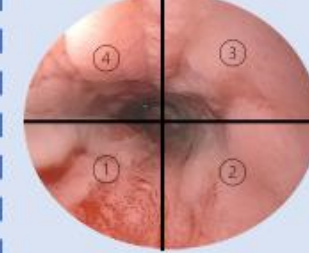

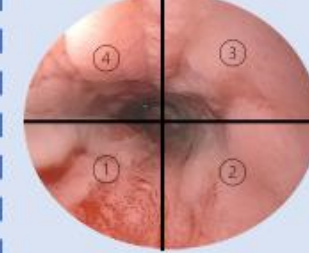

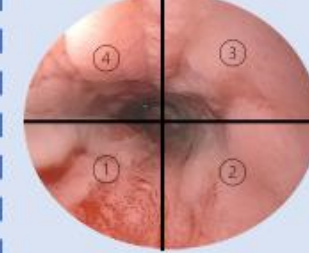
Problem	Cause/Risk factors	Solution
<p><b>Dislodgement</b></p> 	<ul style="list-style-type: none"> <li>• Not properly secured</li> <li>• Broken balloon</li> <li>• Confused or neurologically impaired patients</li> </ul>	<ul style="list-style-type: none"> <li>• Less than 4-6 weeks after placement → ED</li> <li>• More than 6 weeks after placement → replace with spare G-tube or foley</li> <li>• Contrast study to confirm proper placement</li> <li>• If recurrent – consider non-balloon GT (e.g. Bard™)</li> </ul>
<p><b>Granulation Tissue</b></p> <p>Raised, moist red tissue +/- yellow sticky discharge</p> 	<ul style="list-style-type: none"> <li>• Excessive movement of the tube</li> <li>• Pressure from the tube</li> <li>• Excessive moisture</li> </ul>	<ul style="list-style-type: none"> <li>• Warm compresses</li> <li>• Keep site clean and dry</li> <li>• Secure extension tubing during feeds</li> <li>• Silver nitrate q48-72h, betadine cleaning in between</li> <li>• Steroid cream</li> </ul>
<p><b>Infection</b></p> <p>Red, hot, painful and swollen skin</p> 	<ul style="list-style-type: none"> <li>• Excessive traction on internal bumper</li> <li>• Narrow skin incision at time of placement</li> <li>• Poor wound healing/care</li> <li>• Partially extruded tube/Buried bumper syndrome</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation by surgical team</li> <li>• Antibiotics: cephalexin or amoxicillin/clavulanic acid as first line option</li> <li>• Consider ultrasound to rule out fluid collection</li> </ul>
<p><b>Leakage</b></p> 	<ul style="list-style-type: none"> <li>• Excessive movement of tube → expansion of tube entry site</li> <li>• Viral illness/excessive gastric acid secretion</li> <li>• Poor wound healing</li> </ul>	<ul style="list-style-type: none"> <li>• Keep site clean</li> <li>• Protect skin with barrier cream</li> <li>• Proton pump inhibitors</li> <li>• Check balloon</li> <li>• Secure extension tubing during feeds</li> <li>• Remove tube for short amount of time to allow</li> </ul>

# Wound healing

- Epithelialize in 2 days, no bathing/submerging ~1-2 weeks
- Erythema around wound – Short course of antibiotics
- Fluctuance – Open wound & drain
- Minimize heavy lifting/use of abdominal core for abdominal incisions for ~1 month



# Endoscopic Surveillance in Asymptomatic Esophageal Atresia Patients

Why?	When?	How?				
<p>Esophagitis can be silent </p> <p> 2/3 of biopsy proven esophagitis is asymptomatic</p> <p><b>FOUR X</b> Risk of Barrett's Esophagus</p> <p></p> <p>Unknown/Finite Esophageal Cancer Risk</p>	<p> Stopping Anti-acid</p> <p> Before 10 years of age</p> <p> At transition to adulthood</p> <p> Every 5 to 10 years</p> <p> Symptoms</p>	<table border="0"> <tr> <td data-bbox="1304 385 1593 542"> <p>Normal Appearance</p> <p>1 biopsy per level</p> </td> <td data-bbox="1603 385 1912 542"> <p>Abnormal Appearance</p> <p>[e.g. EOE, esophagitis, Barrett's]</p> </td> </tr> <tr> <td data-bbox="1304 549 1593 1085">  <p>Levels</p> <p>Below</p> <p>Anastomosis</p> </td> <td data-bbox="1603 549 1912 1085">  <p>1 biopsy per quadrant</p> <p>4 quadrants per level</p> <p>[@every cm if Barrett's]</p> <p>All levels</p> </td> </tr> </table>	<p>Normal Appearance</p> <p>1 biopsy per level</p>	<p>Abnormal Appearance</p> <p>[e.g. EOE, esophagitis, Barrett's]</p>	 <p>Levels</p> <p>Below</p> <p>Anastomosis</p>	 <p>1 biopsy per quadrant</p> <p>4 quadrants per level</p> <p>[@every cm if Barrett's]</p> <p>All levels</p>
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