Newborn Bowel Obstruction

Shahrzad Joharifard MD MPH FRCSC

June 22, 2023

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GLOBAL SURGERY LAB

BC Children's Hospital

MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

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Who are we?

BC Children's Hospital



John Lawrence

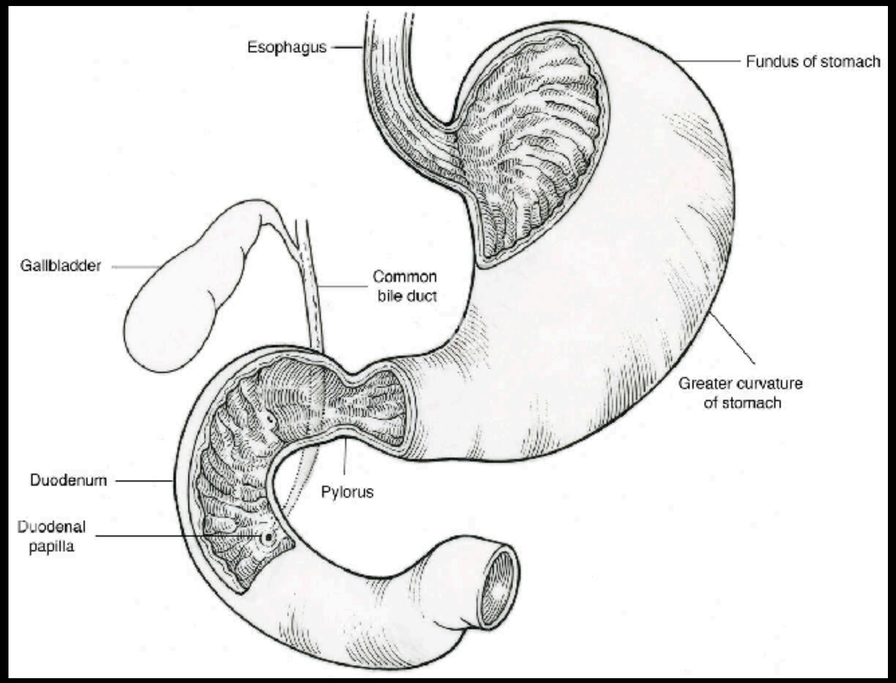


Shahrzad Joharifard

@scarzad

Newborn Bowel Obstruction | Basics

- **Proximal** bowel obstruction results in vomiting with minimal or even no abdominal distension
  - If the obstruction is proximal to the ampulla, emesis will be non-bilious.
  - If the obstruction is distal to the ampulla, emesis will be bilious



- **Distal** bowel obstruction results in progressive and often severe abdominal distension, with vomiting occurring later in the course
- Bilious emesis in an infant is a bowel obstruction until proven otherwise and requires urgent surgical assessment because it can be **lethal**

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Newborn Bowel Obstruction | Case 1

BC Children's Hospital

- A 6 day old 2.2kg newborn presents with progressive bilious emesis. He appears generally unwell.
- What are your first steps?

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Newborn Bowel Obstruction | Case 1

BC Children's Hospital

- A 6 day old 2.2kg newborn presents with bilious emesis. He appears generally unwell.
- An 8Fr NG tube has been inserted. An IV has been inserted and the patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What next?

Exam for Newborn Bowel Obstruction

- Vital signs
- General appearance
- NG tube output
- Heart
- Abdomen
- Groin
- Anus

Universal
Bile Bag
300ml

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Newborn Bowel Obstruction | Case 1

BC Children's Hospital

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- An 8Fr NG tube has been inserted. An IV has been inserted and the patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- Differential diagnosis for **proximal** bowel obstruction?

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Newborn Bowel Obstruction | Case 1

BC Children's Hospital

- A 6 day old 2.2kg newborn presents with bilious emesis. He appears generally unwell.
- Differential diagnosis for **proximal** bowel obstruction?
    - Malrotation ± volvulus
    - Congenital duodenal obstruction
    - Jejunal or ileal atresia
    - Pyloric stenosis

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Newborn Bowel Obstruction | Case 1

BC Children's Hospital

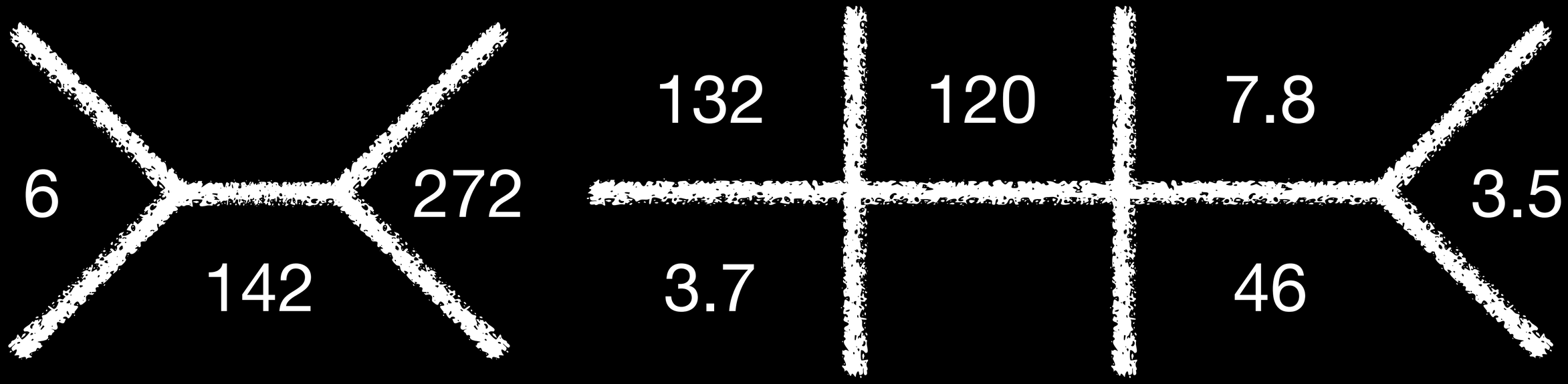
- A 6 day old 2.2kg newborn presents with bilious emesis. He appears generally unwell.
- An 8Fr NG tube has been inserted. An IV has been inserted and the patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- Further work-up?

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Newborn Bowel Obstruction | Case 1

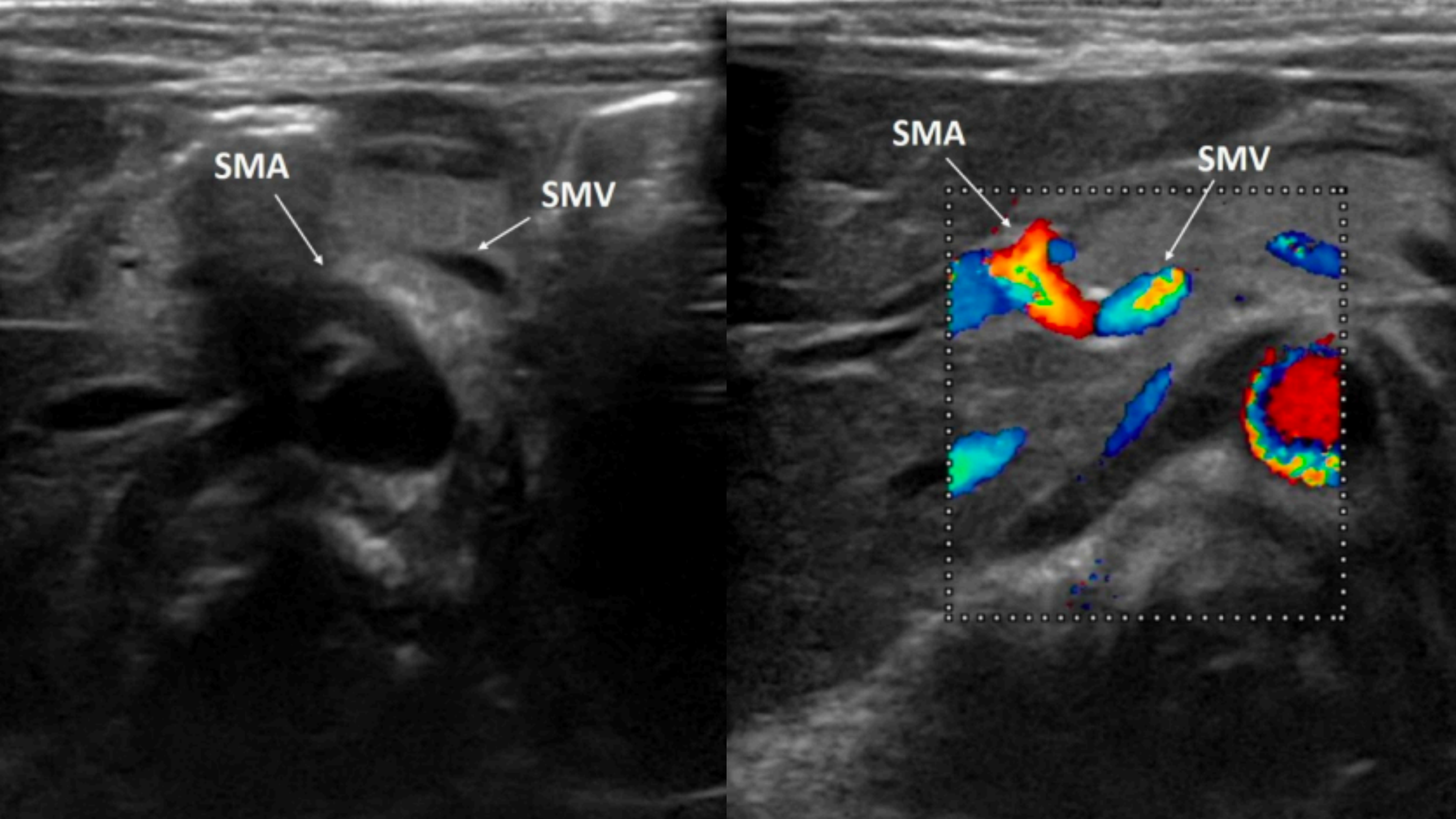
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- A 6 day old 2.2kg newborn presents with bilious emesis. He appears generally unwell.
- Further work-up?
  - Labs —> electrolytes ± venous gas (if possible)
  - Imaging —> AXR ± ultrasound (if possible)



7.3	32	19	4
pH	pCO_2	HCO_3	Lactate




SMA
SMV
SMA
SMV

Malrotation ± Volvulus | X-Ray & US

- X-Ray:
  - Gastric distension, ± “double bubble” ± gases abdomen —> some distal air is concerning if you’re pre-test diagnosis is duodenal atresia…
- Ultrasound:
  - Clockwise whirlpool sign
  - Inverted SMA/SMV relationship
  - Dilated duodenum proximal to obstruction
  - Free intra-abdominal fluid

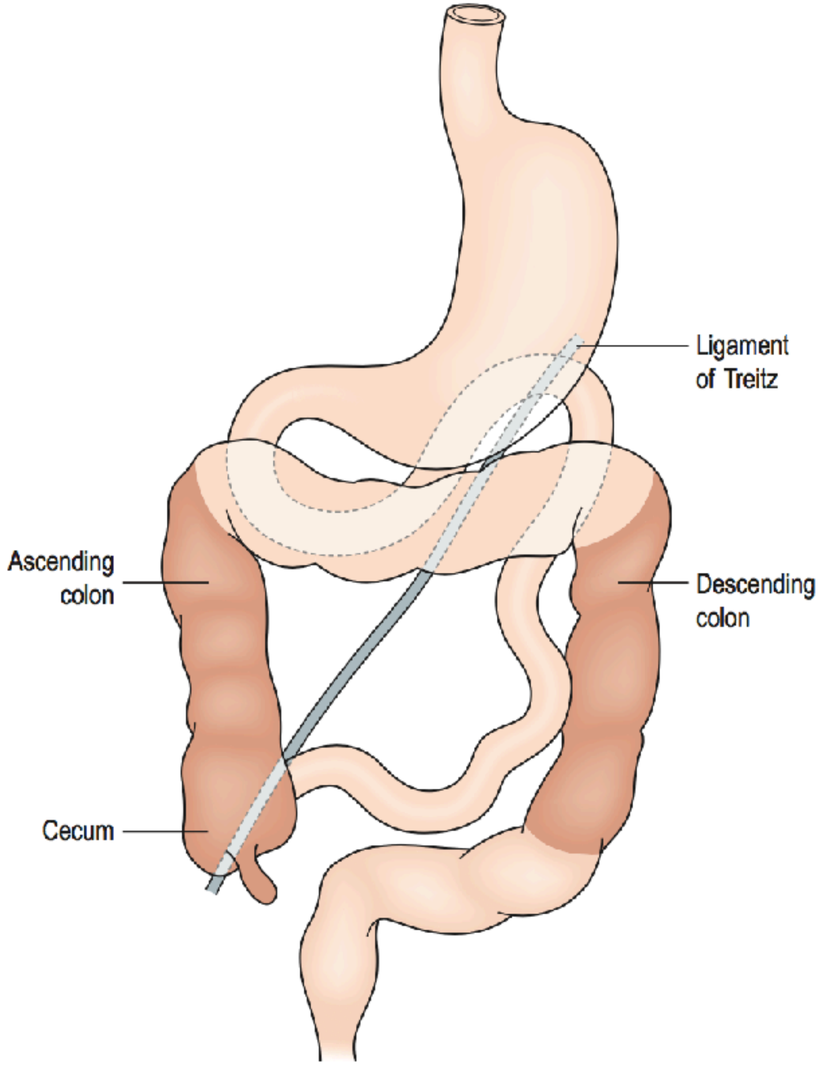


FIGURE 31-1 ■ Normal intestinal anatomy results in fixation of the duodenojejunal junction in the left upper quadrant and the cecum in the right lower quadrant. This allows a wide breadth to the mesentery of the small bowel.

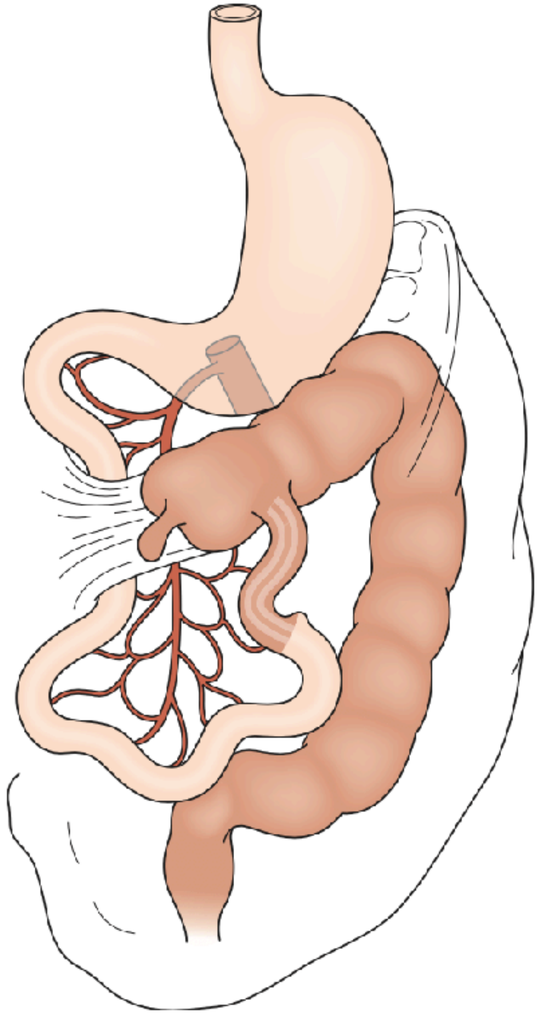
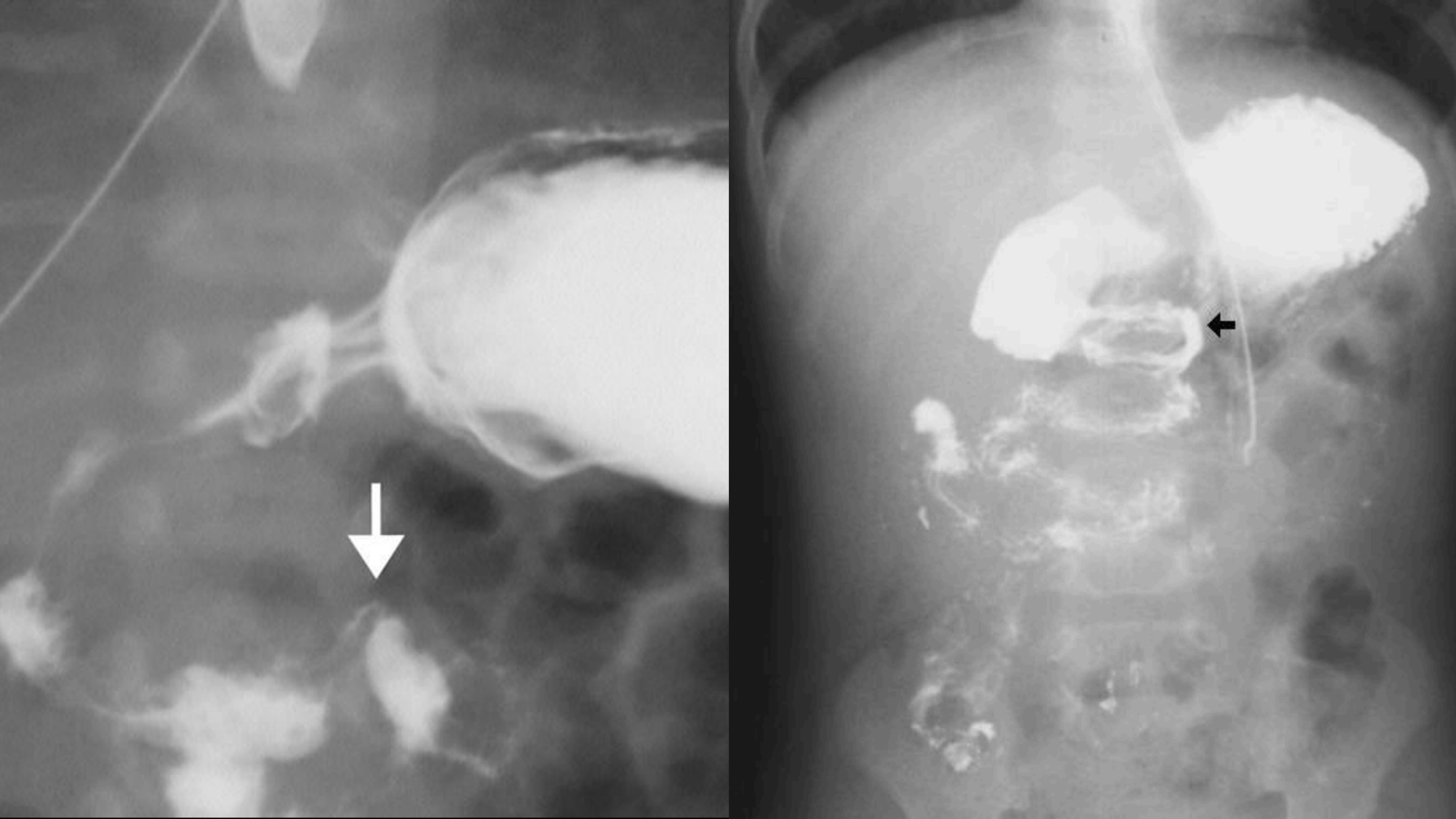


FIGURE 31-3 ■ Incomplete rotation. Both the prearterial (lightly shaded) and postarterial (darkly shaded) segments have undergone partial, yet not complete, rotation. Ladd's bands are seen attaching the cecum to the right posterior abdominal wall. The duodenum becomes compressed and possibly obstructed. Volvulus is a risk.

Malrotation ± Volvulus | UGI

- Gold standard but false positive 10-15%
- Normal study:
  - AP: duodenum crosses spine & duodenum rises to the level of the pylorus
  - Lateral: D2 & D3 travel posteriorly into retroperitoneum
- Malrotation:
  - AP view: duodenum doesn't cross spine & duodenum does not rise to the level of the pylorus
  - Lateral: D2 & D3 not located posteriorly in retroperitoneal position
- Volvulus:
  - Dilated duodenum with "bird's beak"
  - "Corkscrew" appearance of duodenum & small bowel



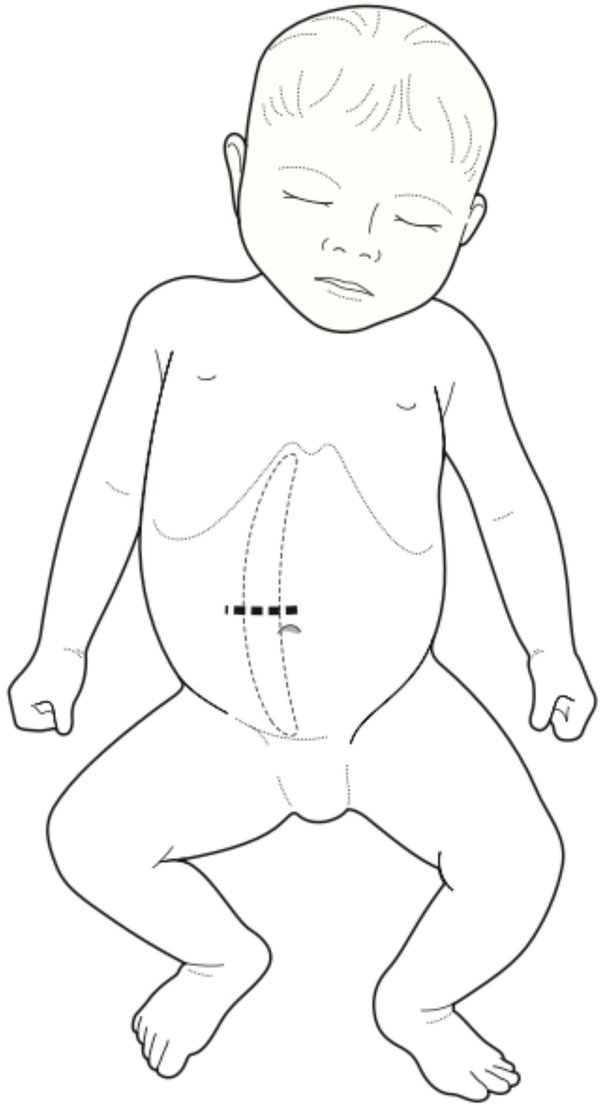
Malrotation ± Volvulus | Epidemiology

- Incidence:
  - Autopsy series incidence of malrotation 1:200 (0.5%)
  - Population incidence of volvulus 1:6000
  - Therefore, 1 in 30 patients with malrotation will develop volvulus
- When do rotational anomalies present?
  - 70% of symptomatic patients present during 1st year
    - 70% of those present during 1st month

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Malrotation ± Volvulus | OT

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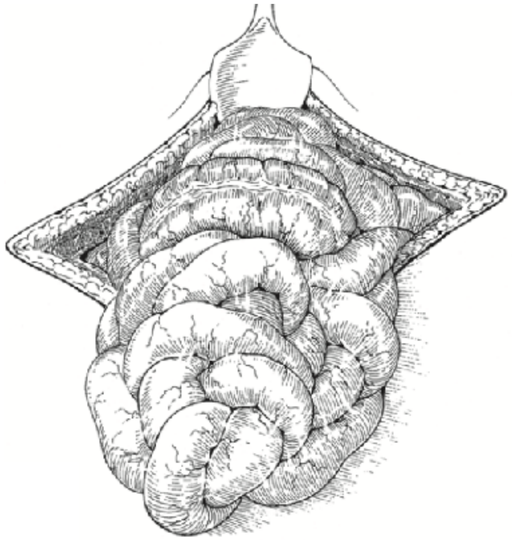




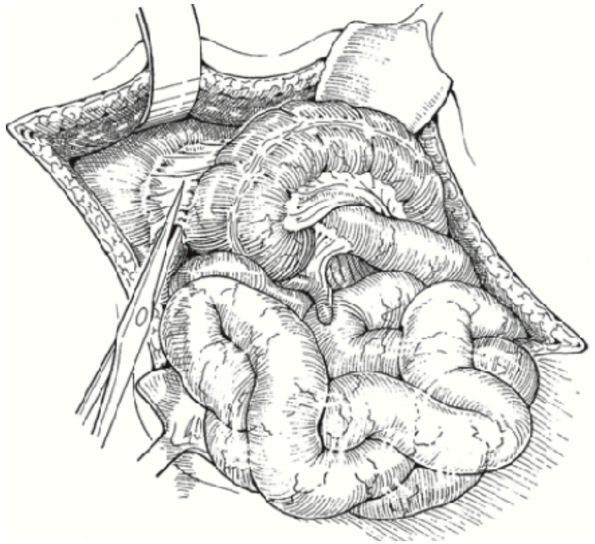
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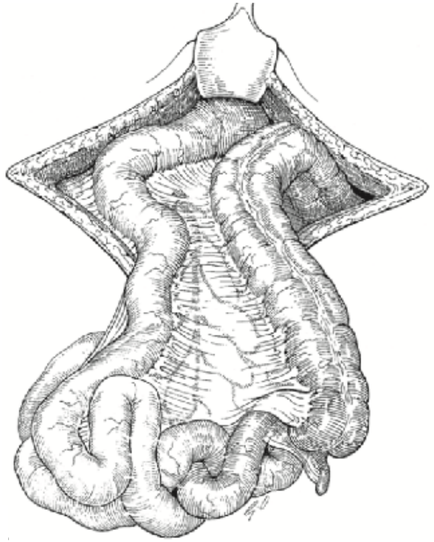
Malrotation ± Volvulus | OT

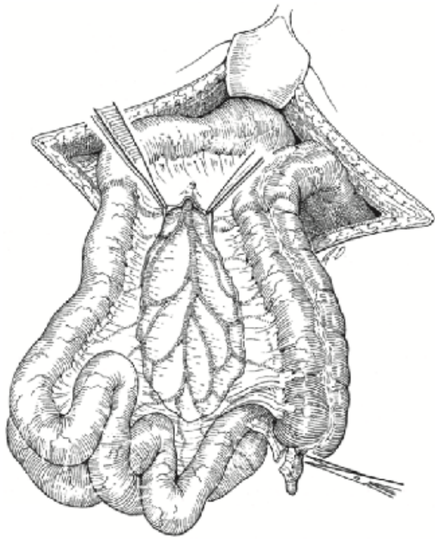
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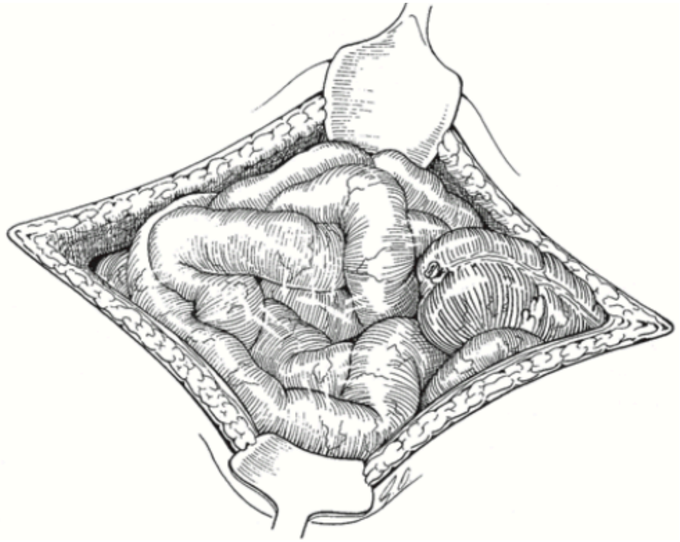












Newborn Bowel Obstruction | Case 2

- A 3 day old 2.2kg old baby arrives in the emergency department with progressive bilious emesis. He is otherwise well.
- What are your first steps?

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Newborn Bowel Obstruction | Case 2

BC Children's Hospital

- A 3 day old 2.2kg old baby arrives in the emergency department with progressive bilious emesis. He is otherwise well.
- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What next?


R



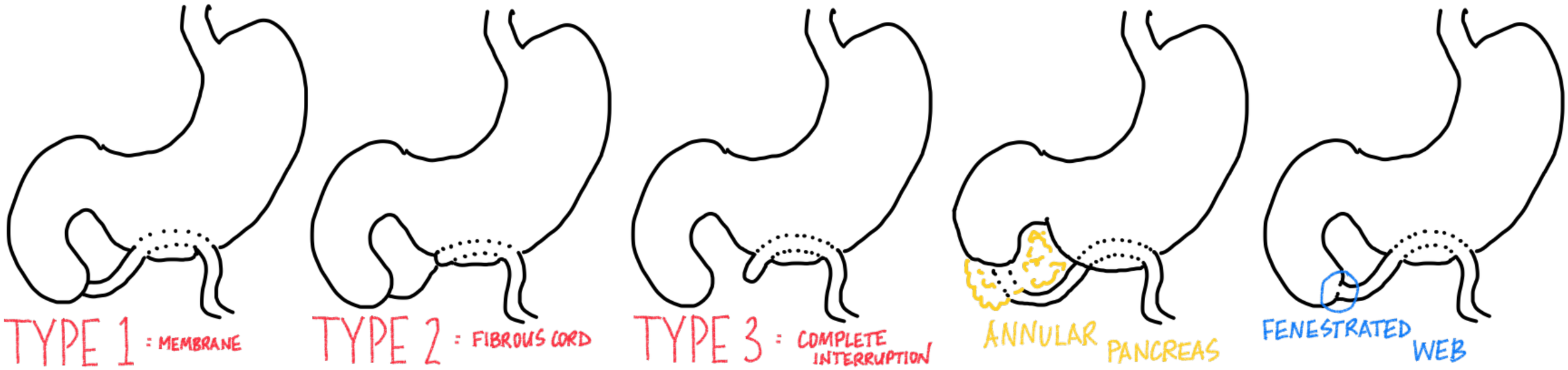
Congenital Duodenal Obstruction | Types

- Intrinsic
  - Duodenal atresia
  - Duodenal web
- Extrinsic
  - Annular pancreas
  - Duodenal duplication
  - Malrotation ± volvulus

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Congenital Duodenal Obstruction | Types

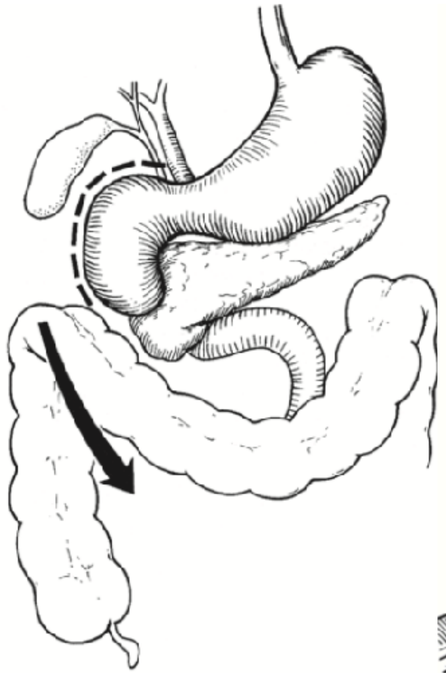
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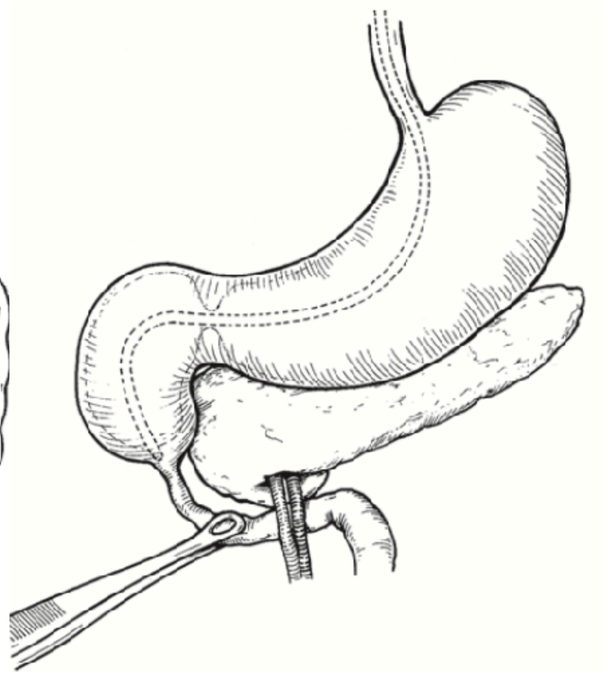


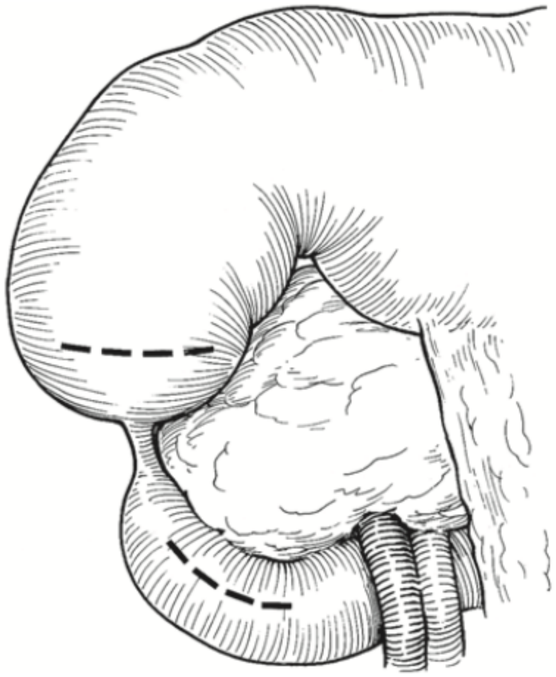
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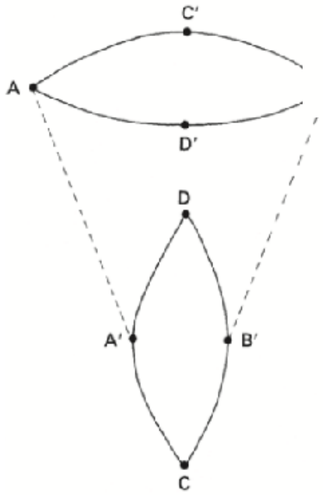
Congenital Duodenal Obstruction | OT

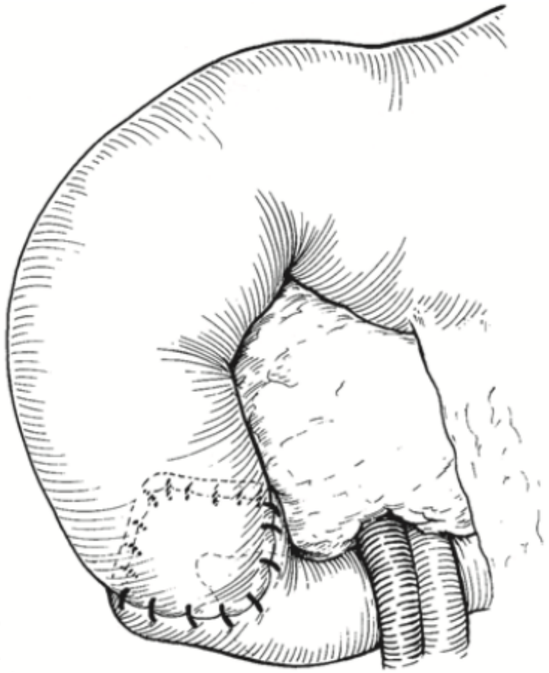
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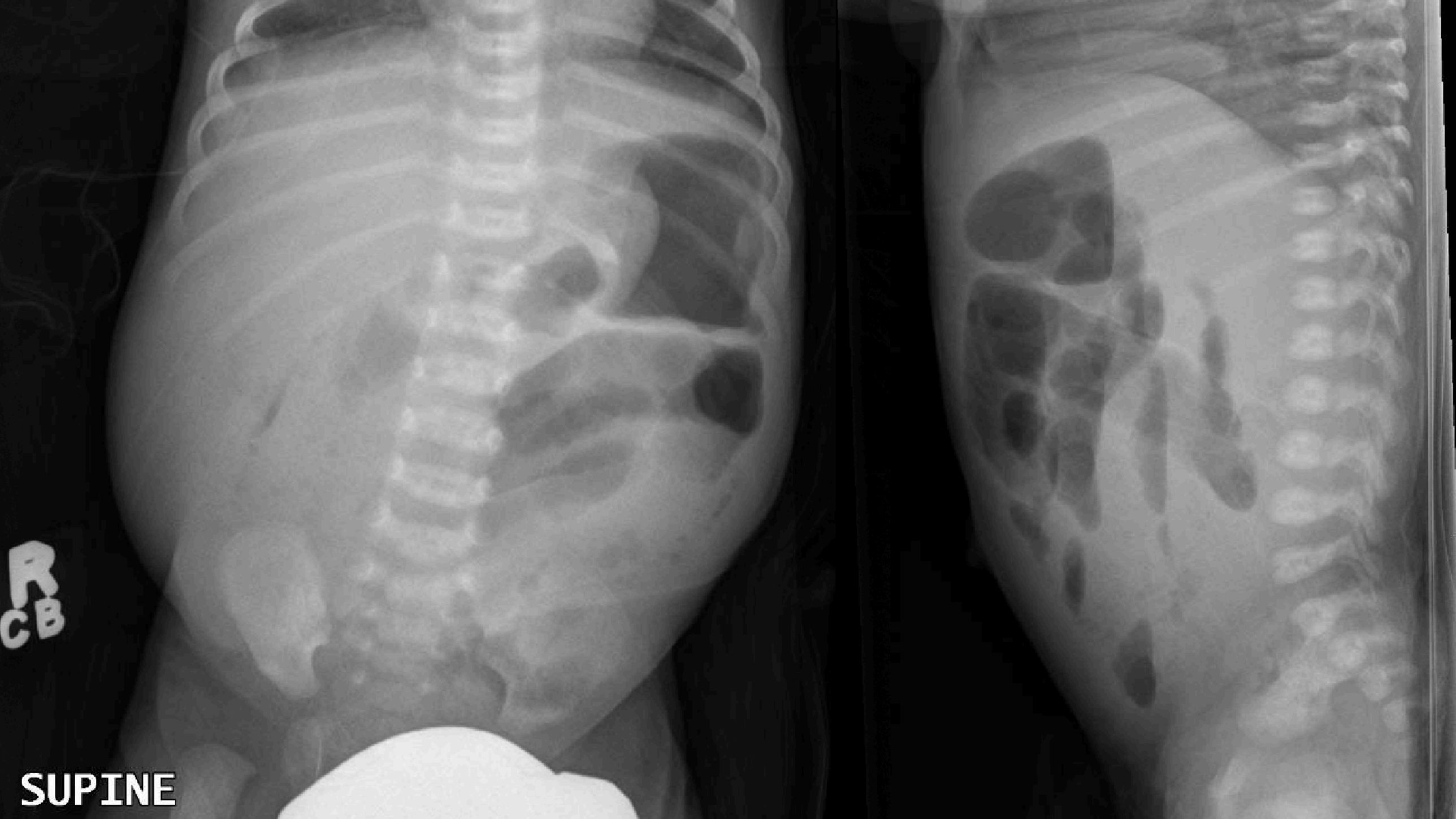




Newborn Bowel Obstruction | Case 3

- A 3 day old 2.2kg old baby arrives in the emergency department with progressive bilious emesis and abdominal distension. He has never passed stool.
- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What are your next steps?

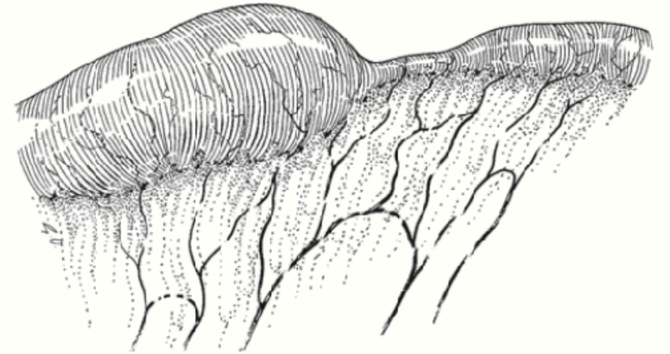



R
CB
SUPINE

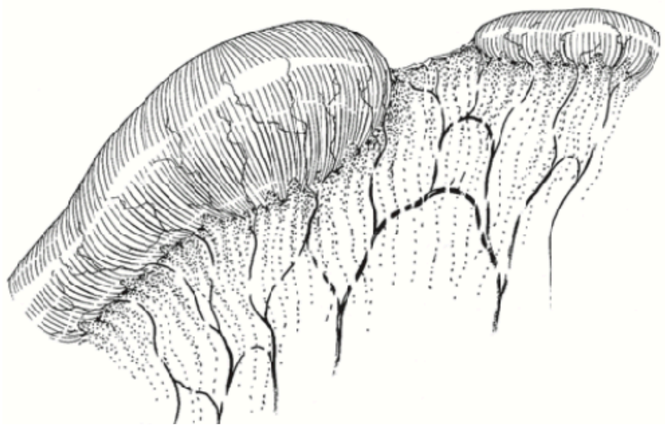
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Types of Intestinal Atresias

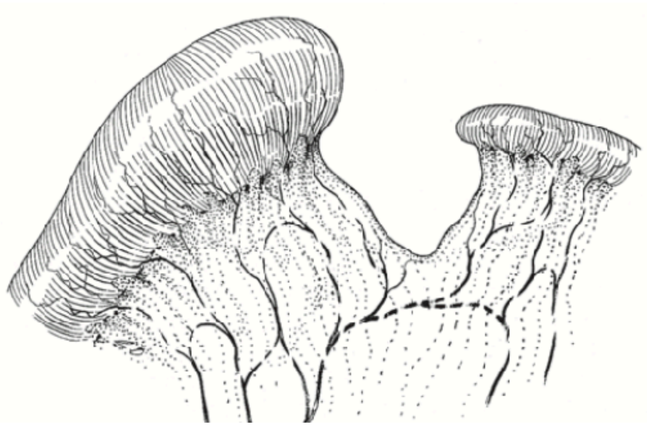
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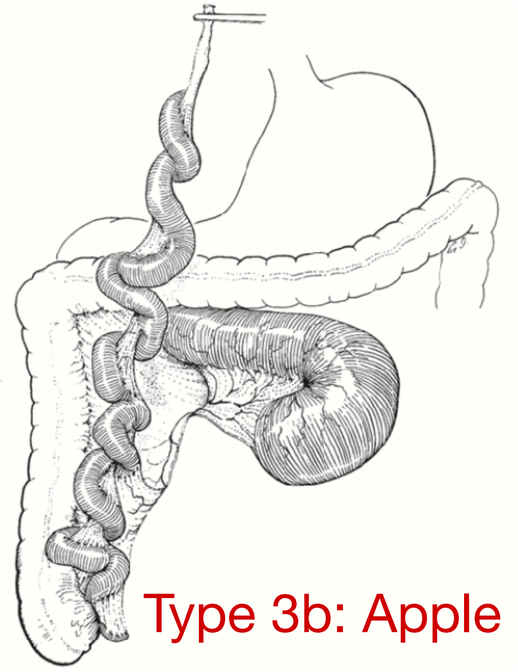
Type 1: Membrane



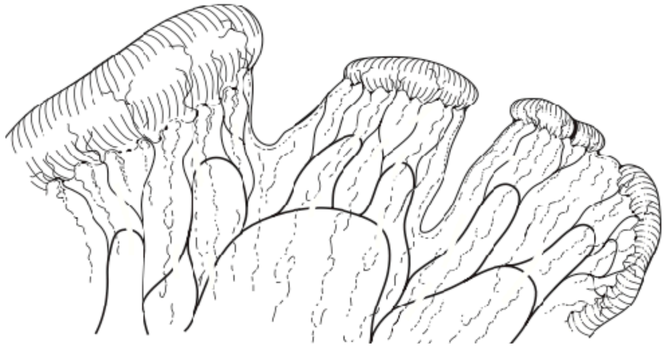
Type 2: Fibrous Cord



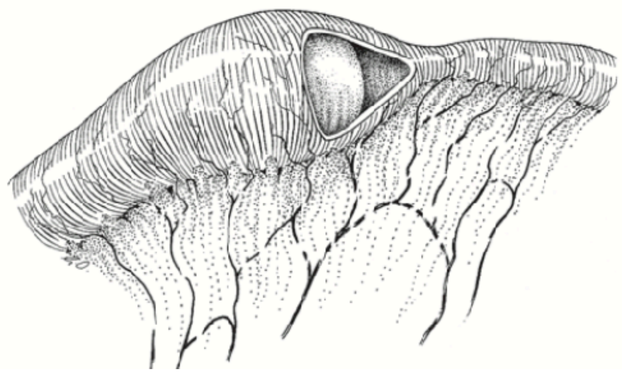
Type 3a: Gap



Type 3b: Apple Peel



Type 4: Multiple



Stenosis

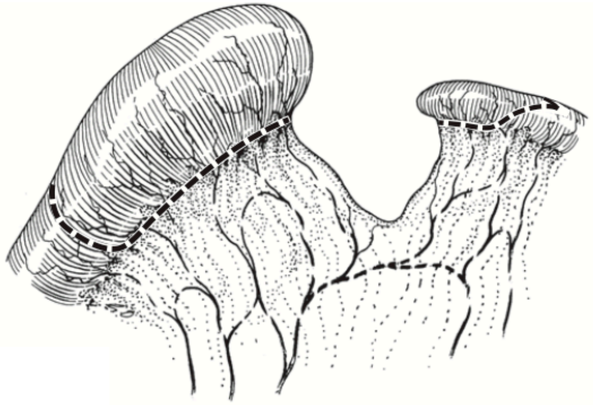


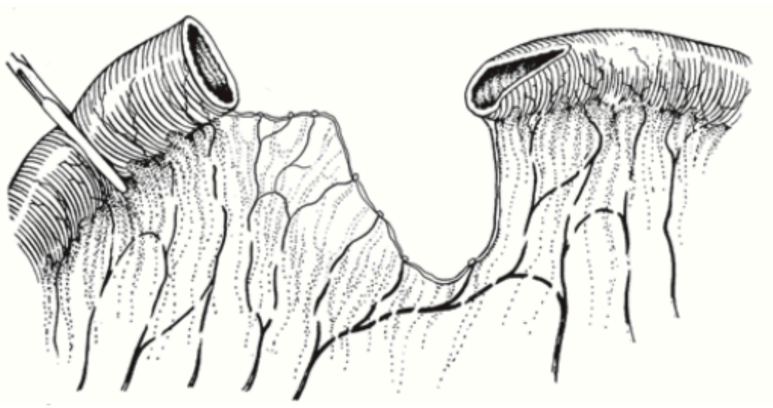


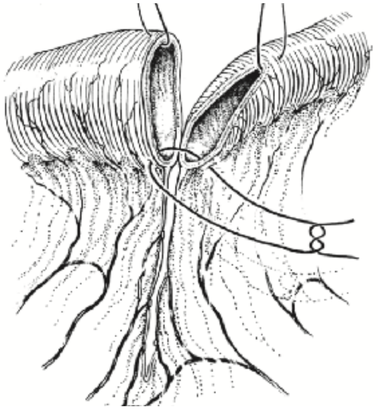
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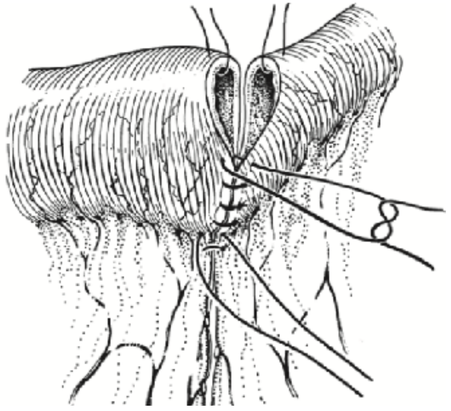
Small Bowel Atresia | OT

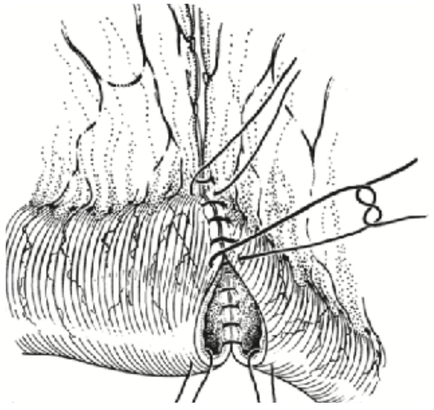
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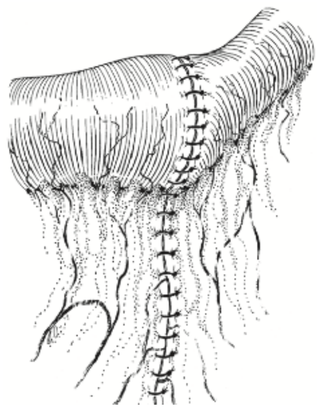








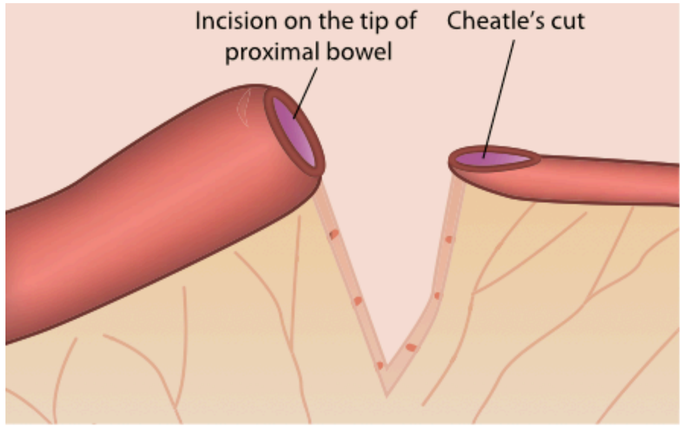


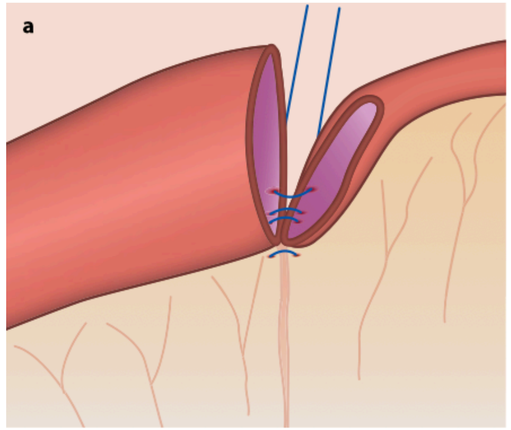


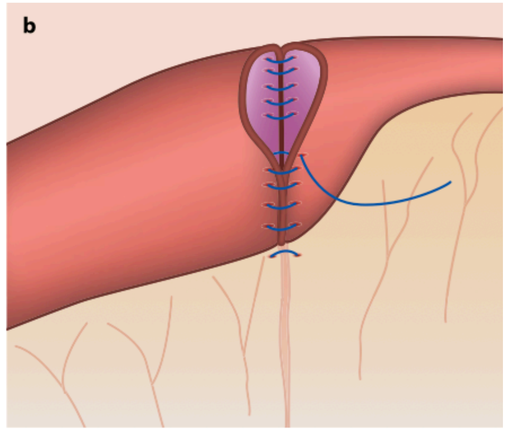
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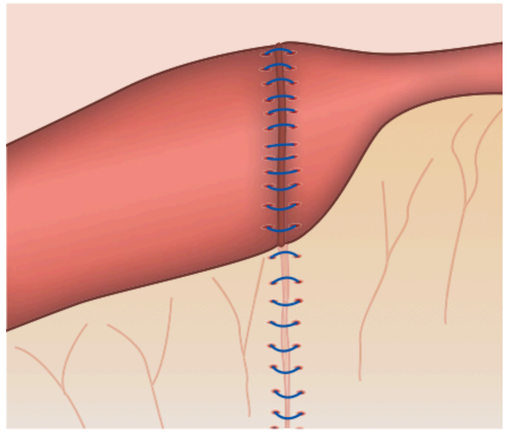
Small Bowel Atresia | OT

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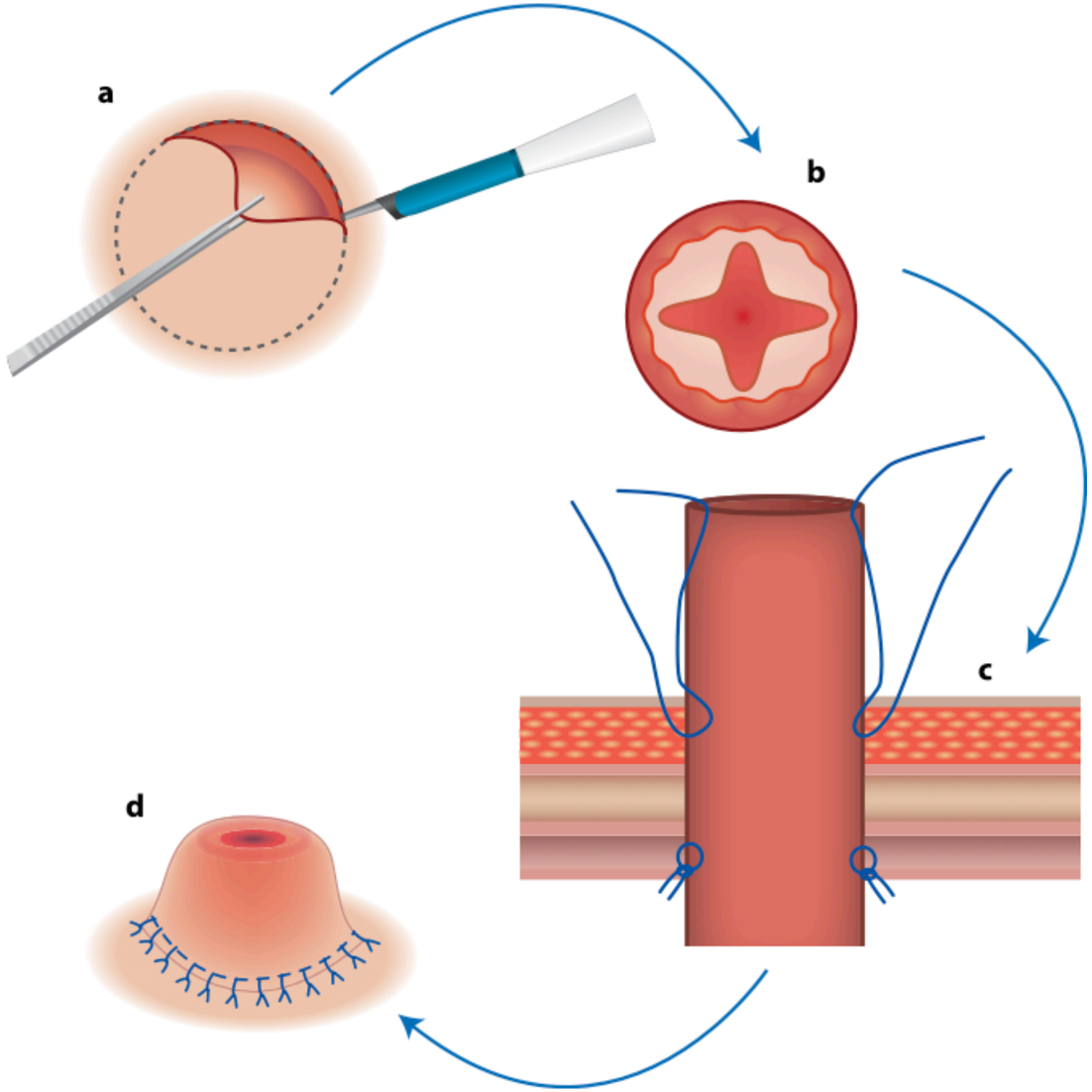




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Small Bowel Atresia | OT

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Newborn Bowel Obstruction | Case 4

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- A 6 week baby arrives in the emergency department with progressive non-bilious emesis and failure to gain weight.
- What are your first steps?

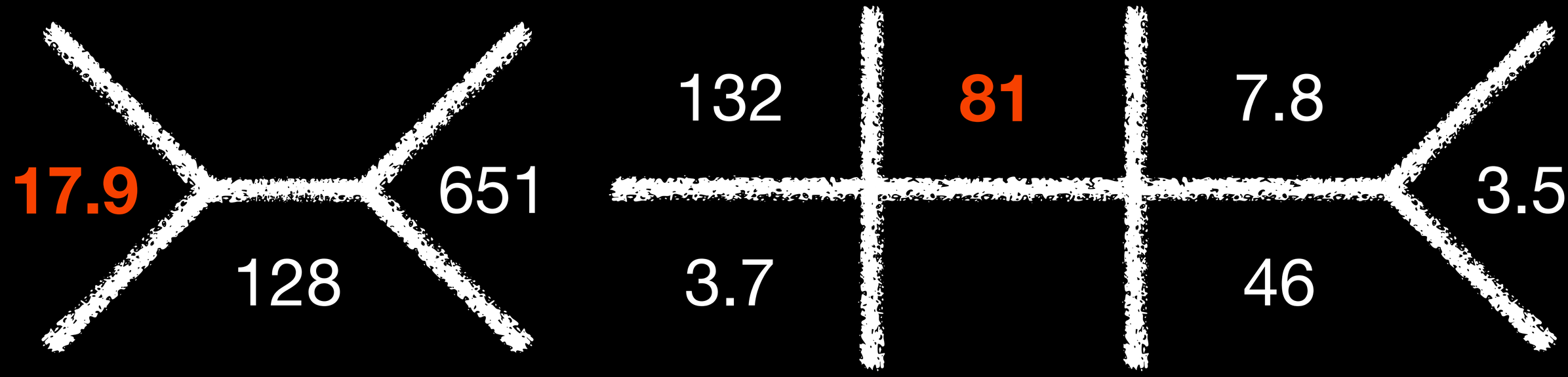
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Newborn Bowel Obstruction | Case 4

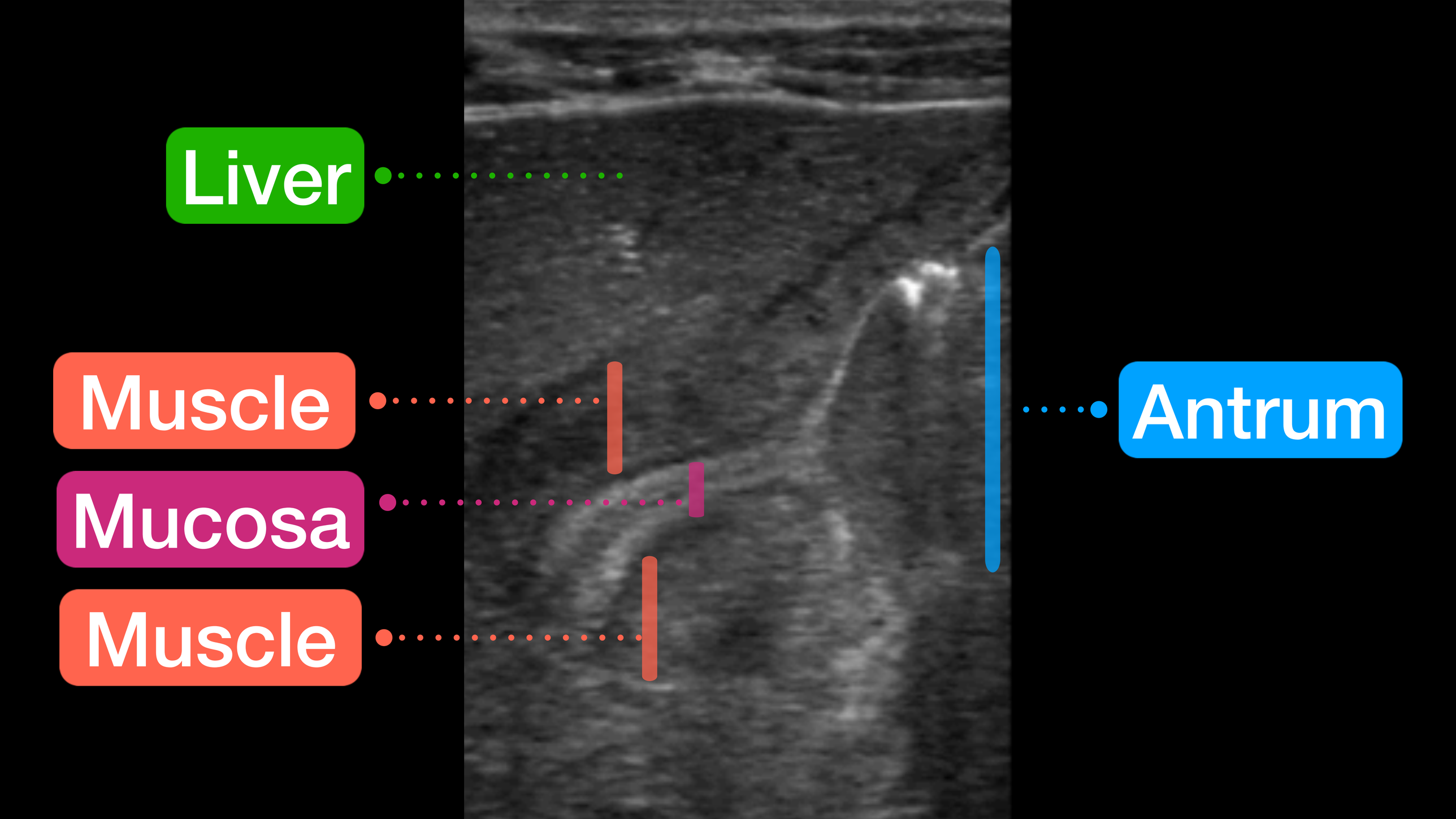
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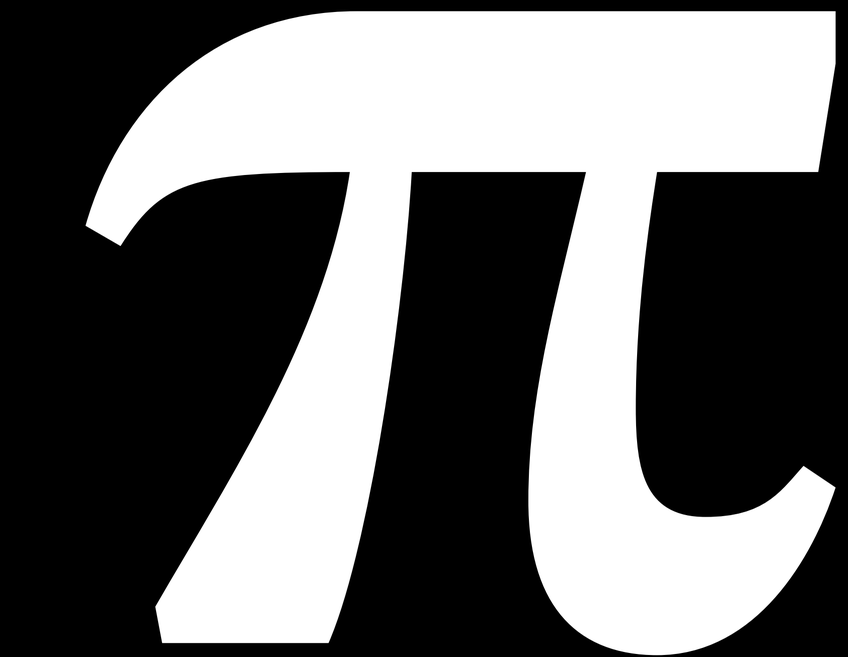
- A 6 week baby arrives in the emergency department with progressive non-bilious emesis and failure to gain weight.
- An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr.
- What next?



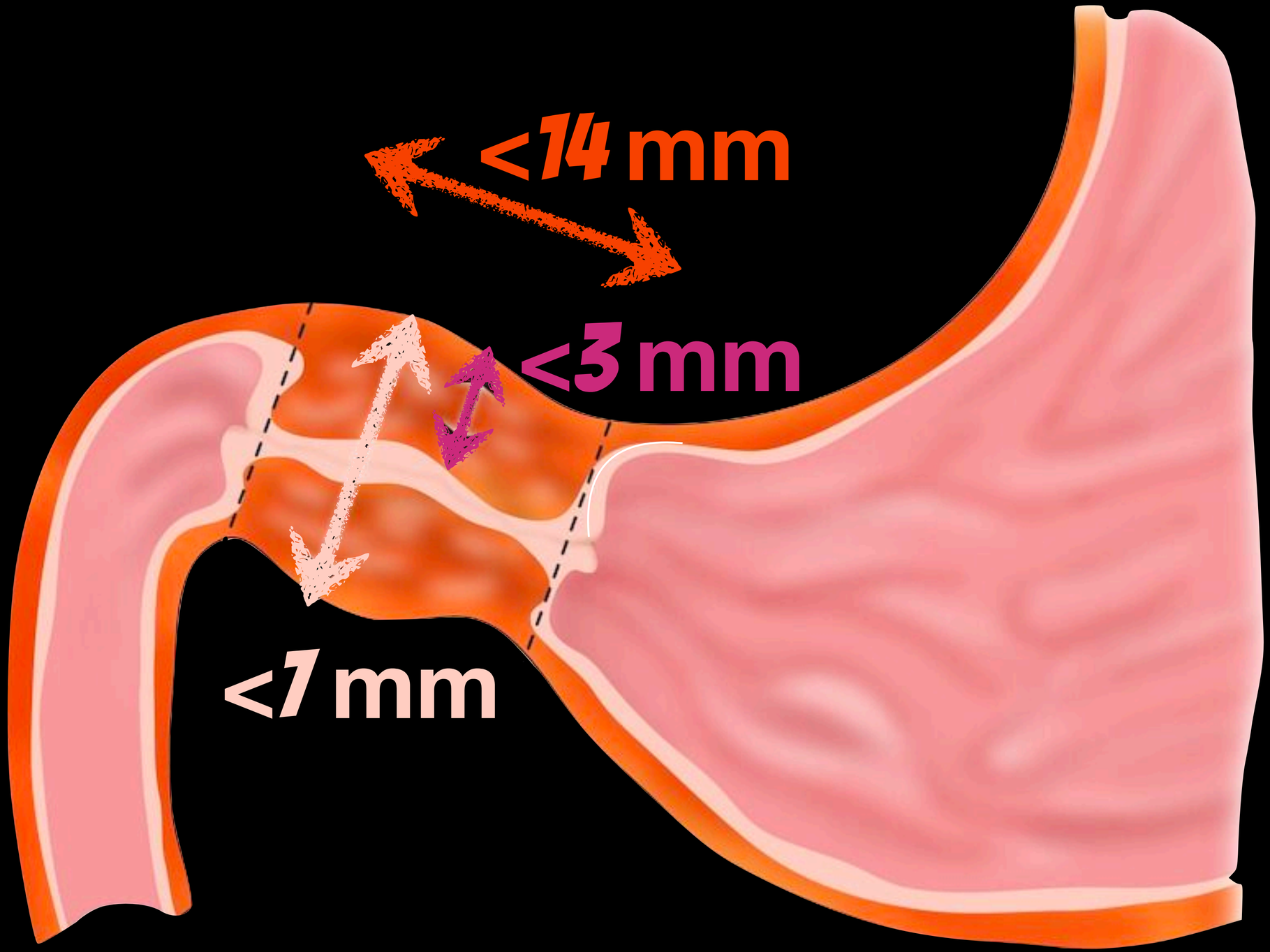


7.52	50	36
pH	pCO_2	HCO_3


Liver
Muscle
Mucosa
Muscle
Antrum




π
3.14


<14 mm
<3 mm
<7 mm

Pyloric Stenosis | Treatment Options

- Atropine
  - Step up or step down approach
  - 0.05mg/kg/day orally or 0.1mg/kg/day IV
  - Watch for side-effects (tachycardia, flushed skin, hematemesis)
- Surgery

Atropine Treatment for Hypertrophic Pyloric Stenosis: A Systematic Review and Meta-Analysis

Giuseppe Lauriti[1,2] Valentina Cascini[1] Pierluigi Lelli Chiesa[1] Agostino Pierro[2] Augusto Zani[2]

[1] Department of Pediatric Surgery, "Spirito Santo" Hospital and "G. d'Annunzio" University, Chieti-Pescara, Italy
[2] Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada

Address for correspondence Giuseppe Lauriti, MD, PhD, Department of Pediatric Surgery, "Spirito Santo" Hospital and University "G. d'Annunzio," Via Fonte Romana 8, Pescara 65100, Italy (e-mail: giuseppe.lauriti@gmail.com).

Eur J Pediatr Surg 2018;28:393–399.

Abstract

Introduction Several authors have reported the use of atropine as an alternative treatment to pyloromyotomy in infants with hypertrophic pyloric stenosis (HPS). Our aims were to review the efficacy of atropine in treating HPS and to compare atropine therapy versus pyloromyotomy.

Materials and Methods Using a defined search strategy (PubMed, MEDLINE, OVID, Embase, Cochrane databases), two investigators independently identified studies reporting the use of atropine for HPS. Case reports and opinion articles were excluded. Outcome measures included success rate, side effects, and length of hospital stay. Maneuvers were compared using Fisher's exact test, and meta-analysis was conducted using RevMan 5.3. Data are expressed as mean ± standard deviation.

Results *Systematic review:* of 2,524 abstracts screened, 51 full-text articles were analyzed. There were no prospective or randomized studies. Twelve articles (508 infants) reported HPS resolution using atropine in 402 (79.1%) patients. Atropine side effects were documented in 38/251 (15.1%) infants and included tachycardia, increased transaminases, and flushed skin. *Meta-analysis:* five studies compared atropine treatment (293 infants) with pyloromyotomy (537 infants). Pyloromyotomy had higher success rate (100%) than atropine (80.8%; $p < 0.01$) and shorter hospital stay (5.6 ± 2.3 vs. 10.3 ± 3.8 days, respectively; $p < 0.0001$).

Conclusion Comparative but nonrandomized studies indicate that atropine is less effective than pyloromyotomy to treat infants with HPS. Currently, there is no evidence-based literature to support atropine treatment in these infants. To our knowledge, atropine should be reserved for patients unfit for general anesthesia or surgery.

Keywords

- atropine
- pyloromyotomy
- hypertrophic pyloric stenosis
- systematic review
- meta-analysis

Table 2 Studies reporting atropine treatment in infantile hypertrophic pyloric stenosis

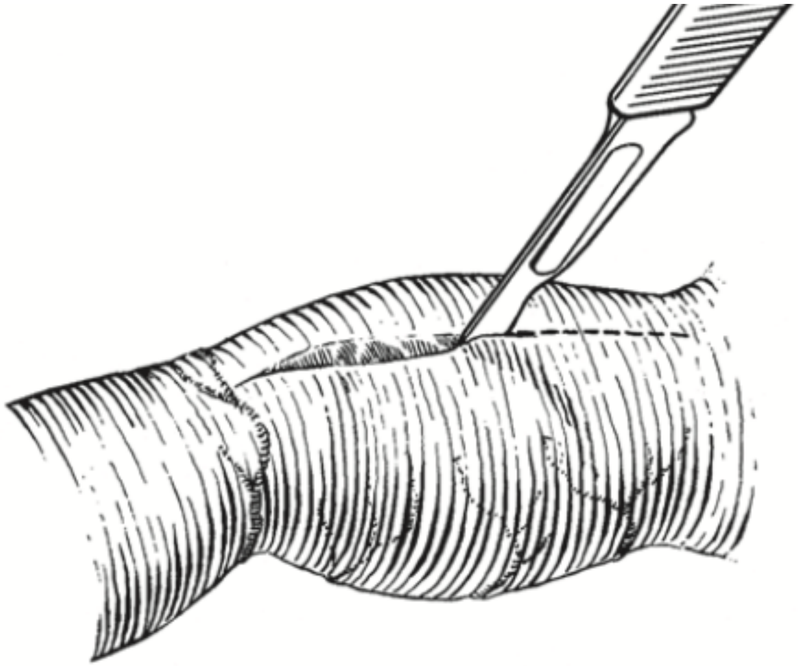
Author	Year	Type of study	Atropine doses (via)	Atropine, *n*	Success, *n* (%)	Collateral effects, *n* (%)	Collateral effects description
Nagita et al[12]	1996	R	0.04–0.11 mg/kg/d (IV)	22	21 (95.5)	6 (27.3)	Flushed skin (3), increased AST/ALT (2), tachycardia (1)
Yamataka et al[13]	2000	R	0.05–0.1 mg/kg/d (orally, then IV)	14	12 (85)	1 (7.1)	Hematemesis (1)
Riccabona et al[14]	2001	R	1 drop/6–8 times per day (orally)	22	7 (32)	n.r.	
Singh et al[15]	2001	R	0.06–0.255 mg/kg/d (IV), 0.12–0.66 mg/kg/d (orally)	52	50 (96.2)	11 (21.2)	Increased AST/ALT (8), tachycardia (3)
Sretenović et al[16]	2004	R	0.05–0.1 mg/kg/d (orally)	22	18 (81.8)	n.r.	
Singh et al[17]	2005	R	0.18 mg/kg/d (orally)	12	11 (91.6)	0 (0)	
Kawahara et al[18]	2005	R	0.06 mg/kg/d (IV), then 0.12 mg/kg/d (orally)	52	45 (87)	3 (5.8)	UTI (1), increased AST/ALT (1), upper respiratory tract infection (1)
Meissner et al[19]	2006	R	0.04–0.11 mg/kg/d (IV), then doubled (orally)	33	25 (75.8)	11 (33.3)	Transient tachycardia (8), flushed skin (2), UTI (1)
Koike et al[20]	2013	R	0.04–0.1 mg/kg/d (IV), then doubled (orally)	33	18 (58)	n.r.	
Lukac et al[21]	2013	R	0.05–0.18 mg/kg/d (orally)	40	30 (75)	0 (0)	
Takeuchi et al[22]	2013	ND	n.r.	180	142 (78.9)	n.r.	
Fan et al[23]	2016	P	0.06 mg/kg/d (step-up IV) then step-down (orally)	26	23 (88.5)	6 (23)	Transient tachycardia and flushed skin (6)

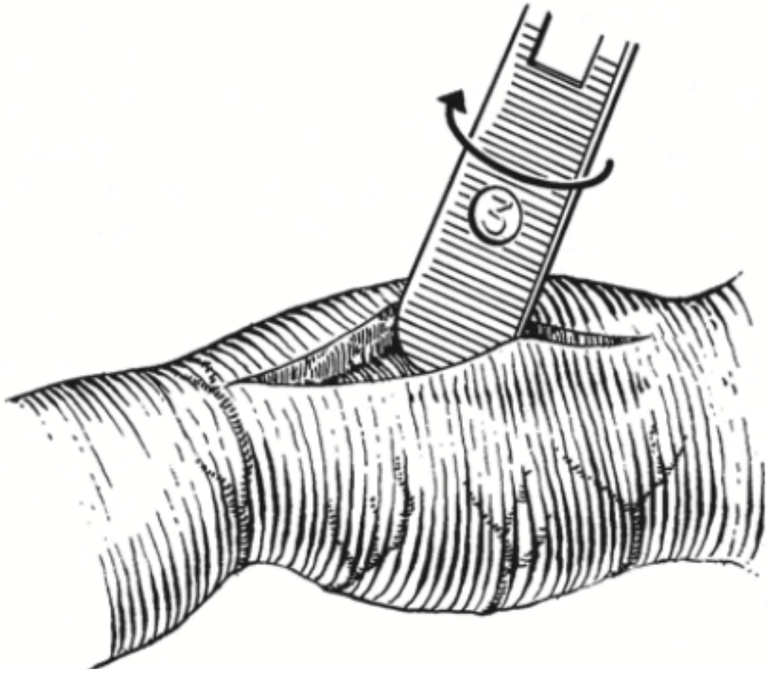
Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; IV, intravenously; n.r., not reported; ND, nationwide database; P, prospective not randomized study; R, retrospective study; UTI, urinary tract infection.

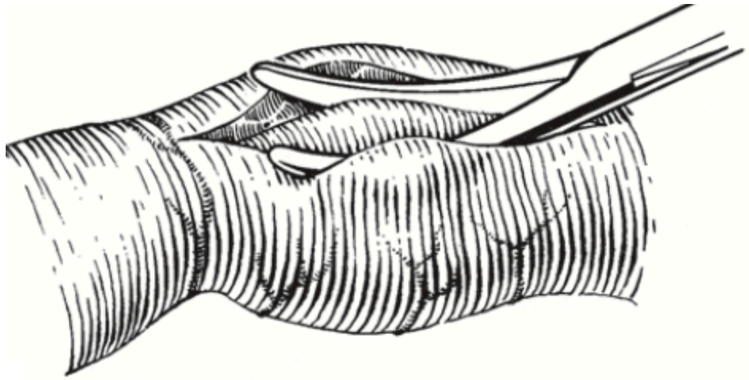
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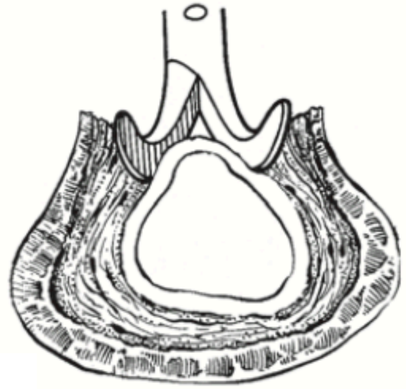
Pyloric Stenosis | OT

BC Children's Hospital





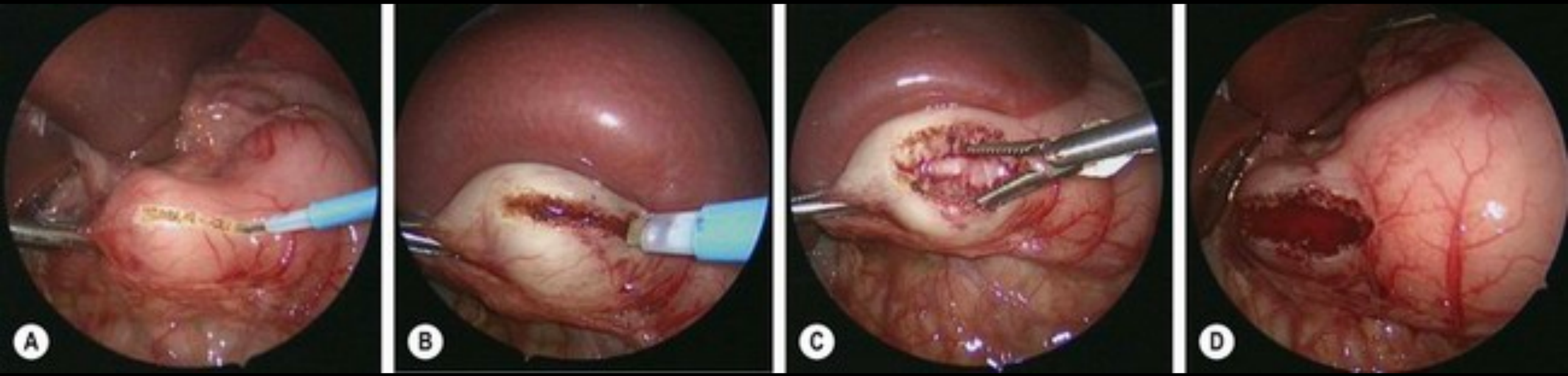




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Pyloric Stenosis | OT

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Newborn Bowel Obstruction | Case 5

BC Children's Hospital

- A baby is born at 37 weeks. Over the course of the first 48 hours, the baby exhibits progressive feed intolerance and abdominal distension. Abdomen is found to be very distended on physical exam. Baby has not yet passed stool.
- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What next?

Exam for Newborn Bowel Obstruction

- Vital signs
- General appearance
- NG tube output
- Heart
- Abdomen
- Groin
- Anus



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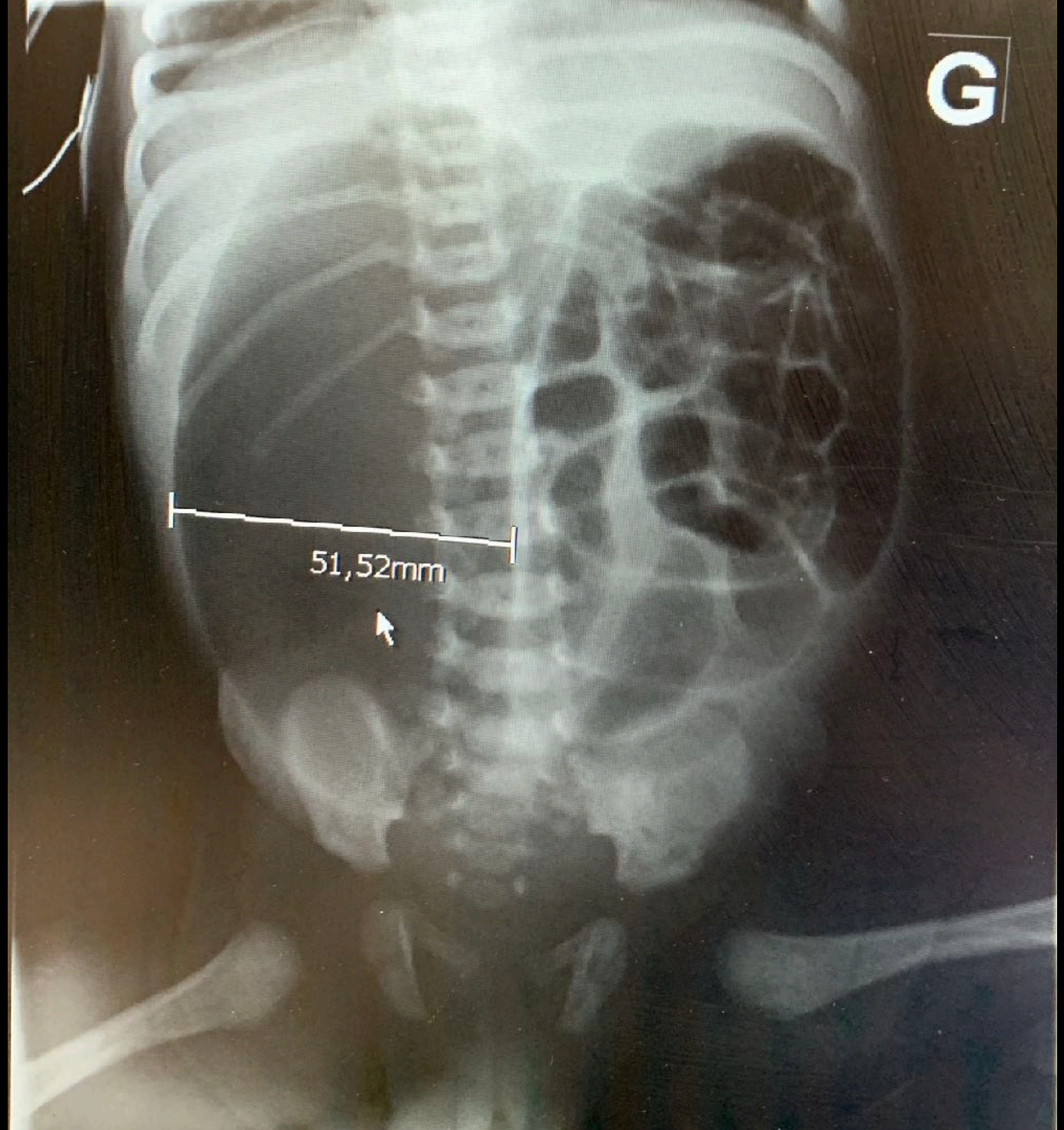
Newborn Bowel Obstruction | Case 5

BC Children's Hospital

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- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- Differential diagnosis for **distal** bowel obstruction?

Newborn Bowel Obstruction | Case 5

- A baby is born at 37 weeks. Over the course of the first 48 hours, the baby exhibits progressive feed intolerance and abdominal distension. Abdomen is found to be very distended on physical exam. Baby has not yet passed stool.
- Differential diagnosis for **distal** bowel obstruction?
    - Colonic atresia
    - Meconium ileus
    - Meconium plug
    - Hirschsprung disease
    - Anorectal malformations


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Colonic Atresia | Photos

BC Children's Hospital

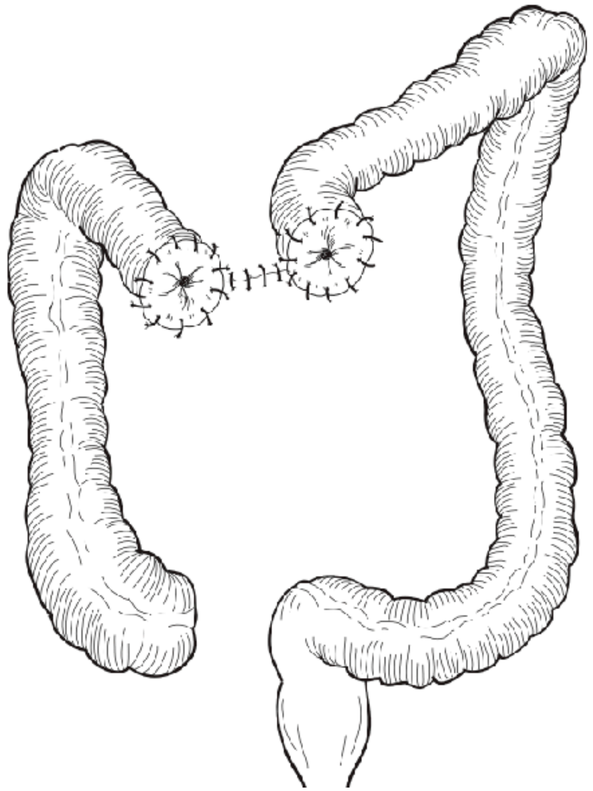


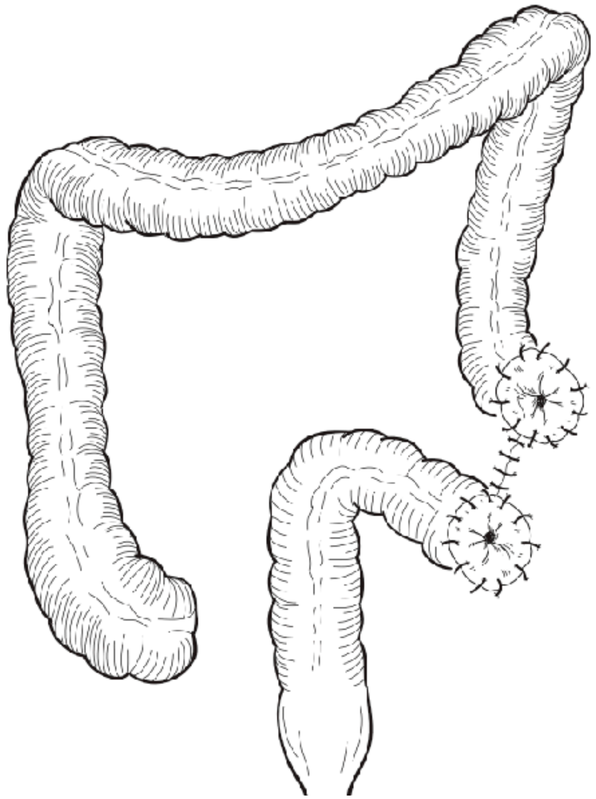


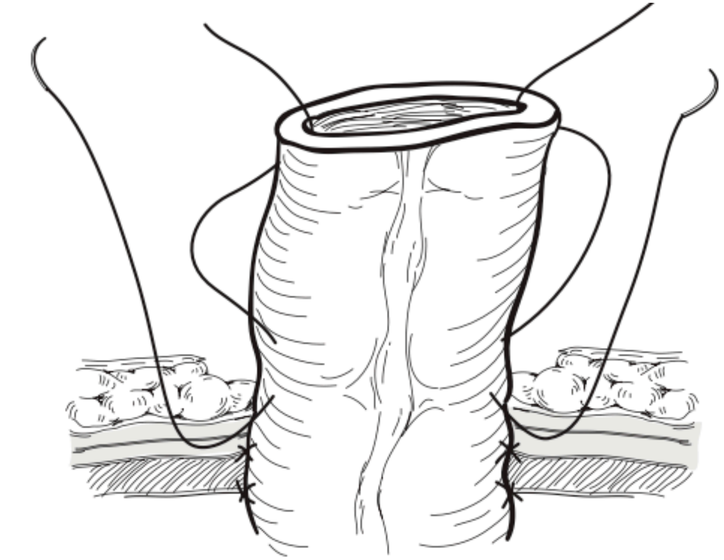
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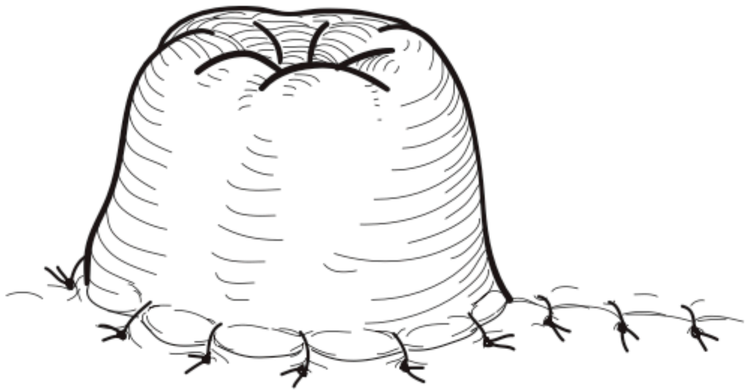
Colonic Atresia | Divided Colostomy

BC Children's Hospital









Newborn Bowel Obstruction | Case 6

- A baby is born at 37 weeks. Over the course of the first 72 hours, the baby exhibits progressive feed intolerance and abdominal distension. Abdomen is found to be very distended on physical exam. Baby has not yet passed stool.
- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What next?




R
CN
SUPINE
:14:33:49
L
CN
X-TABLE
AcqTime:14:36:26
1002M
Chest Abdomen Nursery

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Hirschsprung | Rectal Irrigations

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Hirschsprung | Contrast Enema

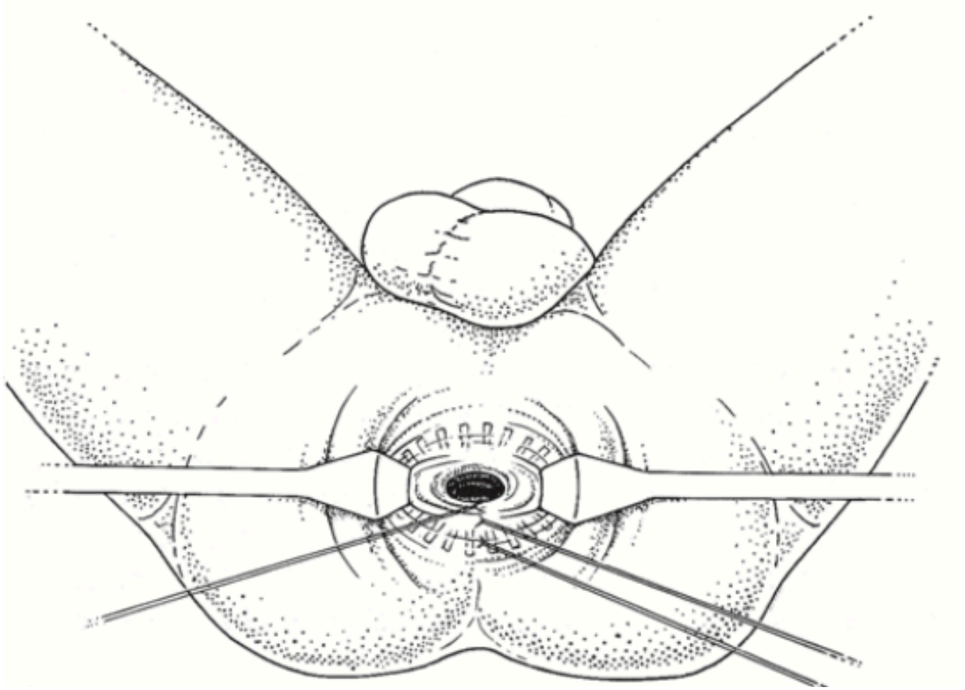
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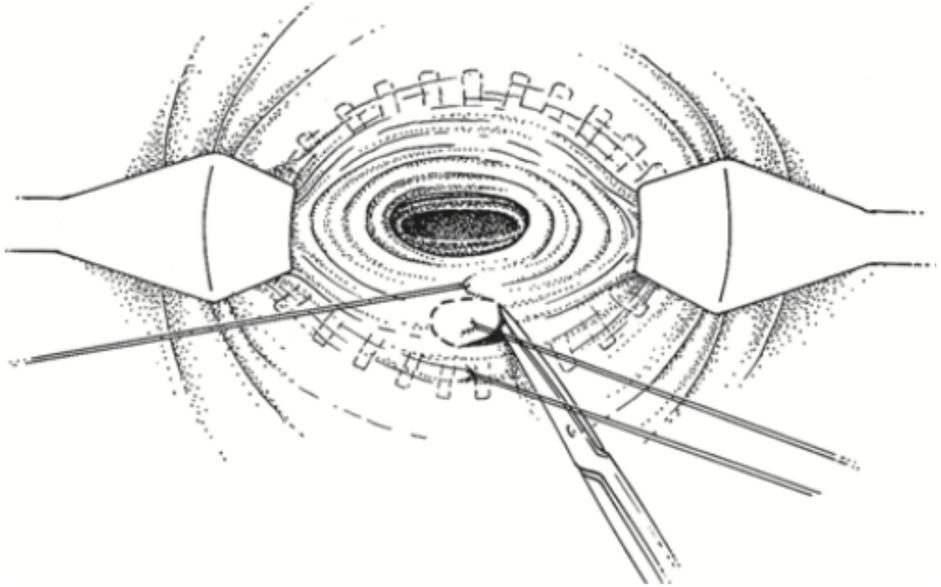


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Hirschsprung | Rectal Biopsy

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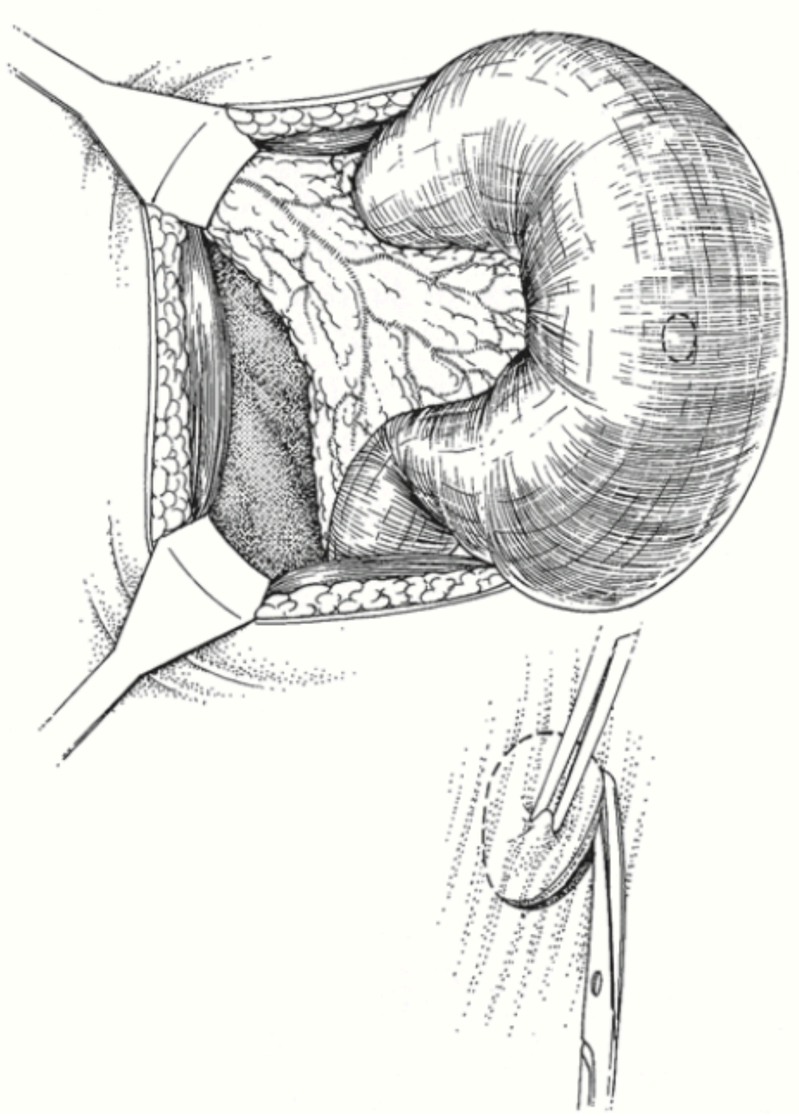


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Hirschsprung | OT

BC Children's Hospital

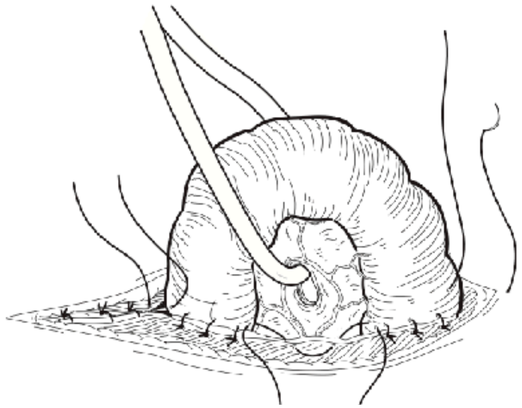


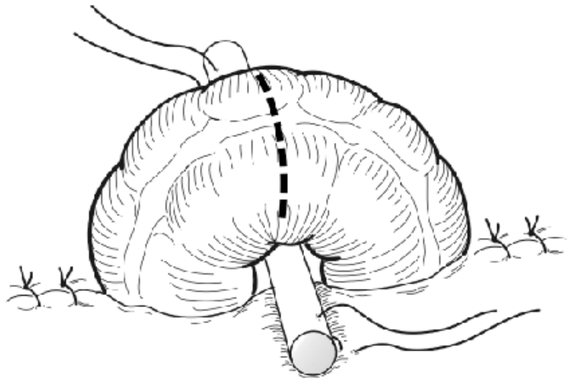


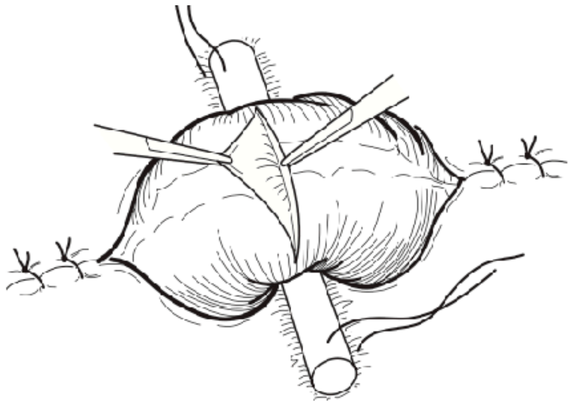
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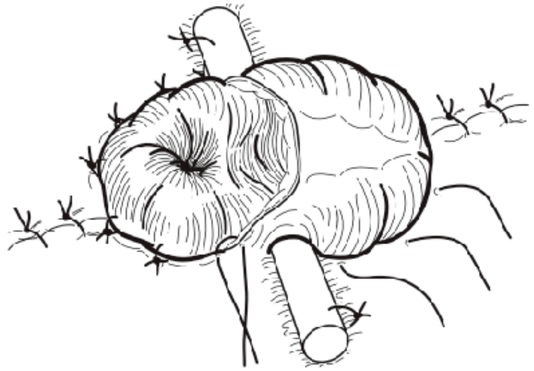
Hirschsprung | Loop Colostomy

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Hirschsprung | Loop Colostomy

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Hirschsprung | Other Topics

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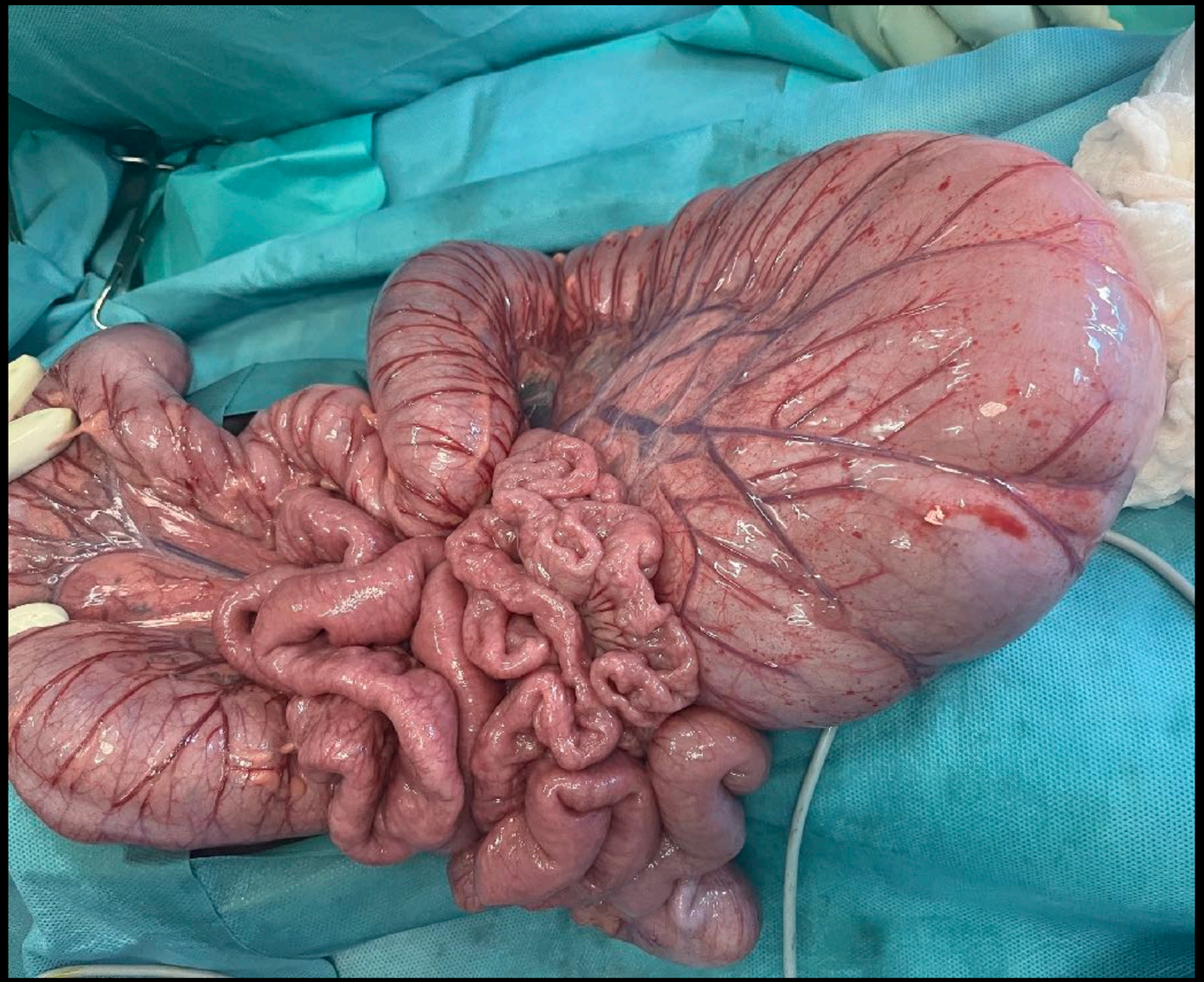
- Timing of OT
- Hirschsprung-Associated Enterocolitis (HAEC)
- Long-term considerations
- Delayed diagnosis

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Hirschsprung | Delayed Diagnosis

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Newborn Bowel Obstruction | Case 7

BC Children's Hospital

- A baby is born at 37 weeks. Over the course of the first 48 hours, the baby exhibits progressive feed intolerance and abdominal distension. Abdomen is found to be very distended on physical exam. Baby has not yet passed stool.
- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What next?


choo-choo



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Meconium Plug | Photo

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Newborn Bowel Obstruction | Case 8

BC Children's Hospital

- A baby is born at 37 weeks. Over the course of the first 48 hours, the baby exhibits progressive feed intolerance and abdominal distension. Abdomen is found to be very distended on physical exam. Baby has not yet passed stool.
- An 8Fr NG tube has been inserted. An IV has been inserted and patient has received 20cc/kg of NS and has been started on D10NS at 10cc/hr. Triple antibiotics have been initiated.
- What next?

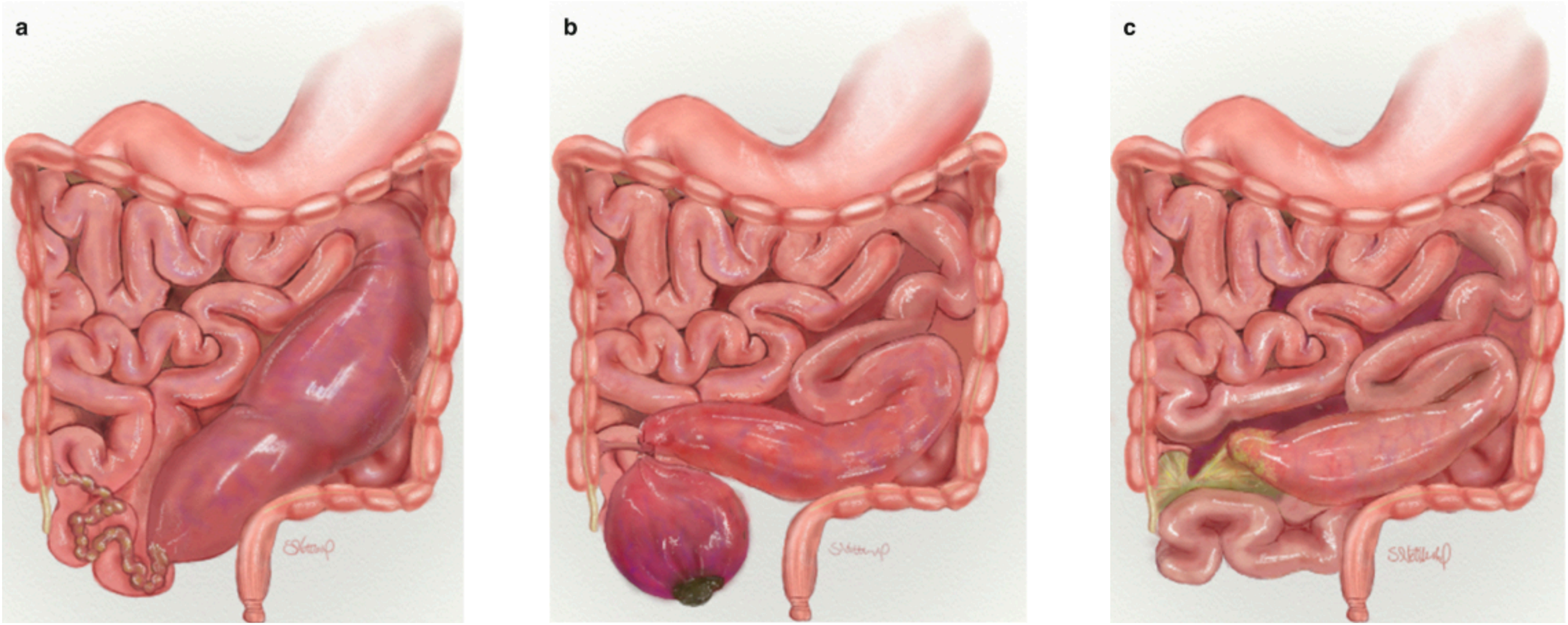



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Meconium Ileus | Complications

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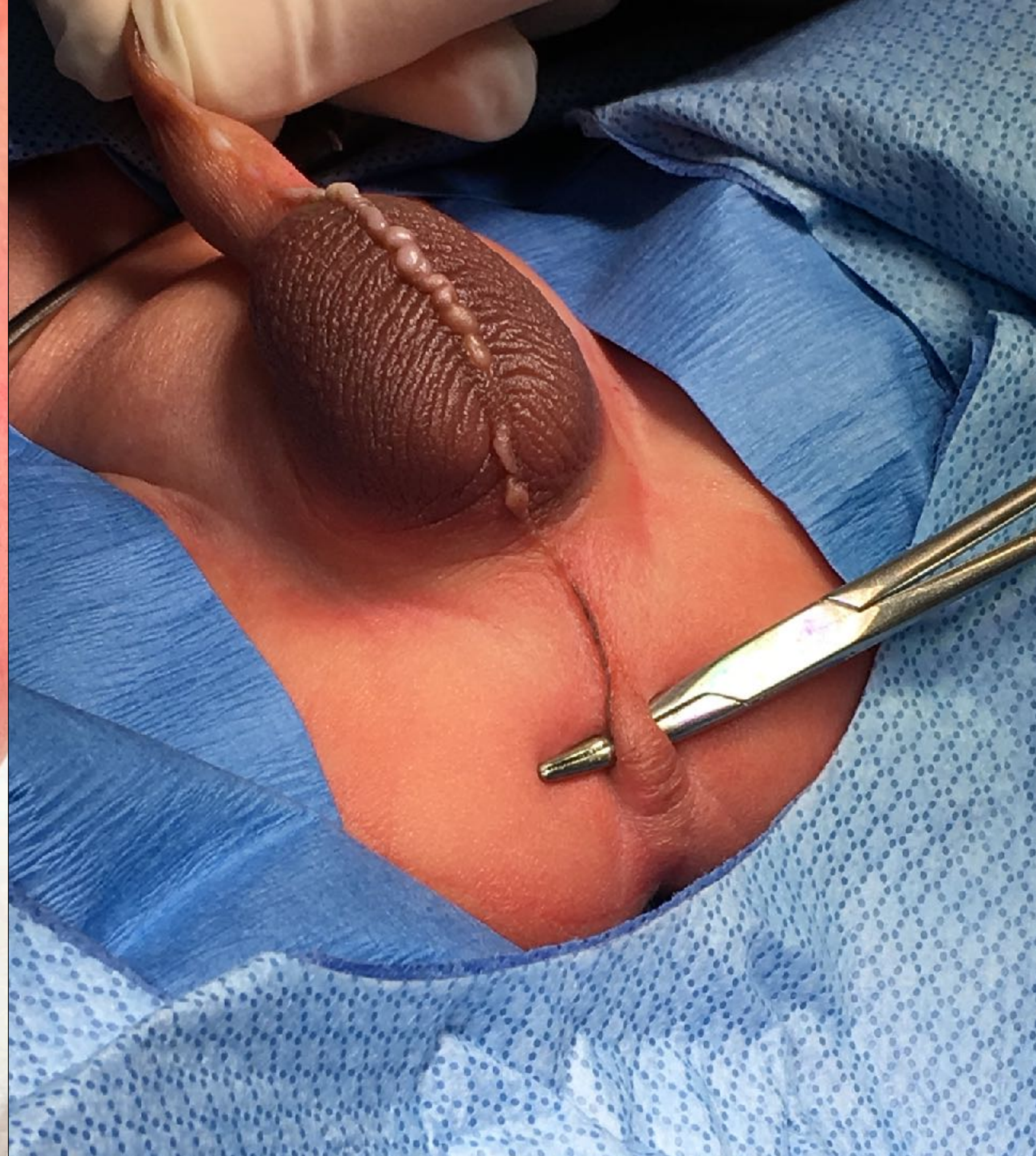
Newborn Bowel Obstruction | Case 9

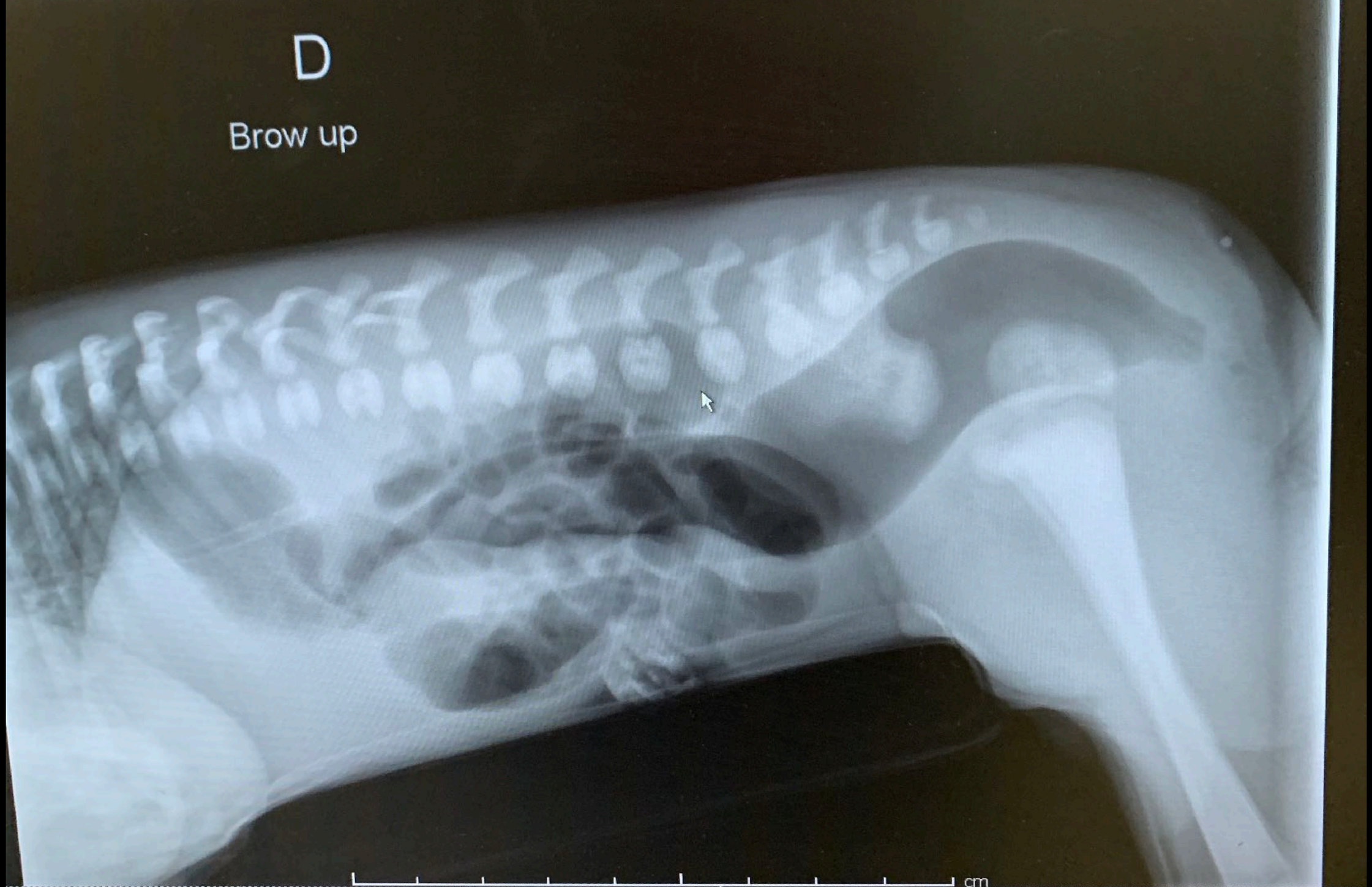
- A 3 day old newborn arrives in the emergency department with progressive emesis (initially milky, now bilious) and severe abdominal distension.
- Workup & management?










D
Brow up
cm

Newborn Bowel Obstruction | Case 10

- A 4 week old newborn arrives in the emergency department with emesis (initially milky, now bilious), abdominal distension, and obstipation.
- Management & work-up?

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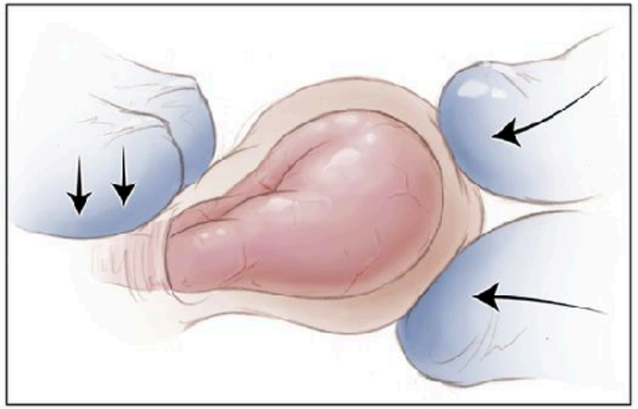
Reduction Techniques

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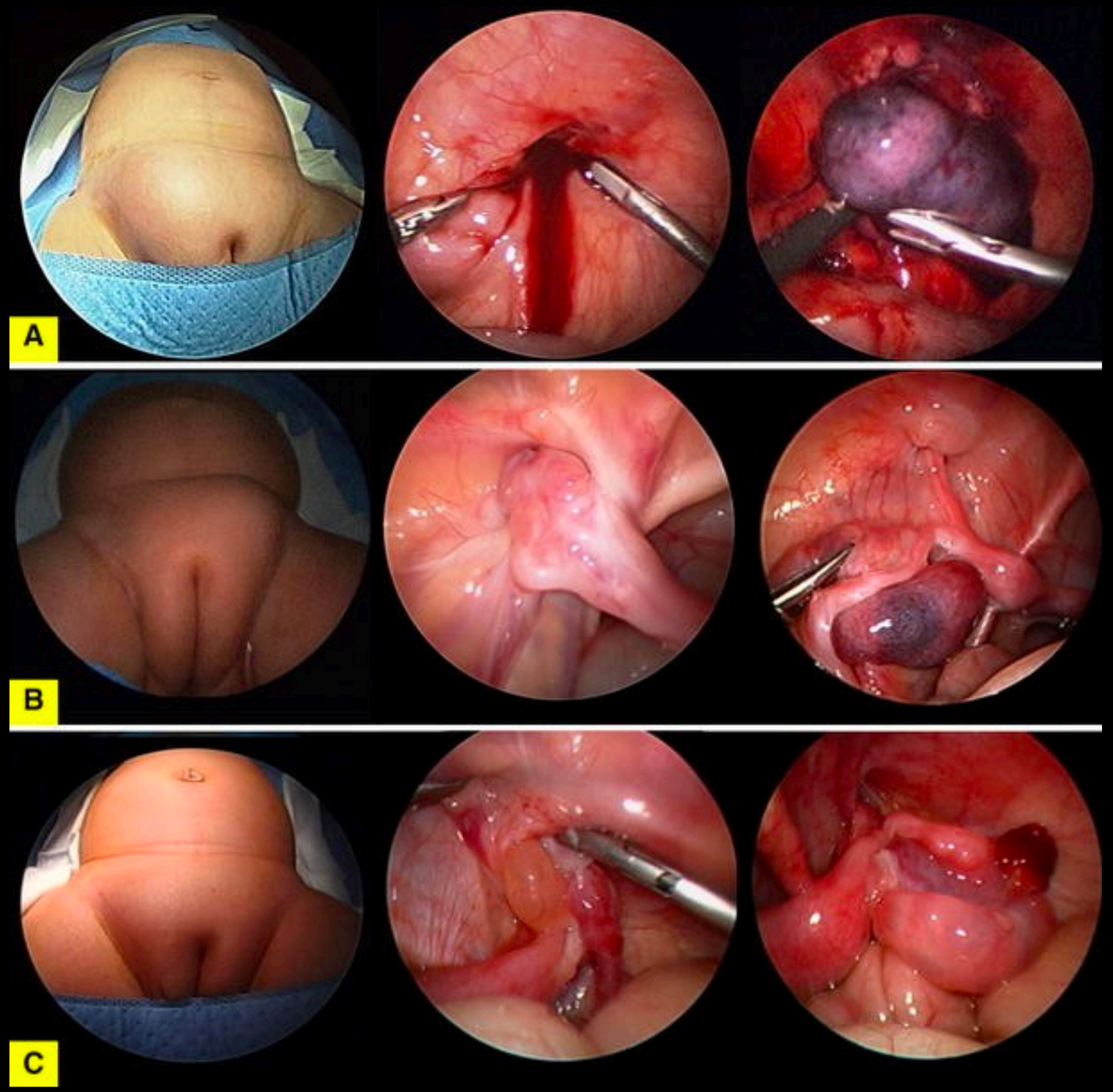











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Inguinal Hernias

BC Children's Hospital

- Almost all pediatric inguinal hernias are **indirect**
- Occur in 1-5% of children → but up to 30% of premature babies
- More common in boys
- 60% right-sided, 30% left-sided, 10% bilateral
  - Right testicle descends after left testicle during 8th month of gestation
  - Bilateral more common in females, pts presenting with left-sided hernias, premies, history of undescended testicle, and young age at presentation

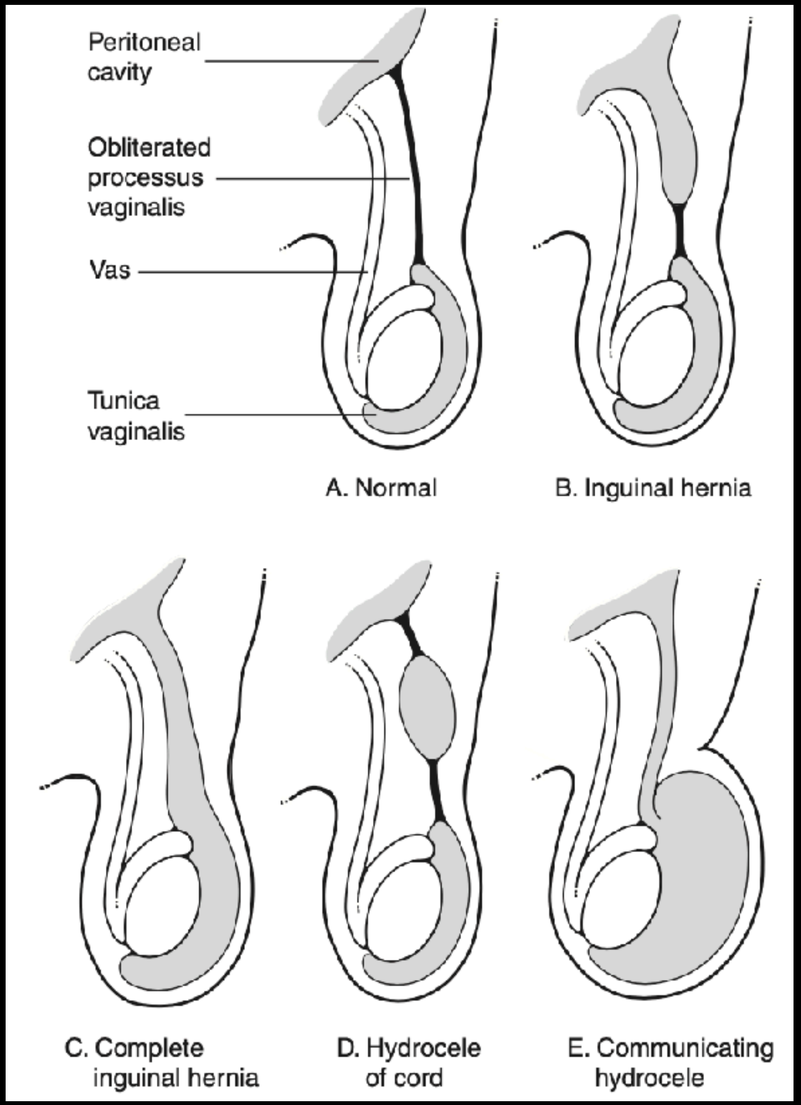






Inguinal Hernias vs Hydroceles

- Communicating hydrocele = inguinal hernia!
- Differentiate communicating vs. non-communicating hydrocele based on **history**
  - Communicating hydroceles treated as inguinal hernias
  - Non-communicating hydroceles should resolve by 1 year old



Inguinal Hernias vs Hydroceles

- Incarcerated hernia vs. non-communicating hydrocele (or hydrocele of the cord) can be a diagnostic dilemma
- Ways to differentiate:
  - History and exam → not always helpful
  - Transillumination → but in a baby, you can transilluminate bowel!
  - AXR
  - **Ultrasound**



Newborn & Pediatric Emergencies

- Next time:
  - Anorectal malformations
  - Inguinal hernias
  - Abdominal wall defects (omphalocele, gastroschisis)
  - Intussusception
  - Typhoid perforation
  - Paraphimosis

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Questions?

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