

Imaging in Anorectal Malformations

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The 65th Workshop for the Surgical Treatment
of Colorectal Problems in Children



INTERNATIONAL CENTER FOR
**COLORECTAL AND
UROGENITAL CARE**



SCHOOL OF MEDICINE
Department of Radiology

UNIVERSITY OF COLORADO ANSCHUTZ MEDICAL CAMPUS

Disclosures

- None



Goals

- 1. *Inspire* a Team Work Approach with Imaging Department to Improve Care Everywhere
- 2. *Promote* Communication of the Purpose of the Study to Create Passion from the Imager
(*Work with purpose inspires passion and work without purpose is punishment*)
- 3. *Share* lessons I have learned – Tips and Tricks

<https://www.pexels.com/photo/teamwork-561003/>

Objectives

- 1. *Build* a Teamwork approach with Imaging Department
- 2. *Explain* the Utility and Pitfalls of the Available Imaging Exams in Anorectal Malformations
- 3. *Discuss and Define* the Information Desired From of Each Exam



Order: Barium Enema

Hx: 2-day-old male with constipation



Q: Patient arrives in radiology fluoroscopy suite. How do we proceed?

- A. Perform water soluble contrast enema
- B. Perform barium contrast enema
- C. Call the ordering provider and tell them the diagnosis
- D. Perform a UGI SBFT

Hx: 2-day-old male with constipation

Order: Barium Enema

1. Clinical exam
Teach your Radiologist
2. Creation of order for
“contrast enema”
3. History
 - ? Prenatal imaging
 - ? Passage of meconium





Children's Hospital Colorado
International Center for
Colorectal and Urogenital Care

Newborn Screening for Patients with Anorectal Malformation

childrenscolorado.org/colorectal | 720-777-9880

First 24 hours of life – rule out important associated malformations:

Cardiac anomalies (echocardiogram)

- 30% of patients have associated cardiac anomalies, 10% of them with hemodynamic repercussion. The most common are: patent ductus arteriosus, atrial septal defect and tetralogy of Fallot.

Gastrointestinal anomalies (nasogastric tube and babygram)

- 8% of patients have esophageal atresia, 3% have duodenal atresia.

Urological anomalies (kidney ultrasound)

- 50% of patients have an associated urological condition. The most common are: hydronephrosis, vesicoureteral reflux, absent kidney and megarureter.

Spinal anomalies (sacral radiograph AP and lateral, spinal ultrasound)

- 25% of patients have tethered cord that can be detected with a spinal ultrasound. The sacral radiographs will rule out a hemi-sacrum (indication of a presacral mass) and would allow to calculate the sacral ratio (help to determine the prognosis for future bowel control).

Hydrocolpos in patients with cloaca (pelvic ultrasound)

- 30% of cloaca patients have a very distended vagina that should be permanently drained at the time of colostomy opening.

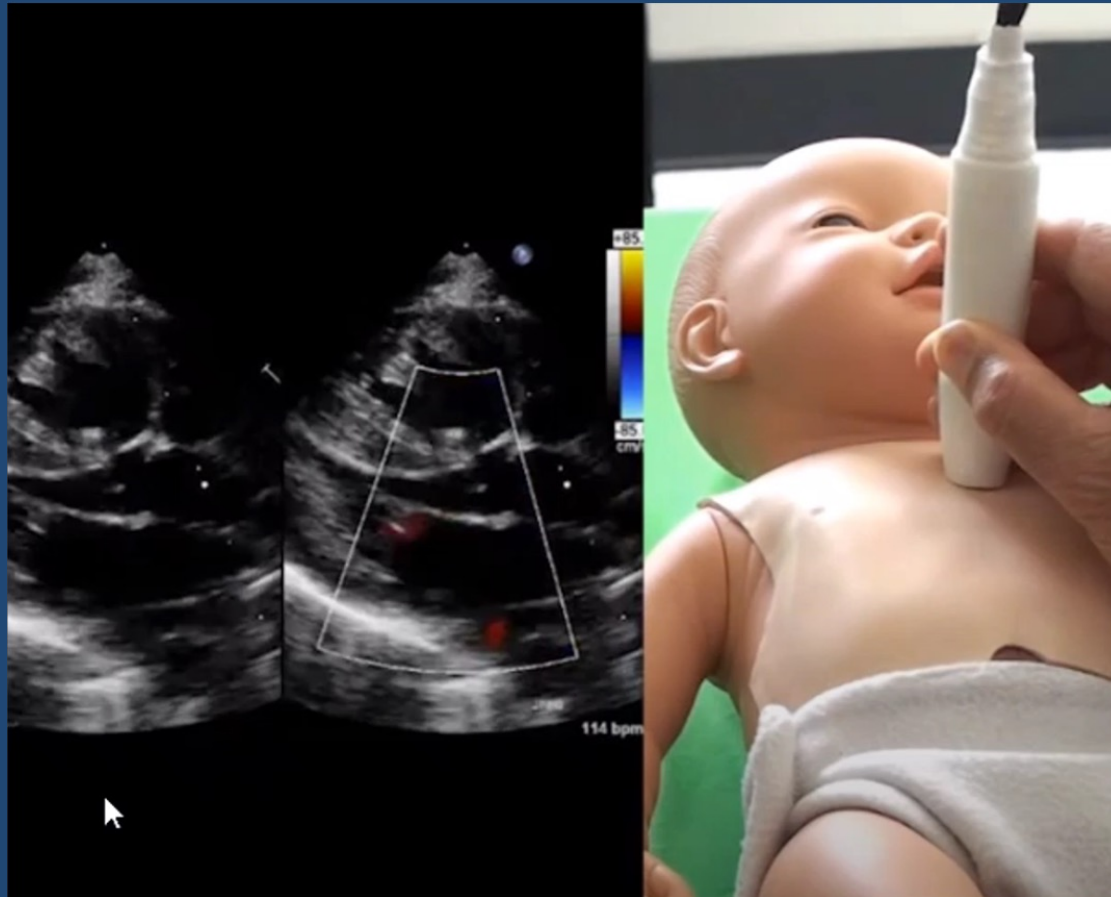
30% have associated Cardiac Abnormalities



PDA



ASD

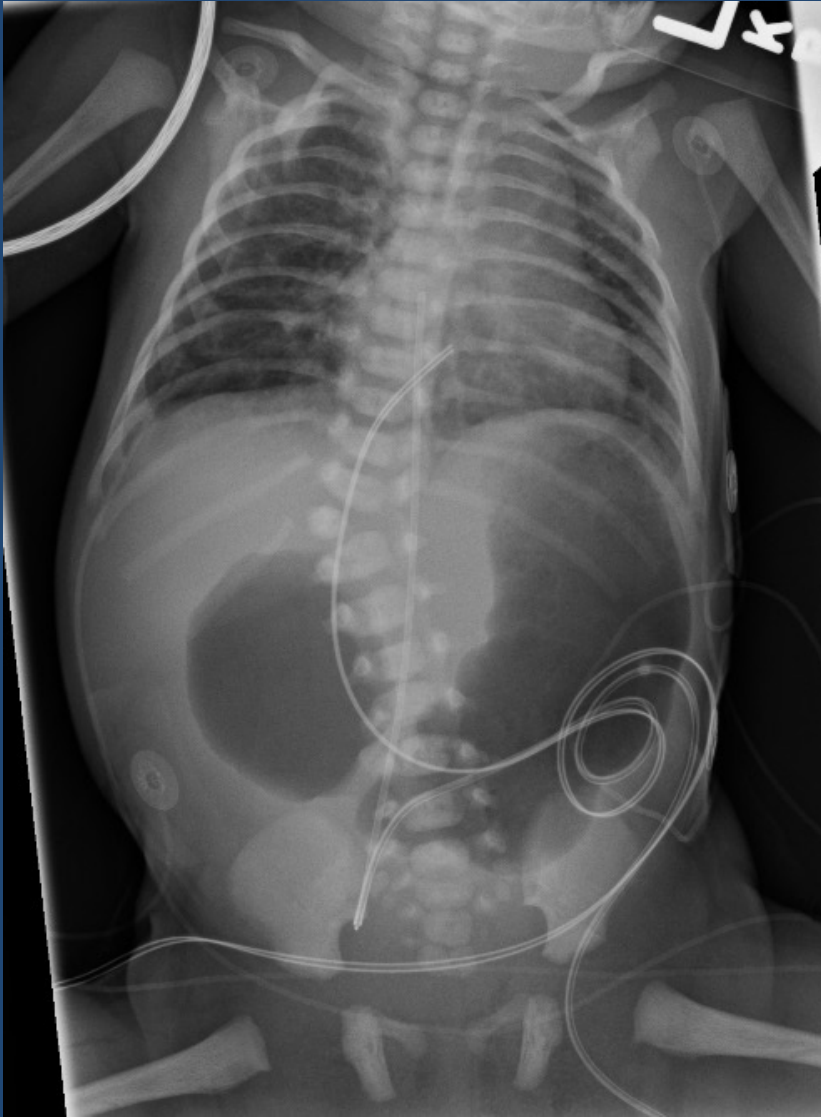


TOF



https://www.youtube.com/watch?v=_oA7phF_zy4&t=127s

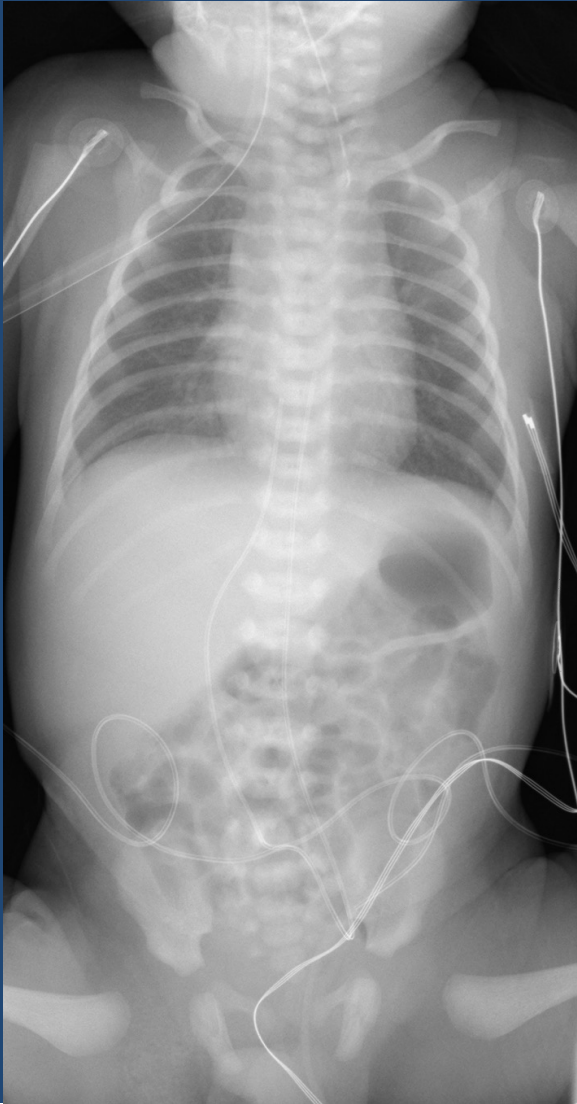
Newborn with ARM-“Babygram”



Q: This X-ray demonstrates the following:

- A. Distal bowel obstruction
- B. Esophageal Atresia
- C. Vertebral abnormalities
- D. Double bubble sign

“Babygram”



Q: This study demonstrates which of the following findings:

- A. Cardiomegaly
- B. Esophageal Atresia
- C. Vertebral Anomalies
- D. Line malposition

Q: What is the percentage of patients with anorectal malformation that have esophageal atresia?

- A. 8%
- B. 16%
- C. 24%
- D. 32%
- E. 40%

Renal US

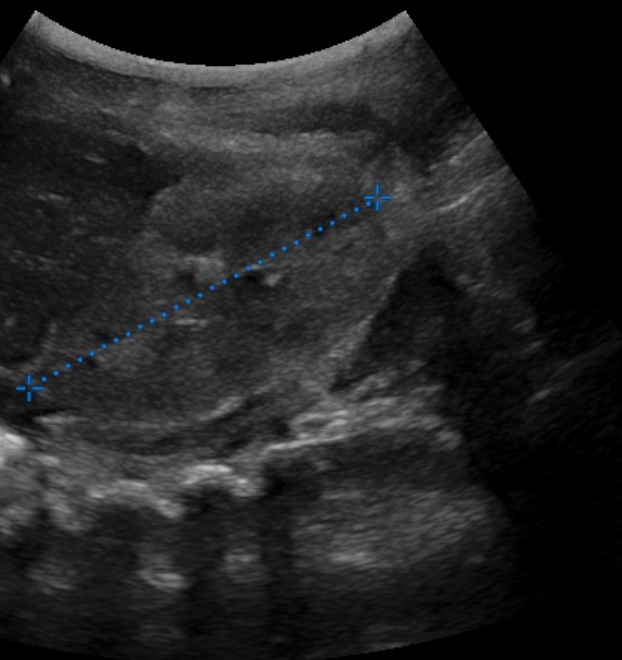
50% have associated GU condition

- Hydronephrosis
- Absent kidney

- Vesicoureteral reflux
- Megaureter

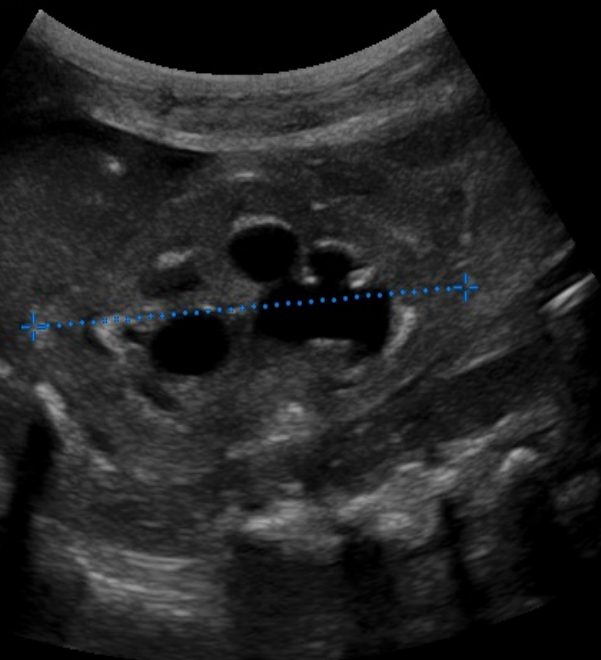
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Z



RT KIDNEY LONG MID

Z

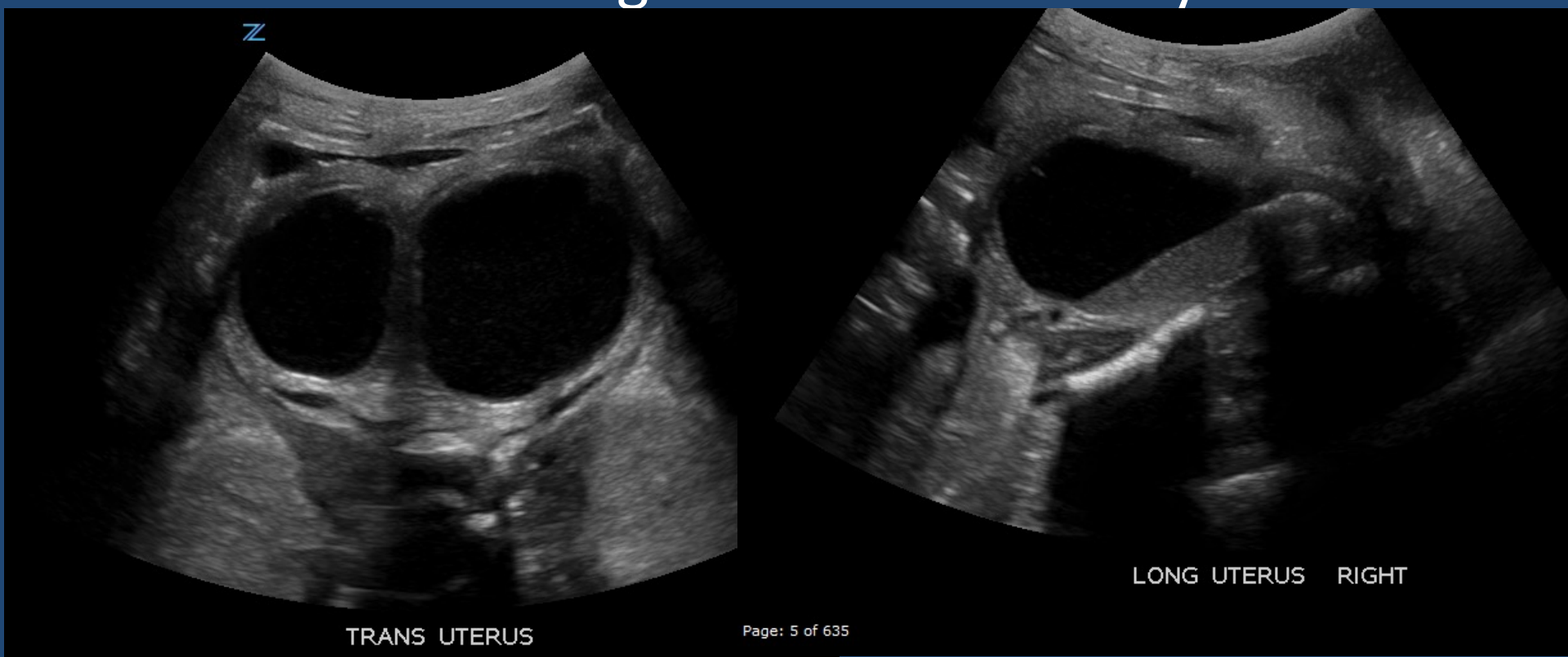


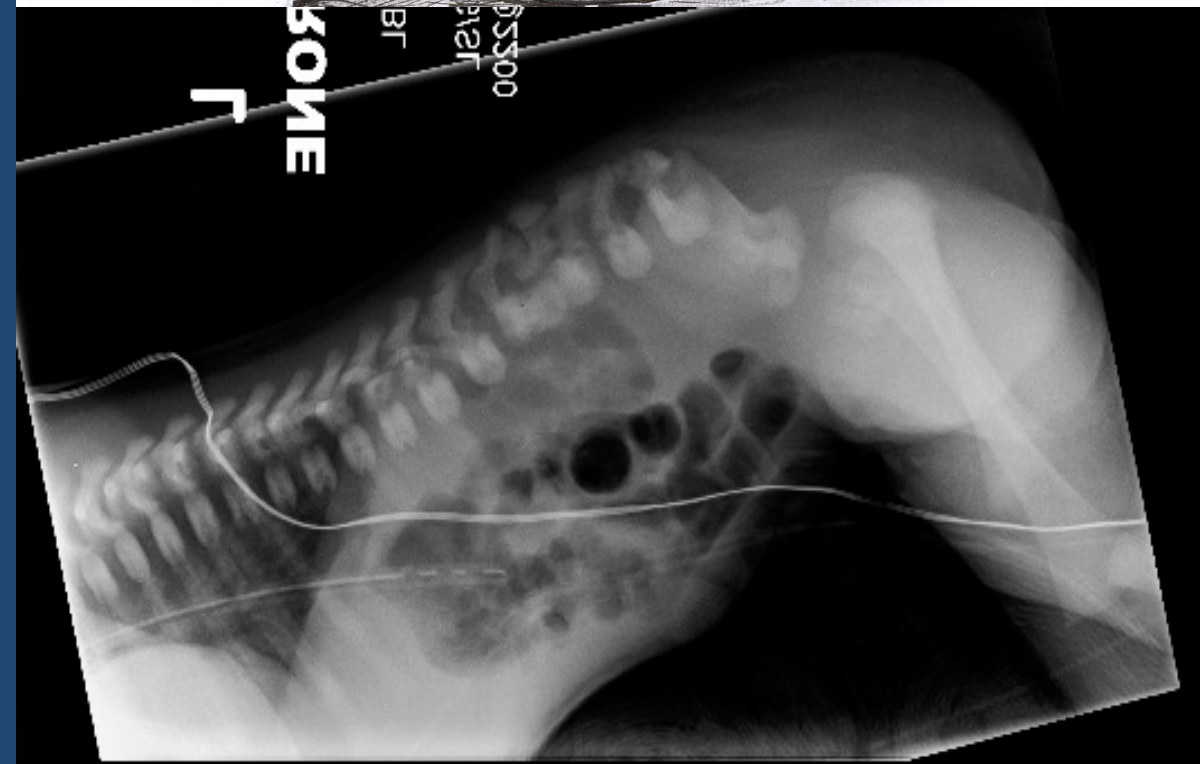
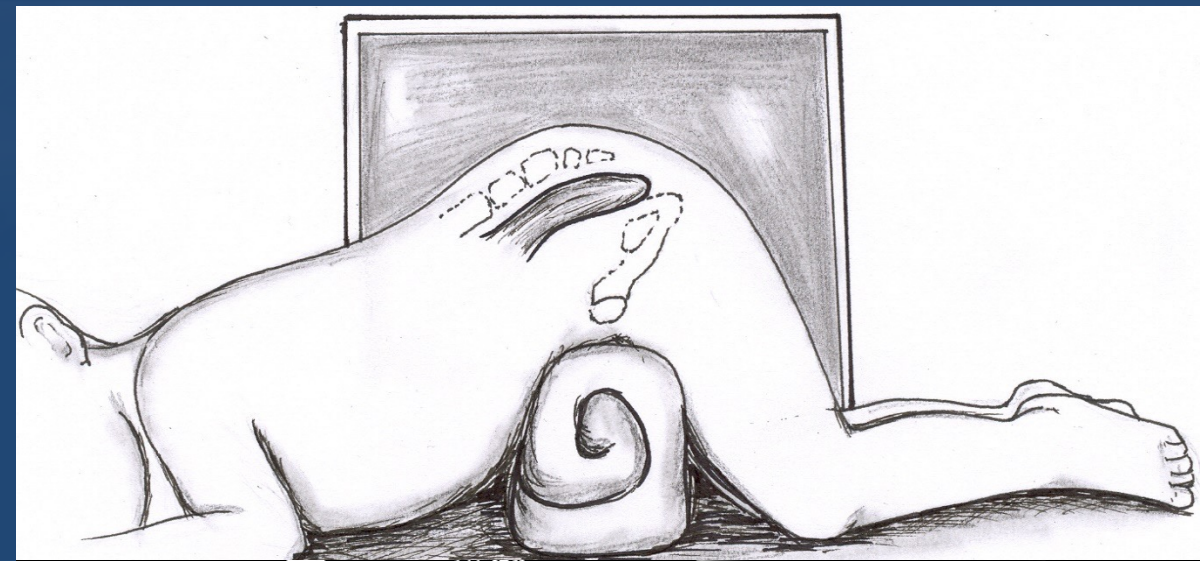
LT KIDNEY LONG MID

Dist 1: 3.99cm

Pelvis US

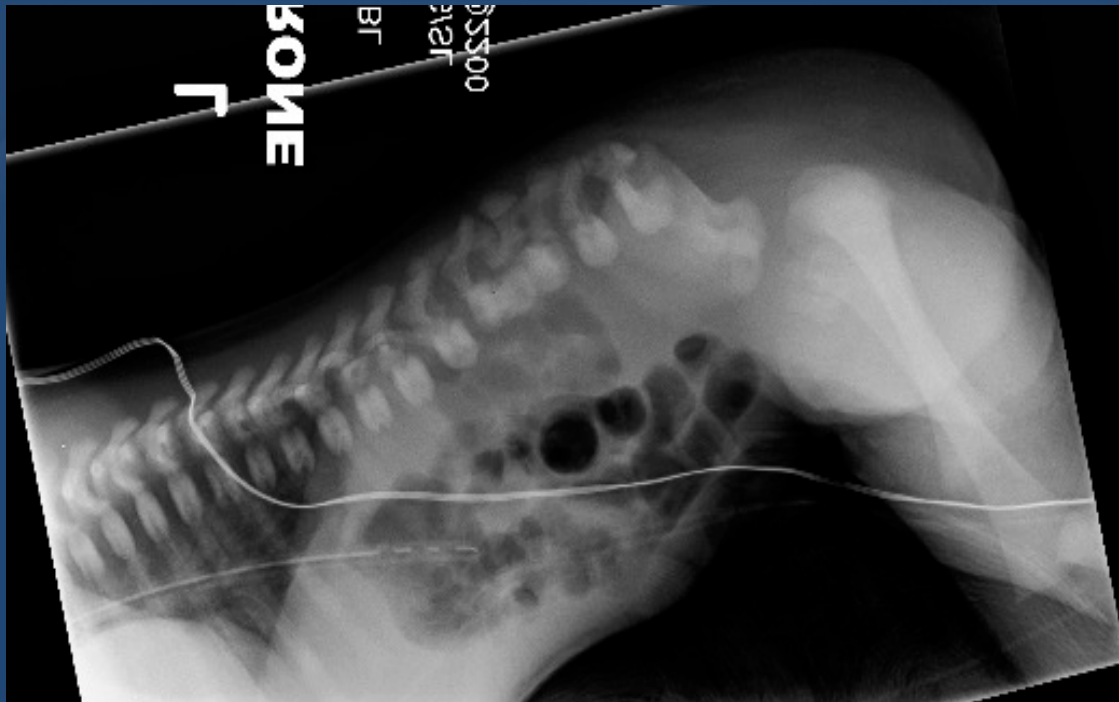
- 30% with cloaca have distended vagina
- Consider draining at initial colostomy



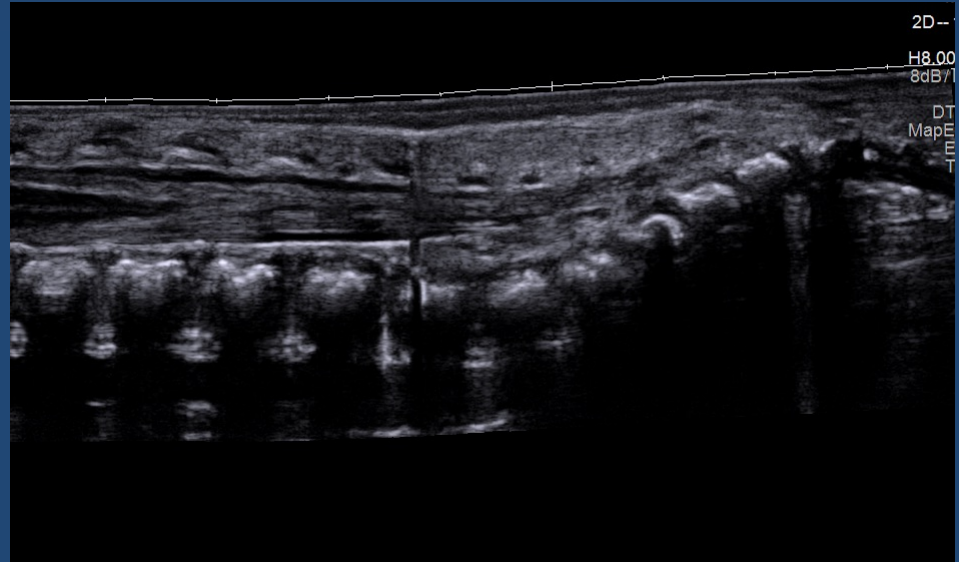
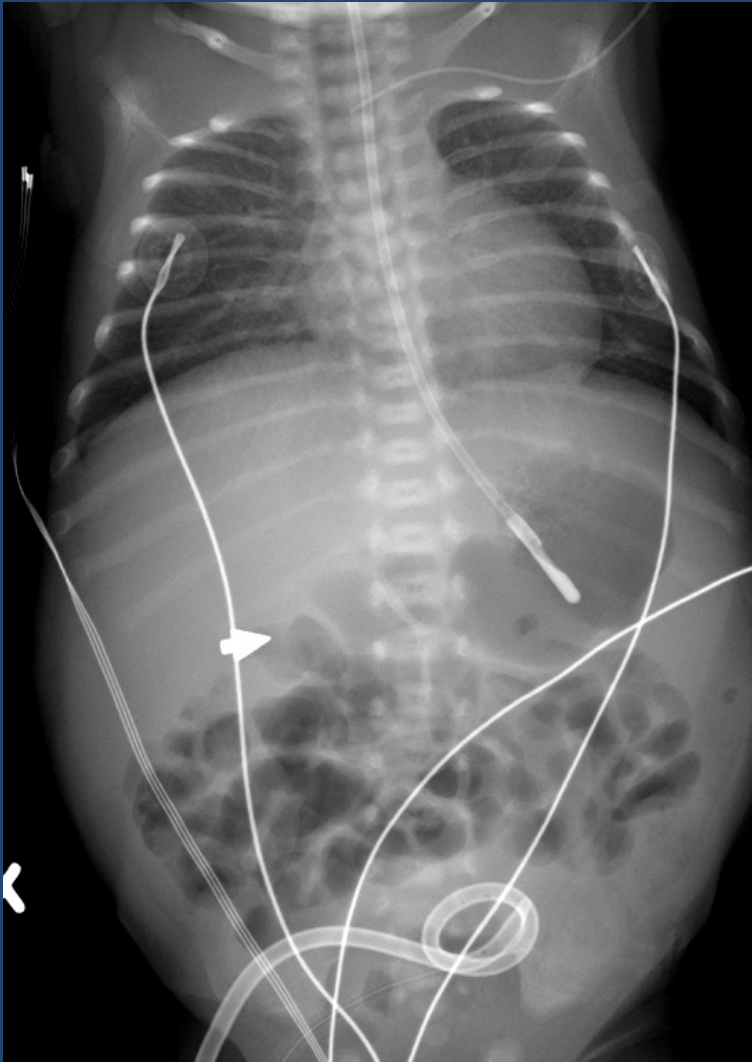


Q: What is technically wrong with this X-ray?

- A. Patient positioning
- B. Labeling of X-ray
- C. Missing marker
- D. Timing of exam
- E. C and D



US for tethered cord



25% tethered cord

Ultrasound spine < 3 mo

MRI spine – feed and sleep swaddle –
0 – 9 months

Q: It is considered tethered cord when the cone is located below:

A. L1

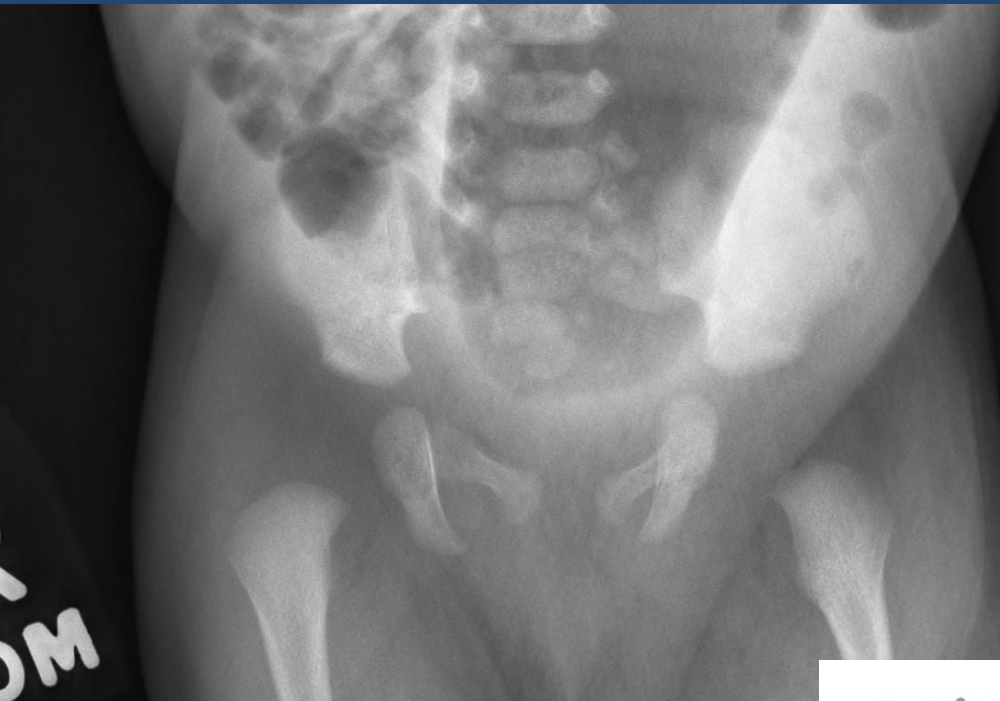
B. L2

C. L3

D. L4

E. L5

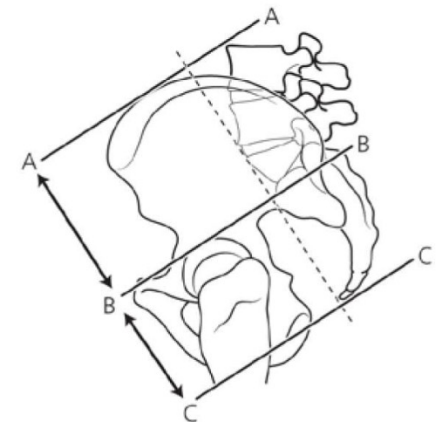
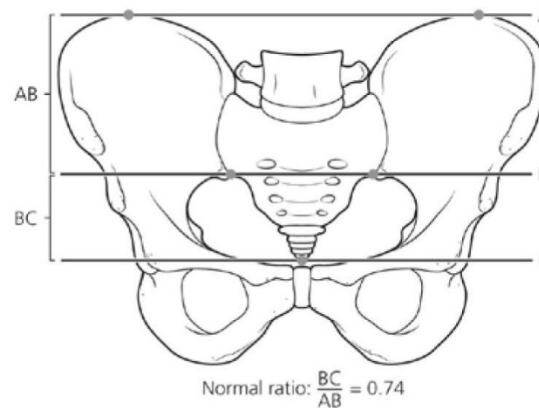
Sacrum and coccyx

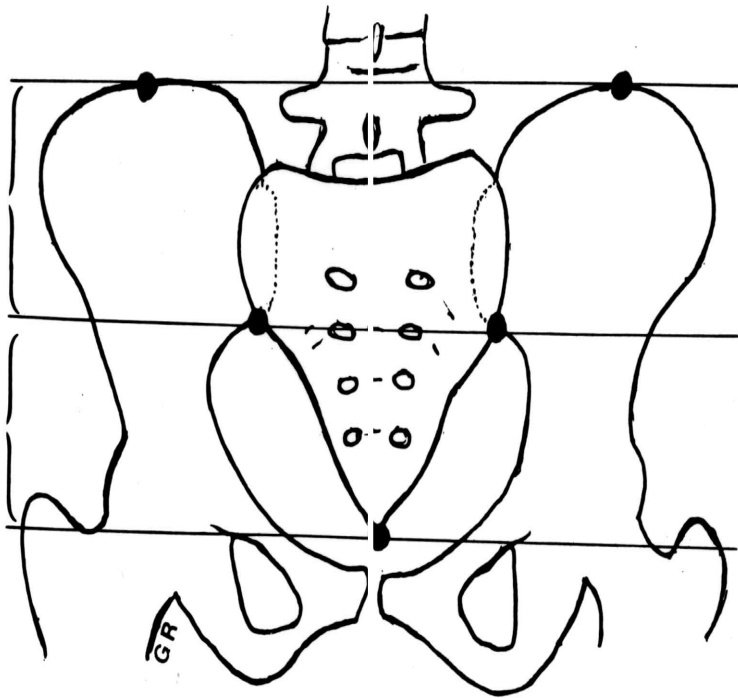


Purpose:

1. AP – Hemi sacrum –
presacral mass
Scimitar sacrum

2. AP and Lateral – sacral ratio
– to determine long term
prognosis for fecal continence



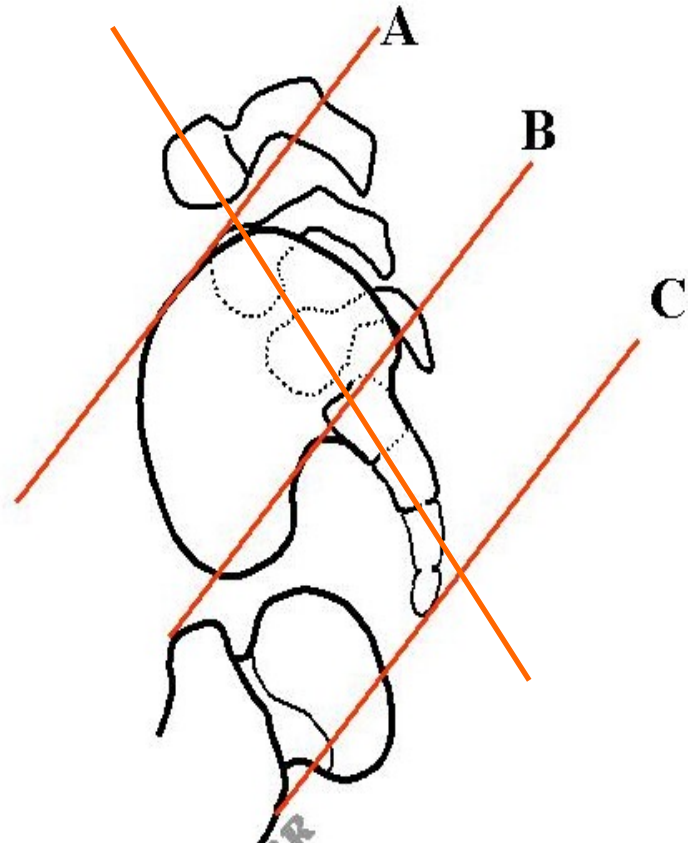


A

B

C

Normal Ratio: $\frac{BC}{AB} = .74$



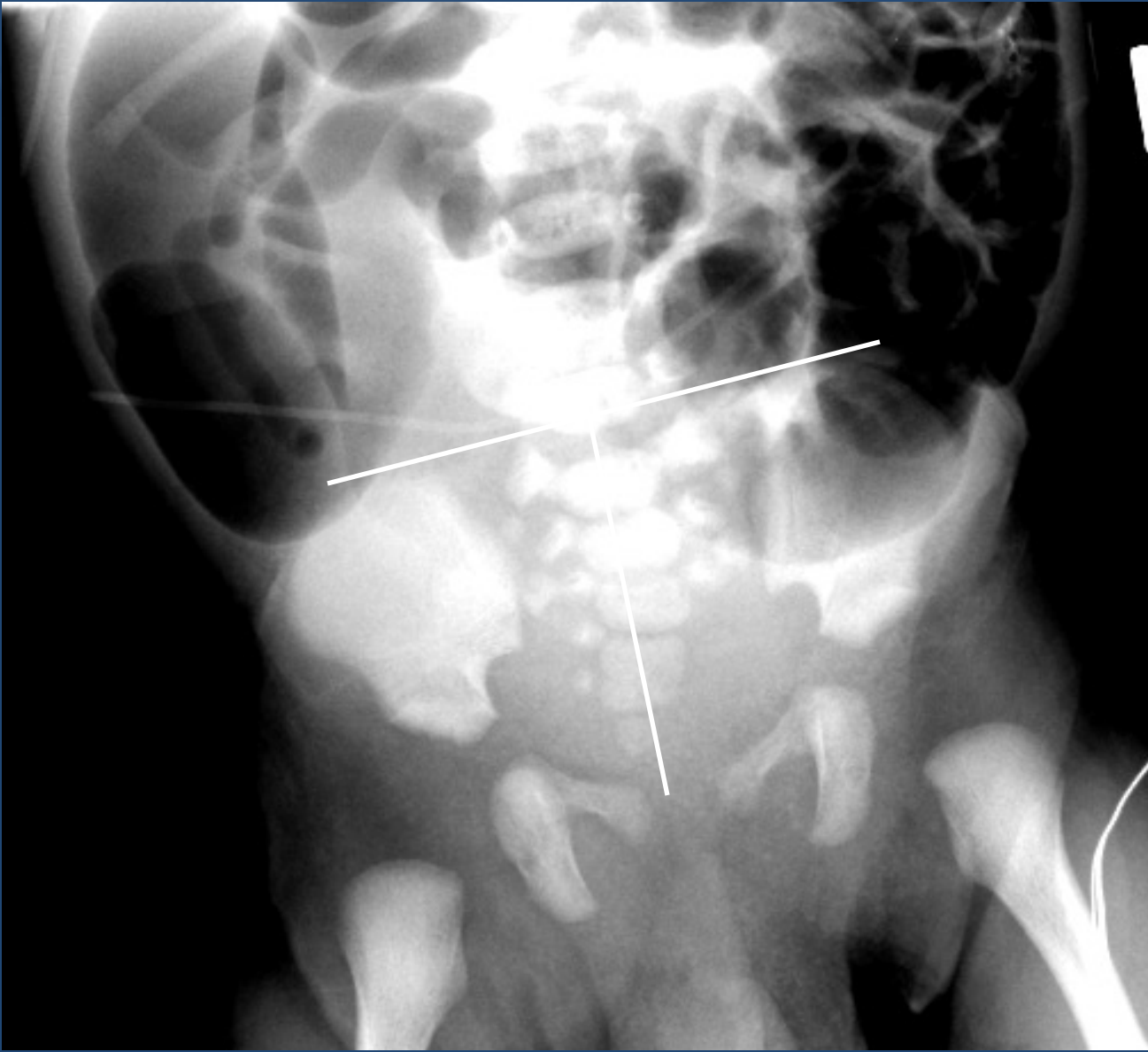
$\frac{BC}{AB} = 0.77$

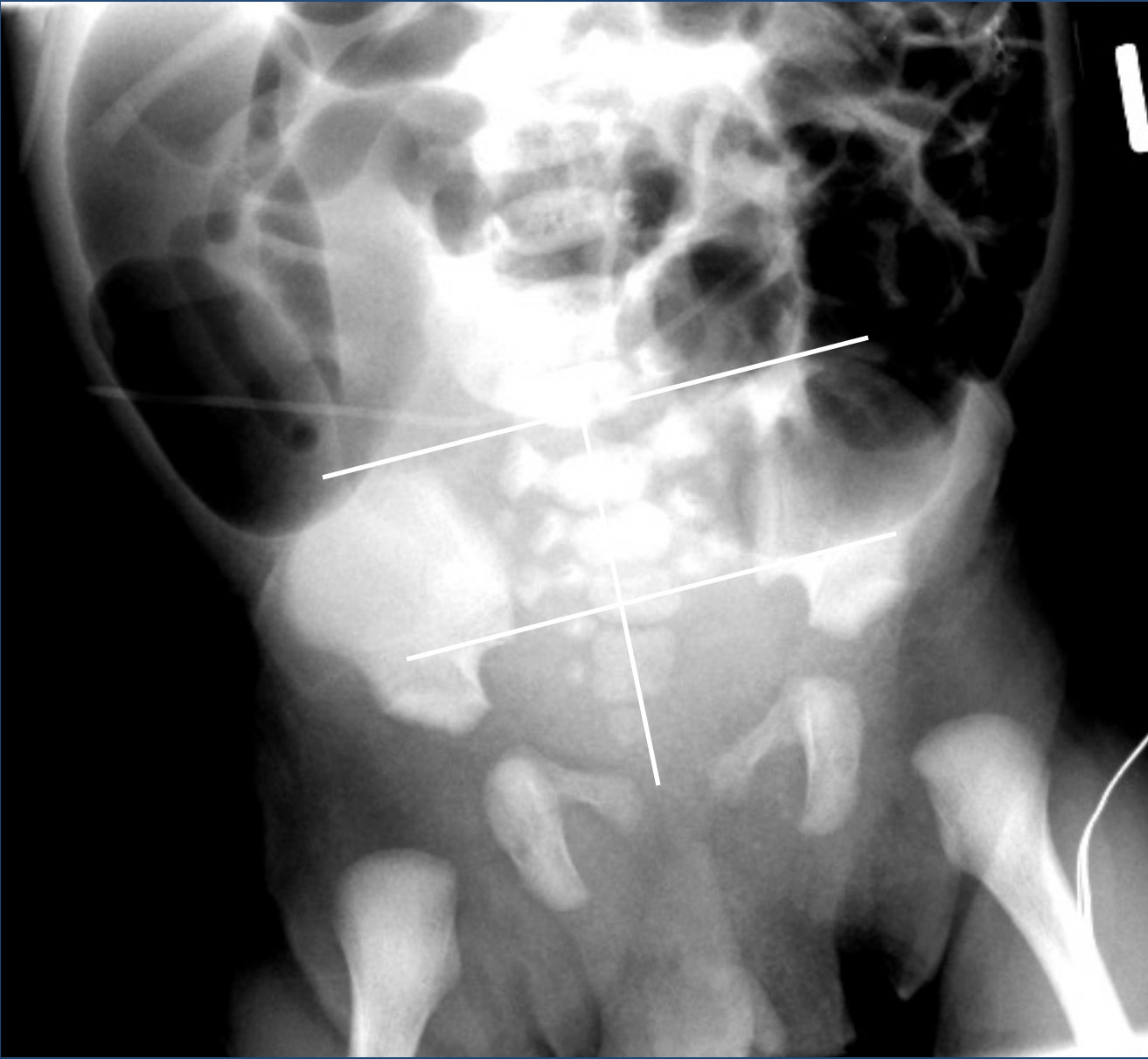
A value that is equal or more than 0.7 represents good prognosis for bowel control.

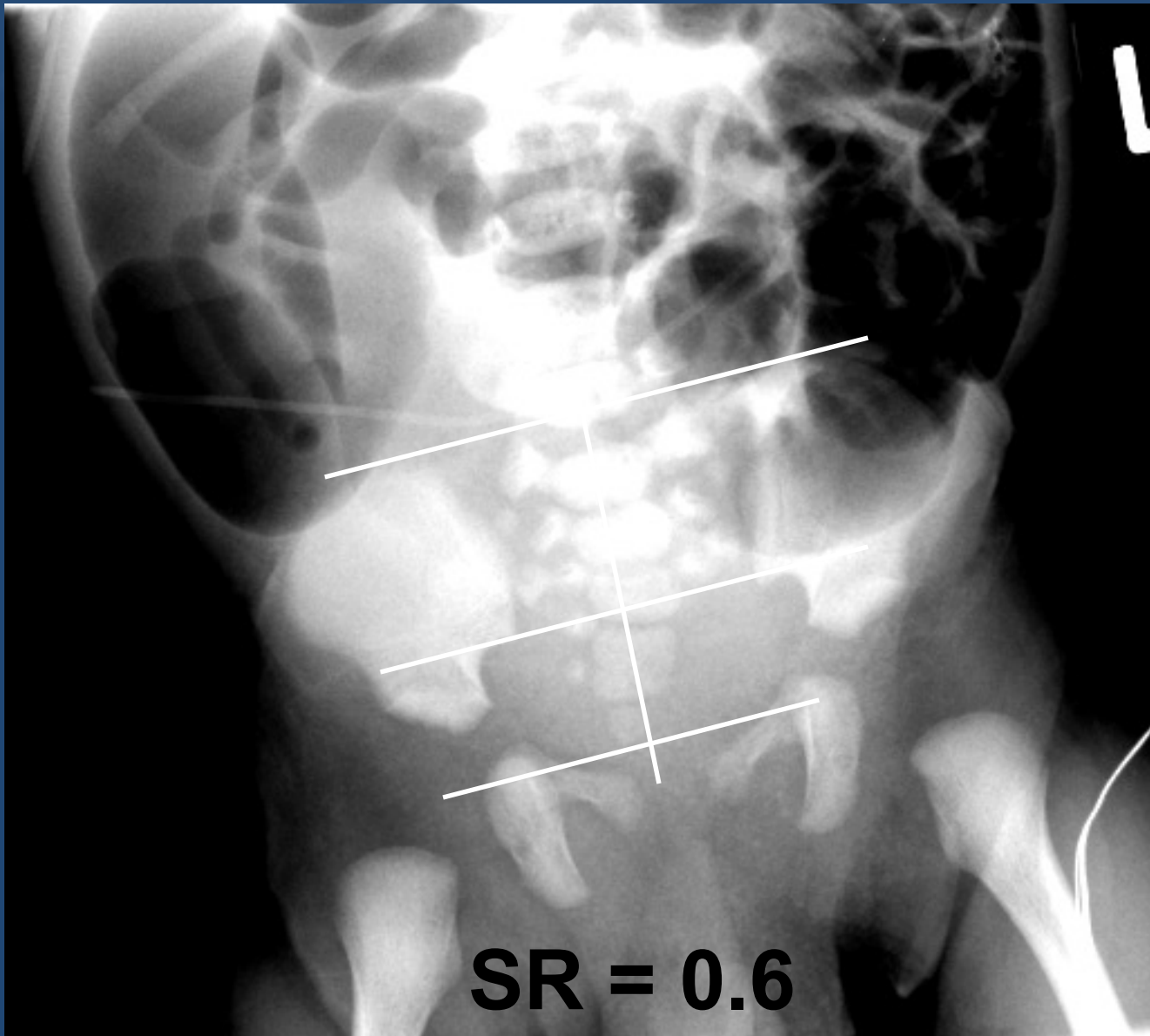
Values between 0.41 - 0.69 are considered undetermined.

A value that is equal or less than 0.4 represents poor prognosis for bowel control (fecal incontinence).

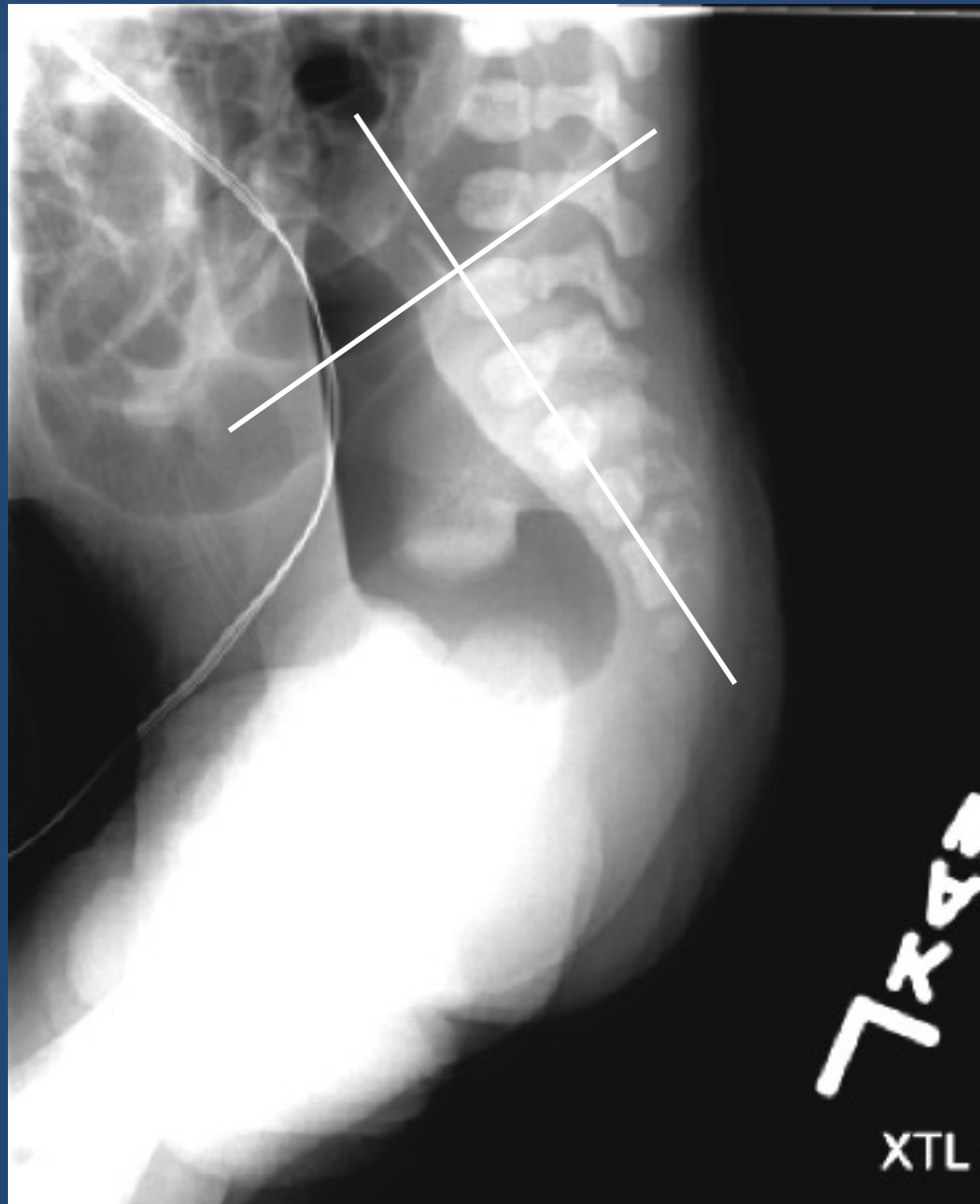


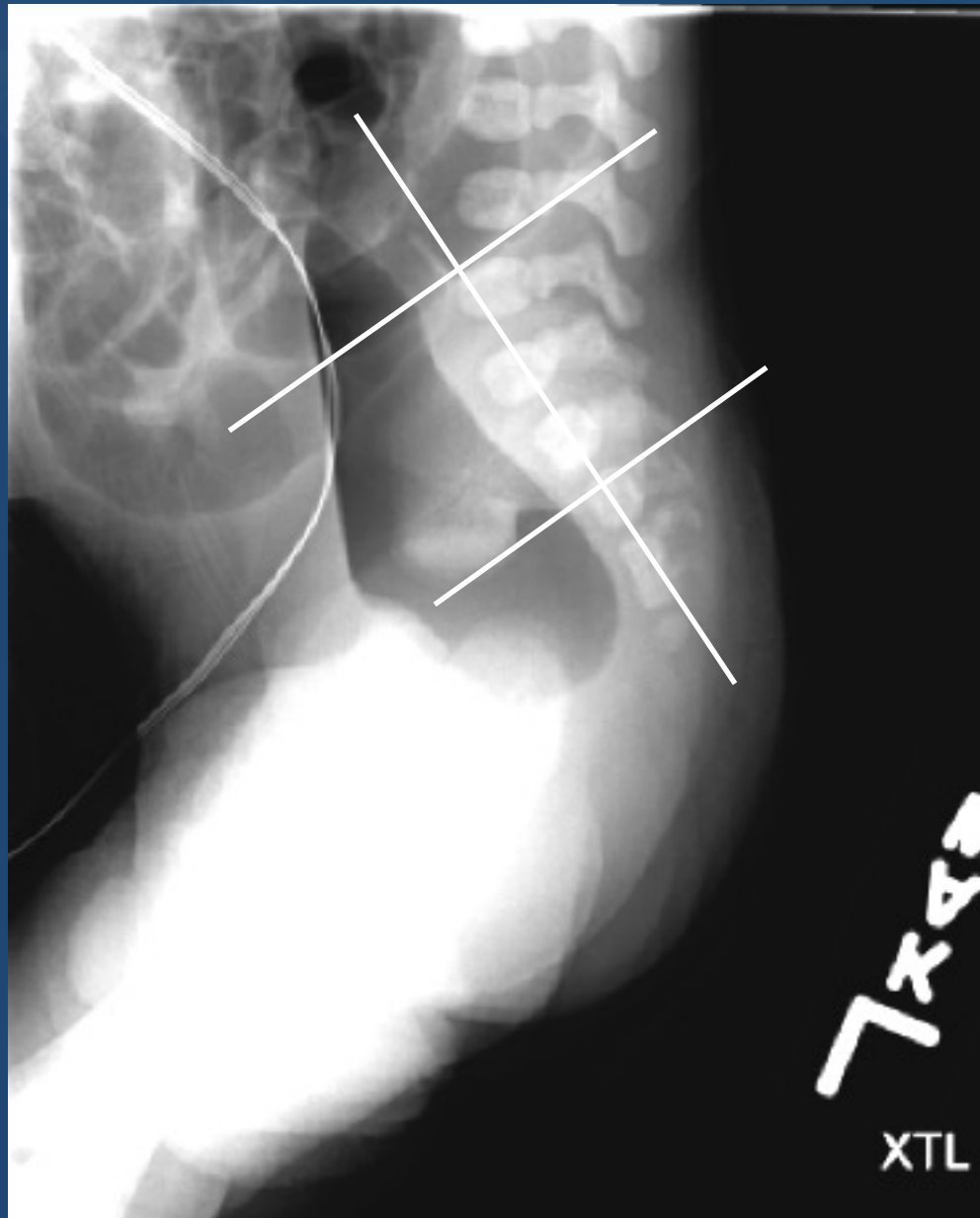














Q: A Sacral Ratio of 0.38 will have what level of bowel control?

- A. A good prognosis for bowel control
- B. A poor prognosis for bowel control
- C. An indeterminate prognosis for bowel control

Q: At what age does the coccyx ossify?

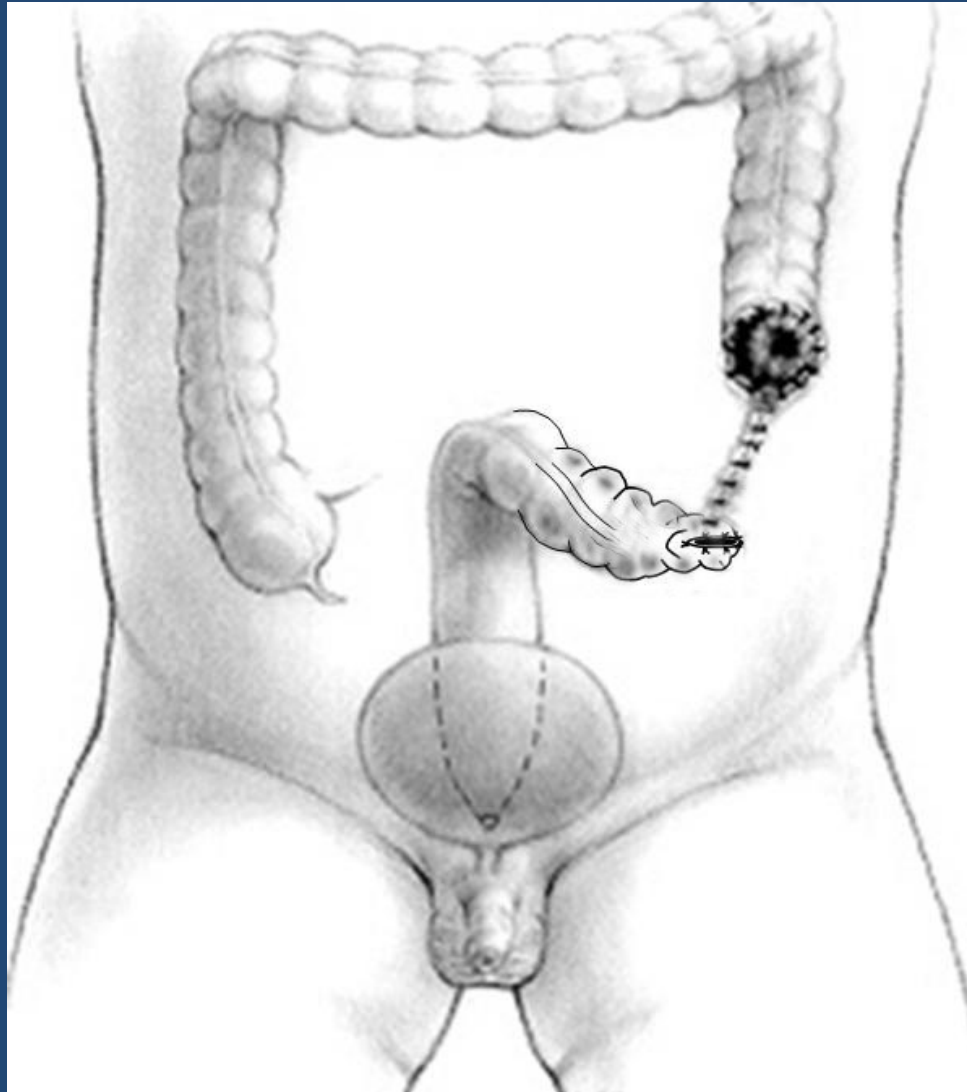
- A. At term (40 weeks)
- B. 6 months
- C. 5 years
- D. 18 years
- E. 27 years

HX: 2 months S/P diverting Colostomy

Evaluate Stoma

1. Which stoma to evaluate?
2. What catheter do I use?
3. What contrast do I use?
4. Hand injection or gravity?
5. How much pressure?

Colostomy and Mucus Fistula



High Pressure Distal Colostogram in a Case of Recto-urethral Bulbar Fistula



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Colorectal Care

Hx: HX: 2 months S/P diverting Colostomy
Evaluate Stoma

*Evaluate mucus fistula and distal colon for length and
fistula prior to colostomy closure, born with Anal
atresia*

1. Which stoma to evaluate – distal mucus fistula
2. What catheter do I use? Foley 6-8 Fr, 2-3 ml air
3. What contrast do I use? – NOT BARIUM, cystografin or isovue
4. Hand injection or gravity? - Hand
5. How much pressure? - Enough

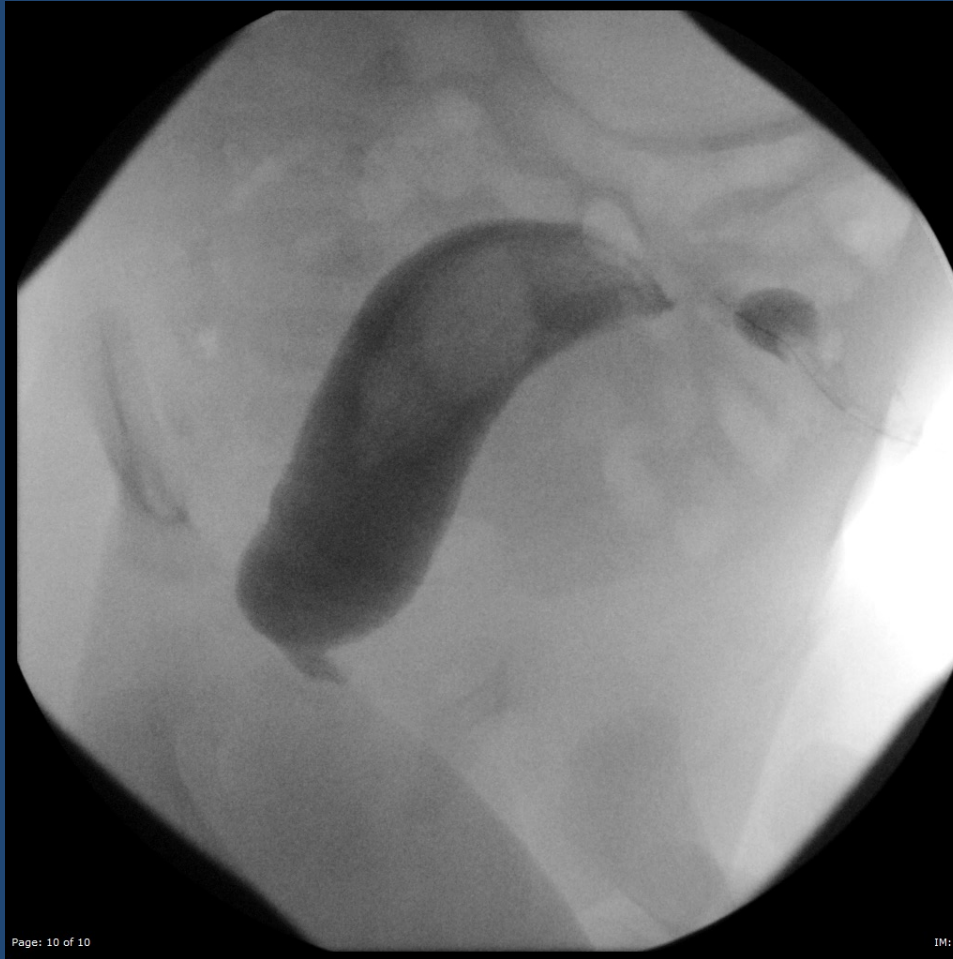
Contrast Selection in Fluoroscopy

Contrast Agent	Osmolality (mosm/kg water)	Iodine (mg/ml)	Cost per 10 mL	Fluoroscopy Study	Precautions
Barium	0	0	\$0.25	Esophagram UGI and SBFT	DO NOT USE if suspicion of perforation
Cysto-Conray 2	400	81	\$1.10	VCUG and enema	
Cystografin	556	141		Newborn enema	
Optiray 320	702	320	\$15.74		
Isovue 300	616	300		leak	
Gastrograffin	1940	367	\$6.34	3/1 dilution	
Gastroview	2000	367	X	CT oral	
Isovue 200m	413	200	200	myelograms	



IM: 1

Impression:
Blind ending tapering channel seen without definite fistula
to the urethra



Q: What is your
conclusion?

- A. No fistula
- B. Prostatic fistula
- C. Bulbar fistula
- D. Bladder neck fistula
- E. Not enough pressure
to answer the question



High Pressure Distal Colostogram

- Foley catheter – 6-12 fr
- Syringe (2-10 ml – air, contrast or water)
- Syringe (20 or 60 ml contrast)
- Water soluble contrast material (NO BARIUM)
– cystoconray, cystografin, isovue
- Radiopaque anal marker
- Injection by hand with fluoroscopic control
- True AP and True lateral



First radiograph : AP



Second Radiograph: AP with contrast.



6-8 Fr Foley in the stoma

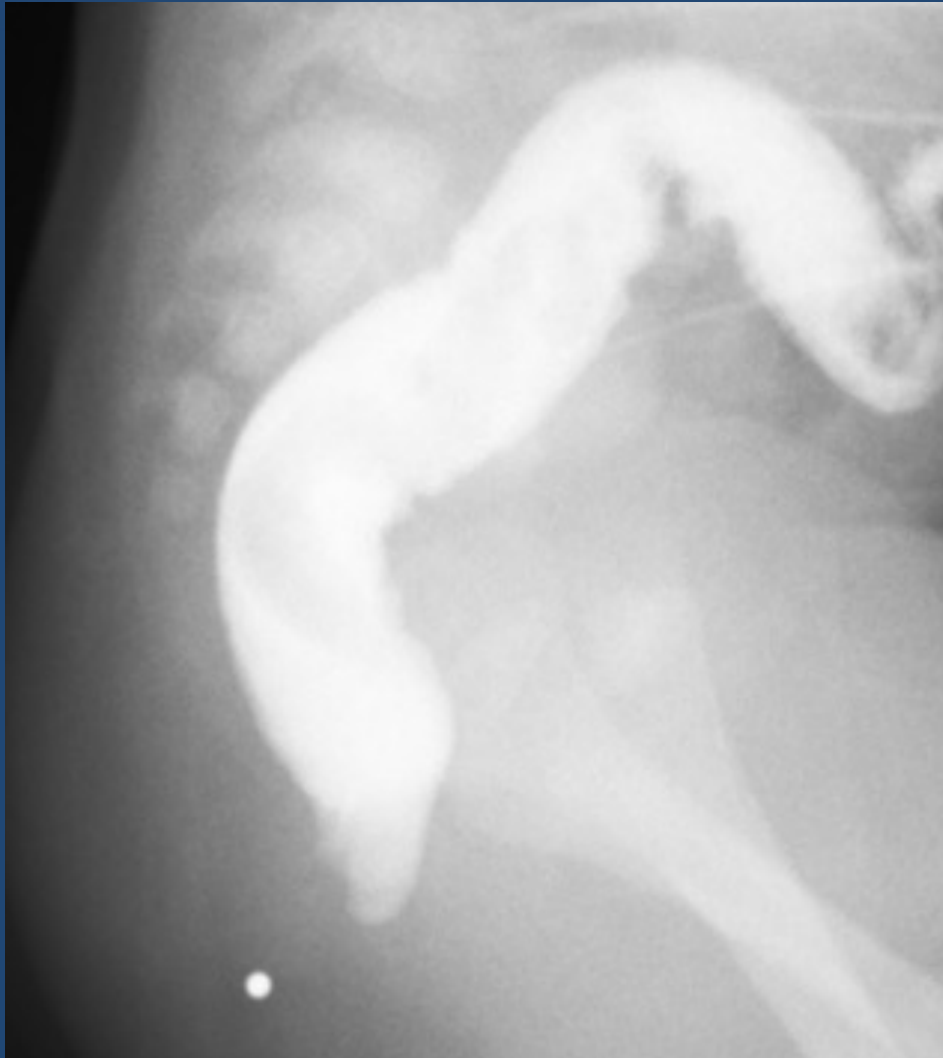
Inflate the balloon 2-3 ml

Hold traction

Third Radiograph: Lateral



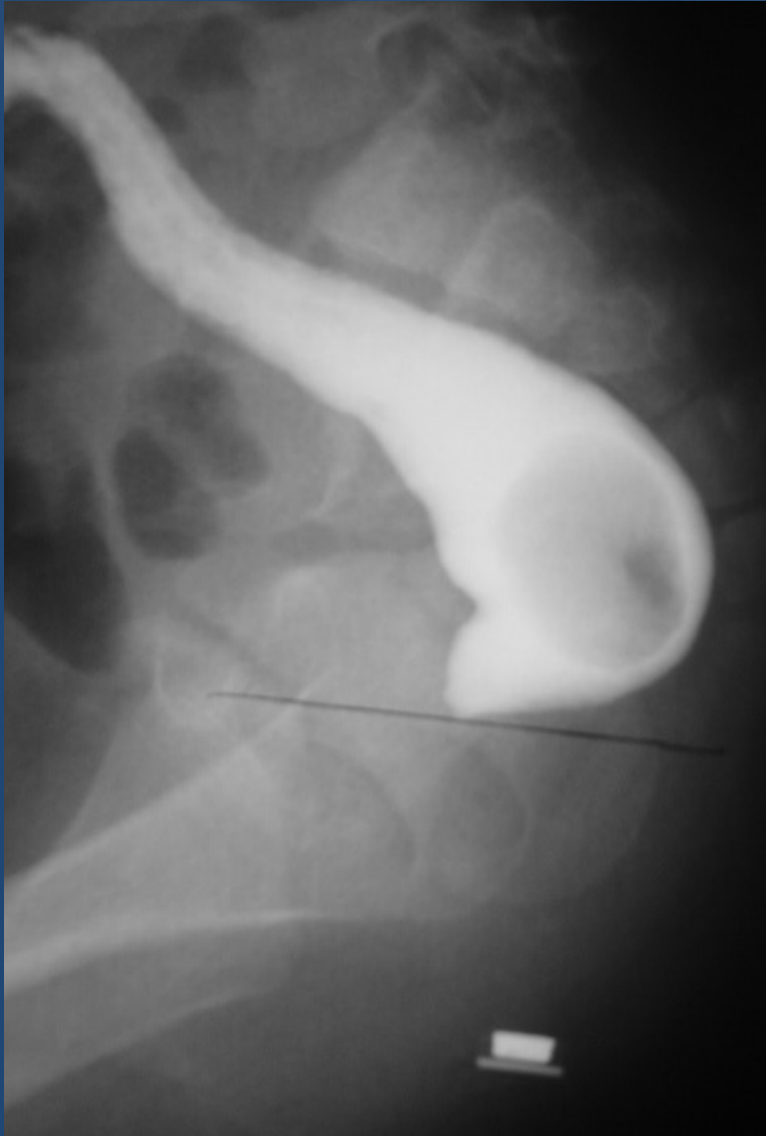
Attention: always show the sacrum and
The anal marker since they are our
reference points!

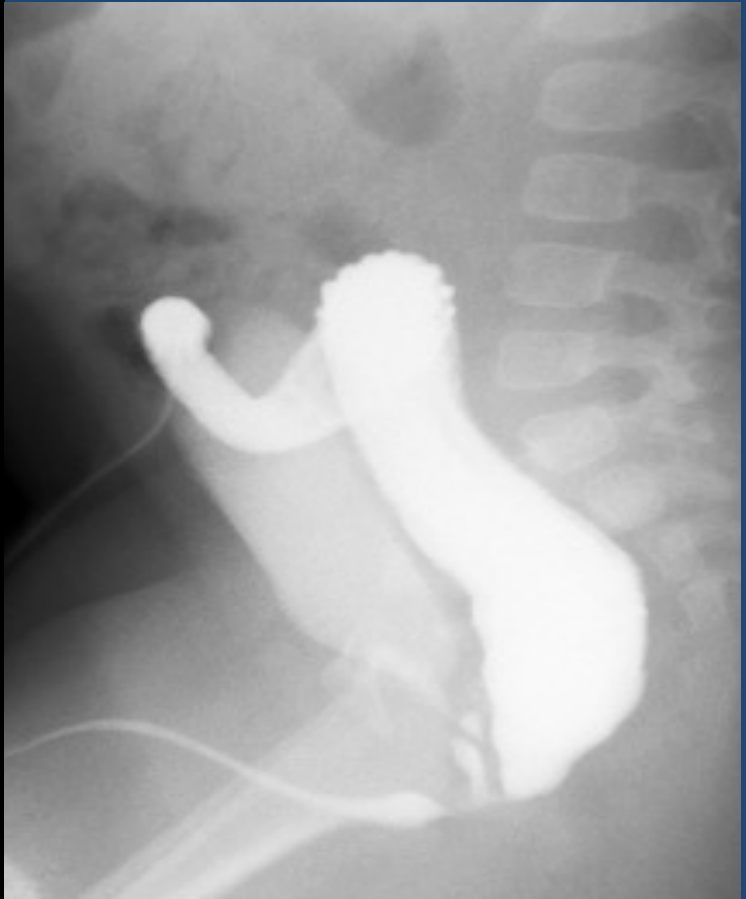
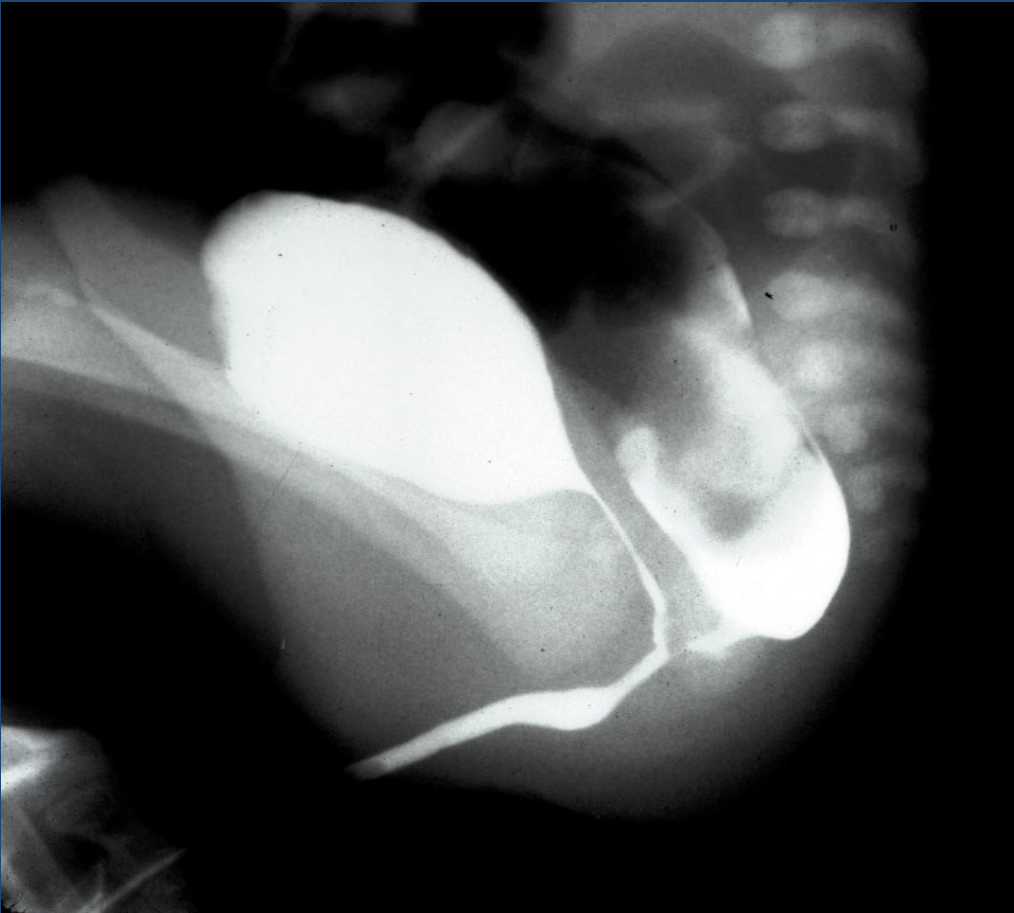




How much pressure?



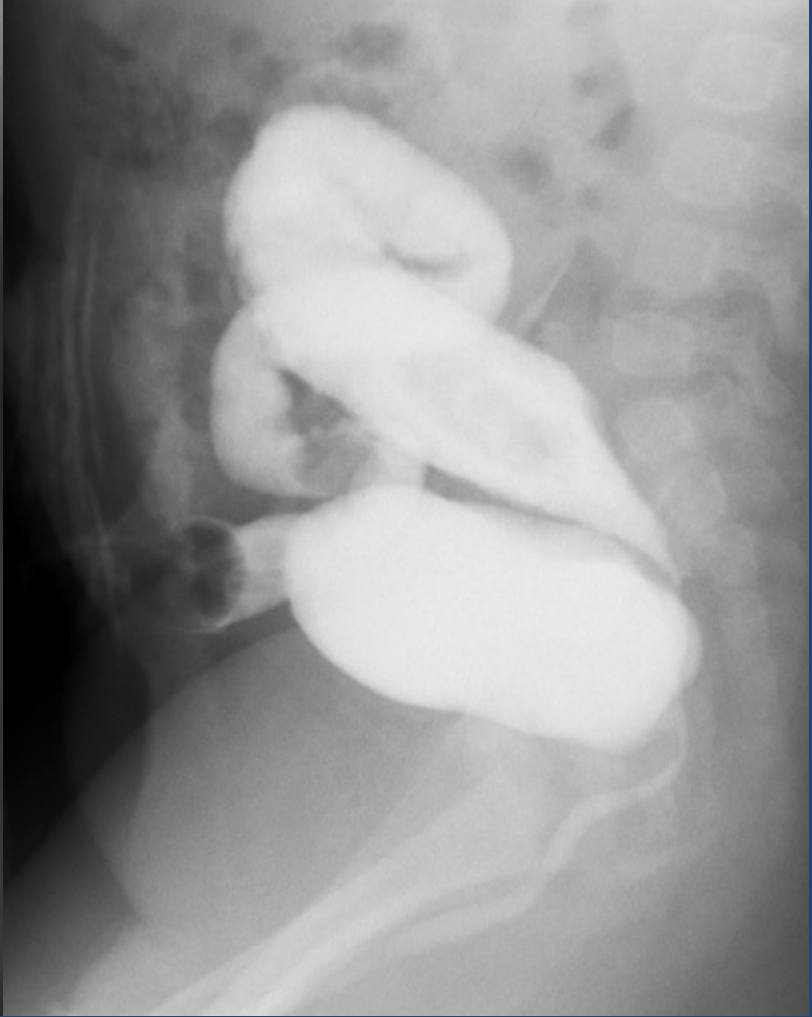




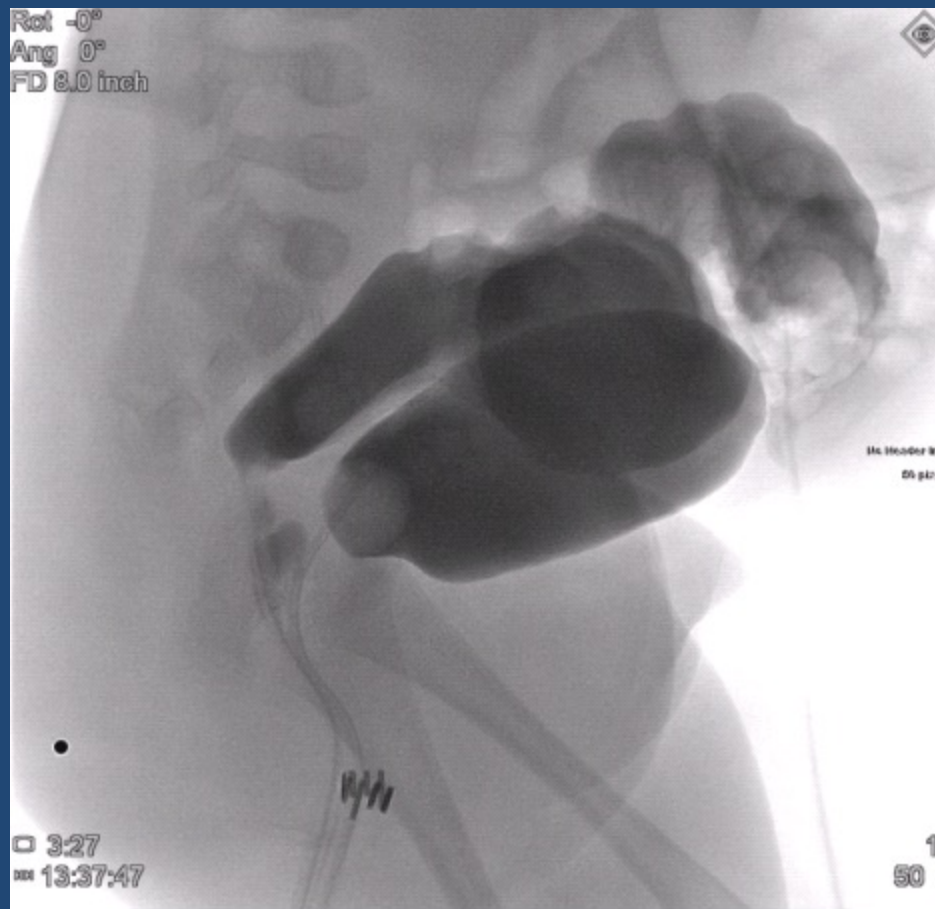
Rectoperineal Fistula

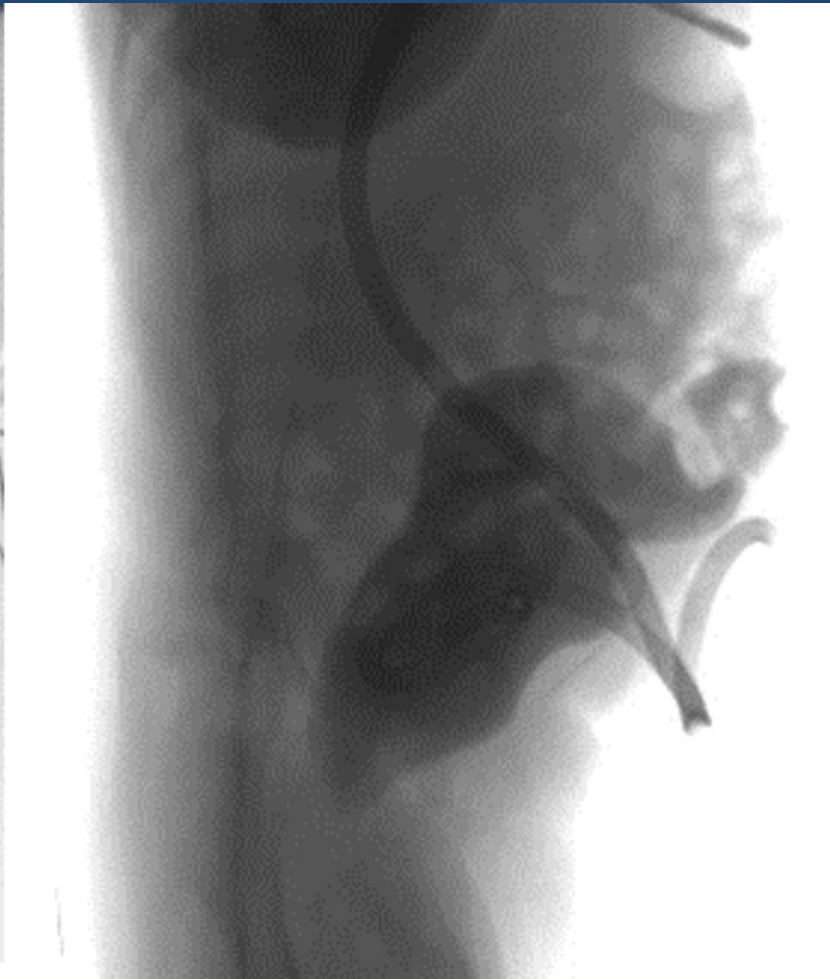
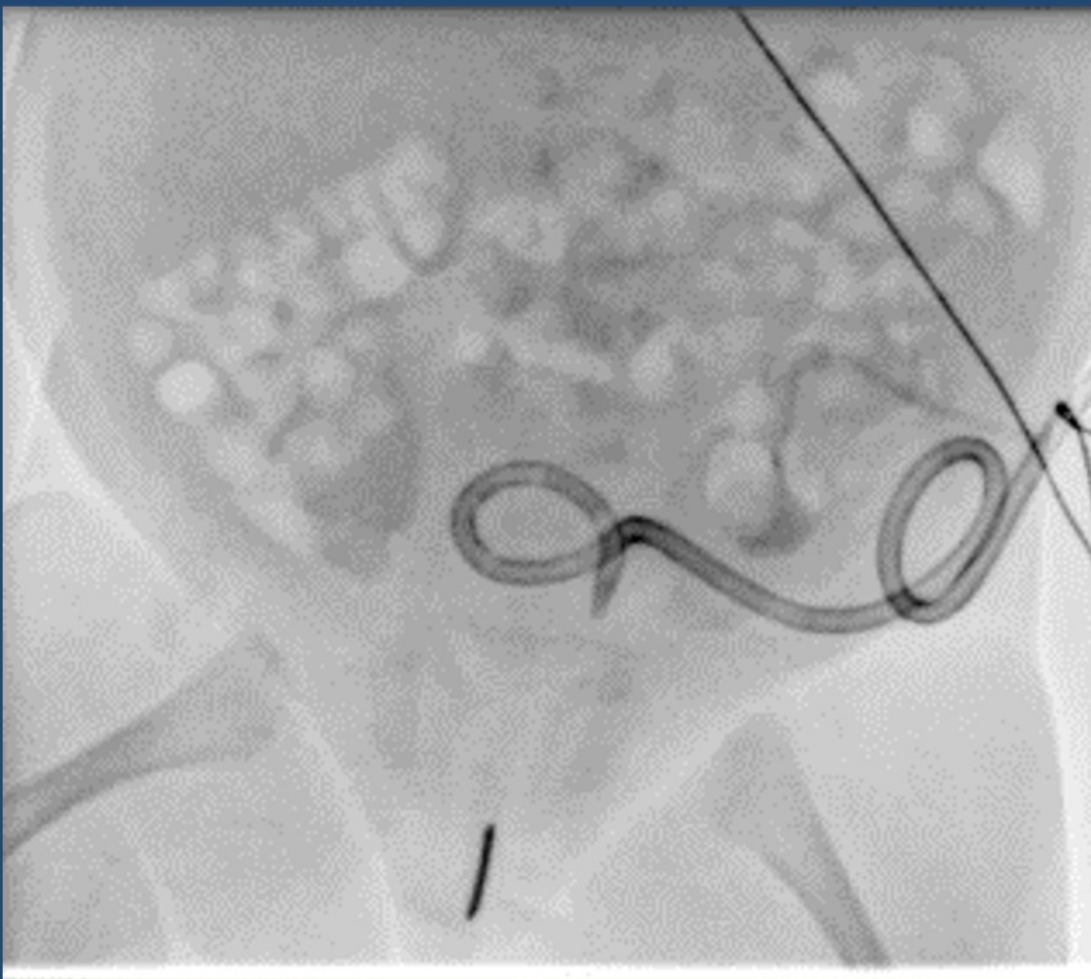


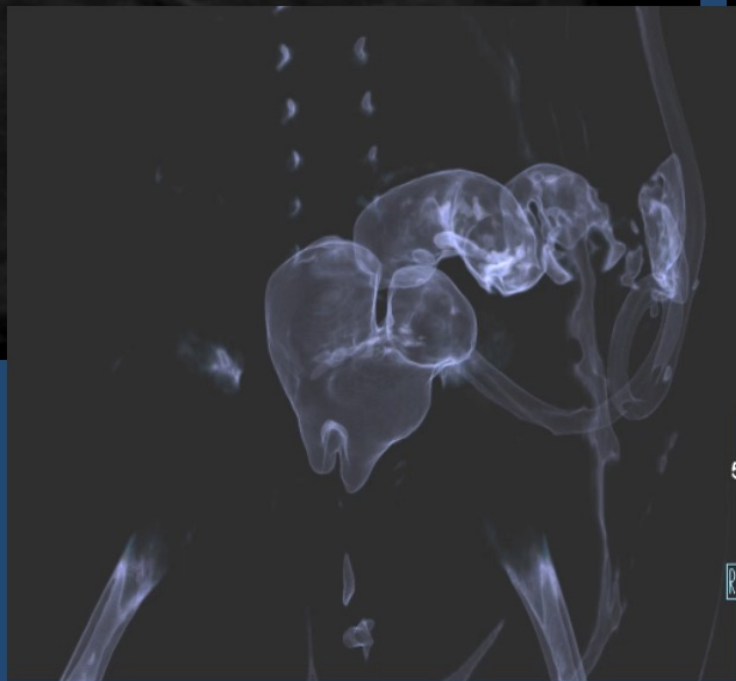
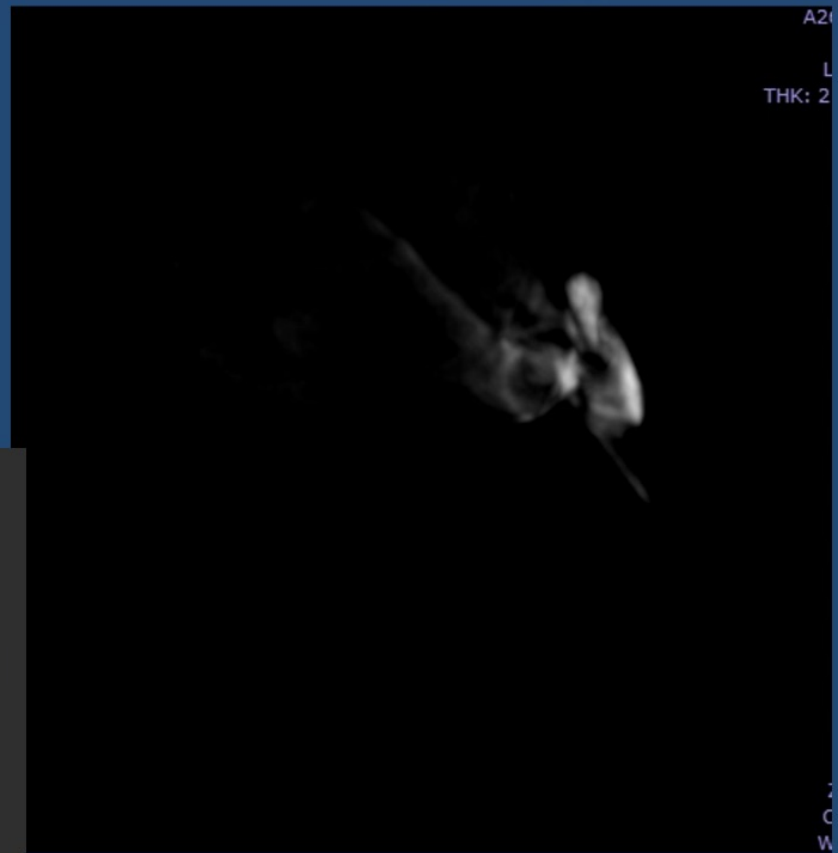
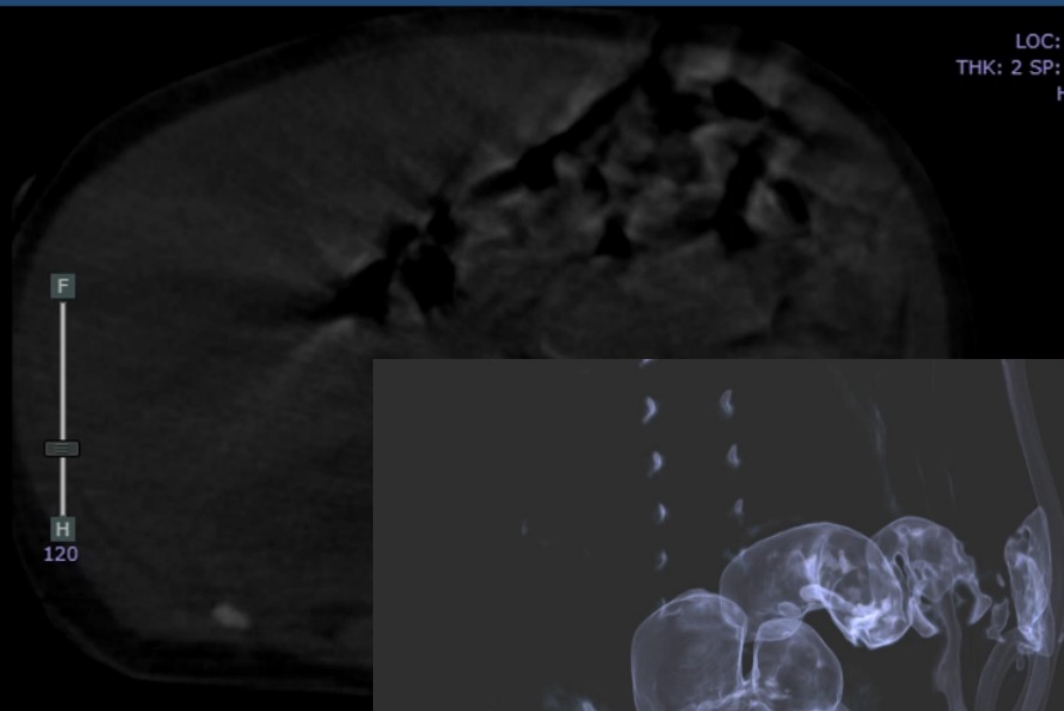




Cloacogram





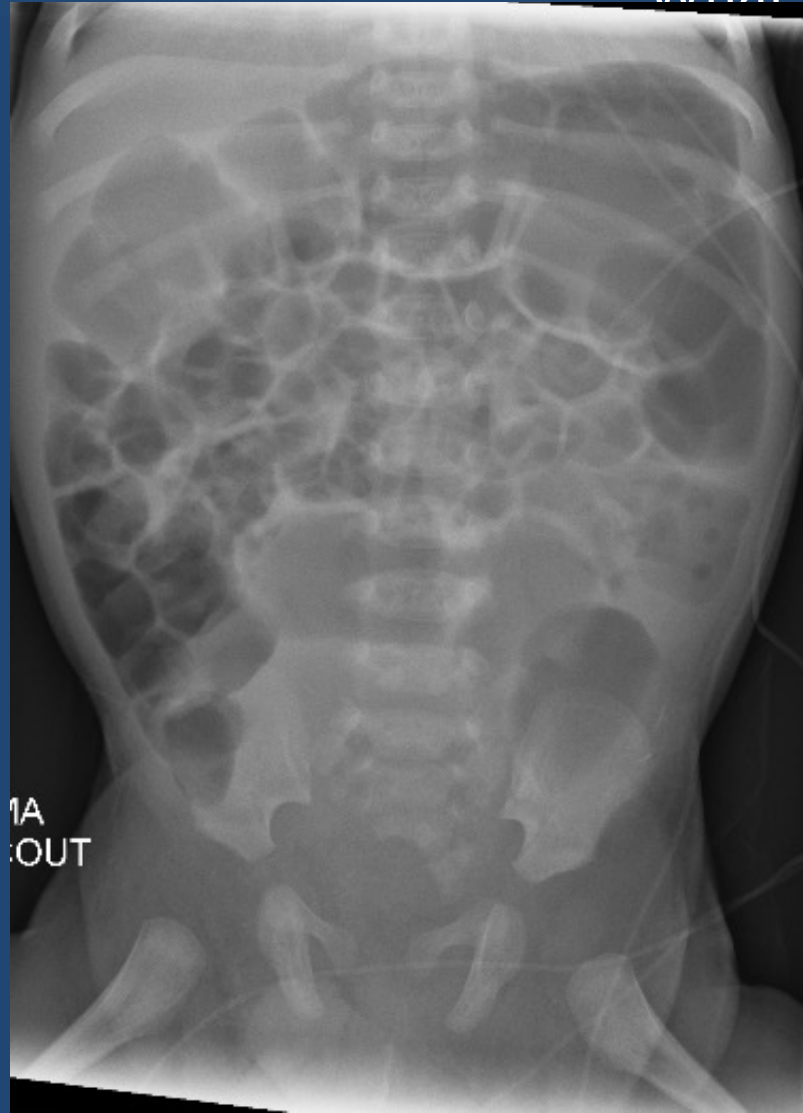


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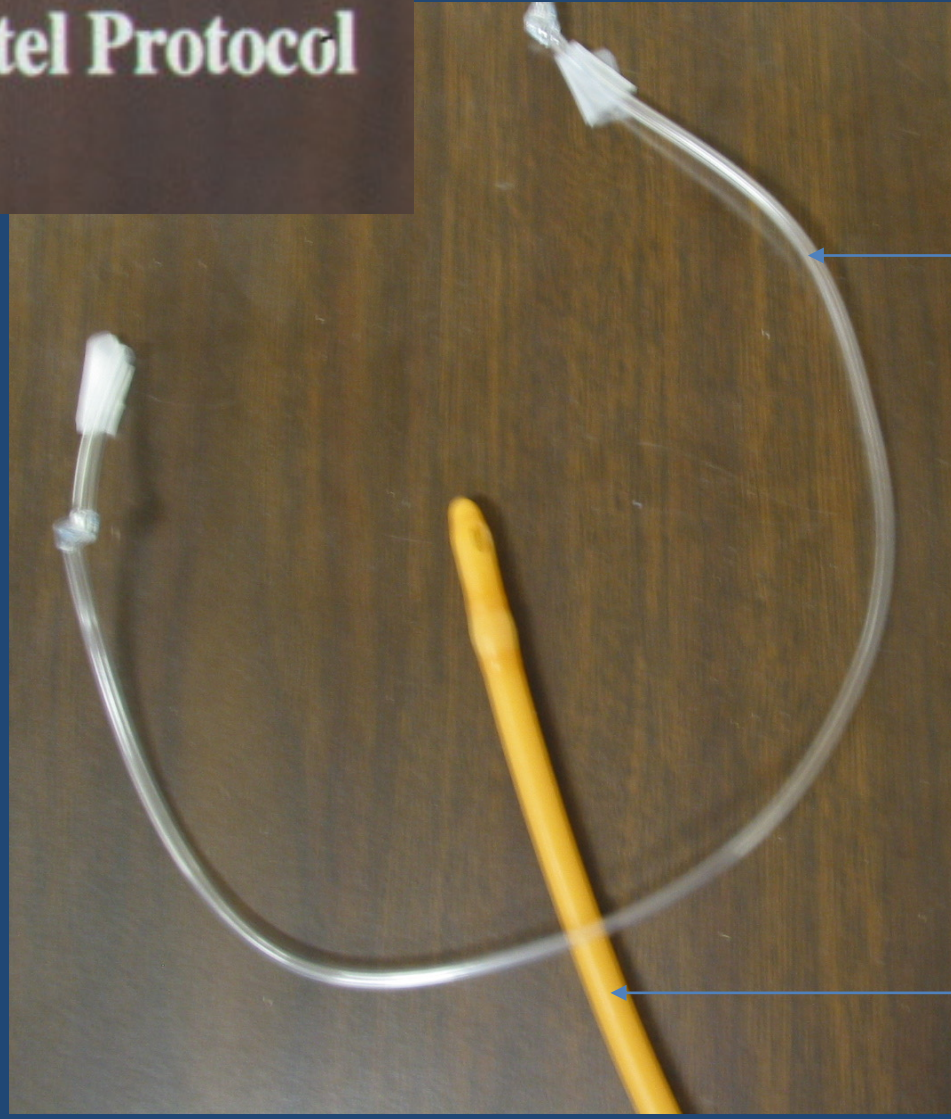
6-week-old male patient suffering from constipation. He eliminated meconium at birth.

What is the diagnosis?



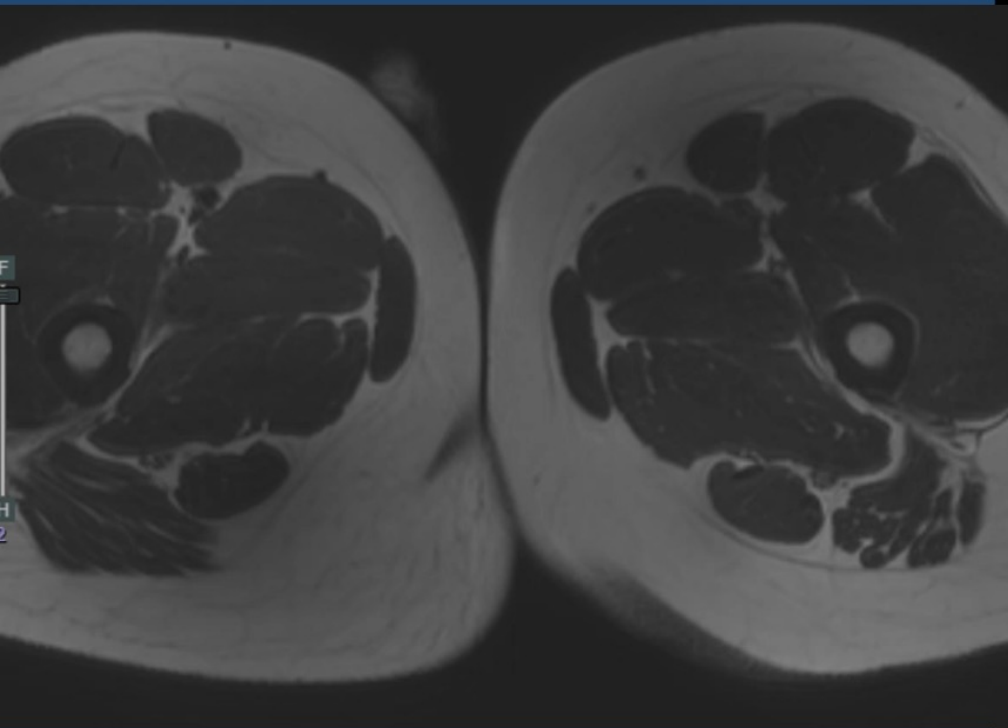
- A. Ultra short Hirschsprung
- B. Pre sacral mass
- C. Normal patient
- D. Constipation
- E. Breast milk allergy

The Peña-Patel Protocol



Aceite

Aire



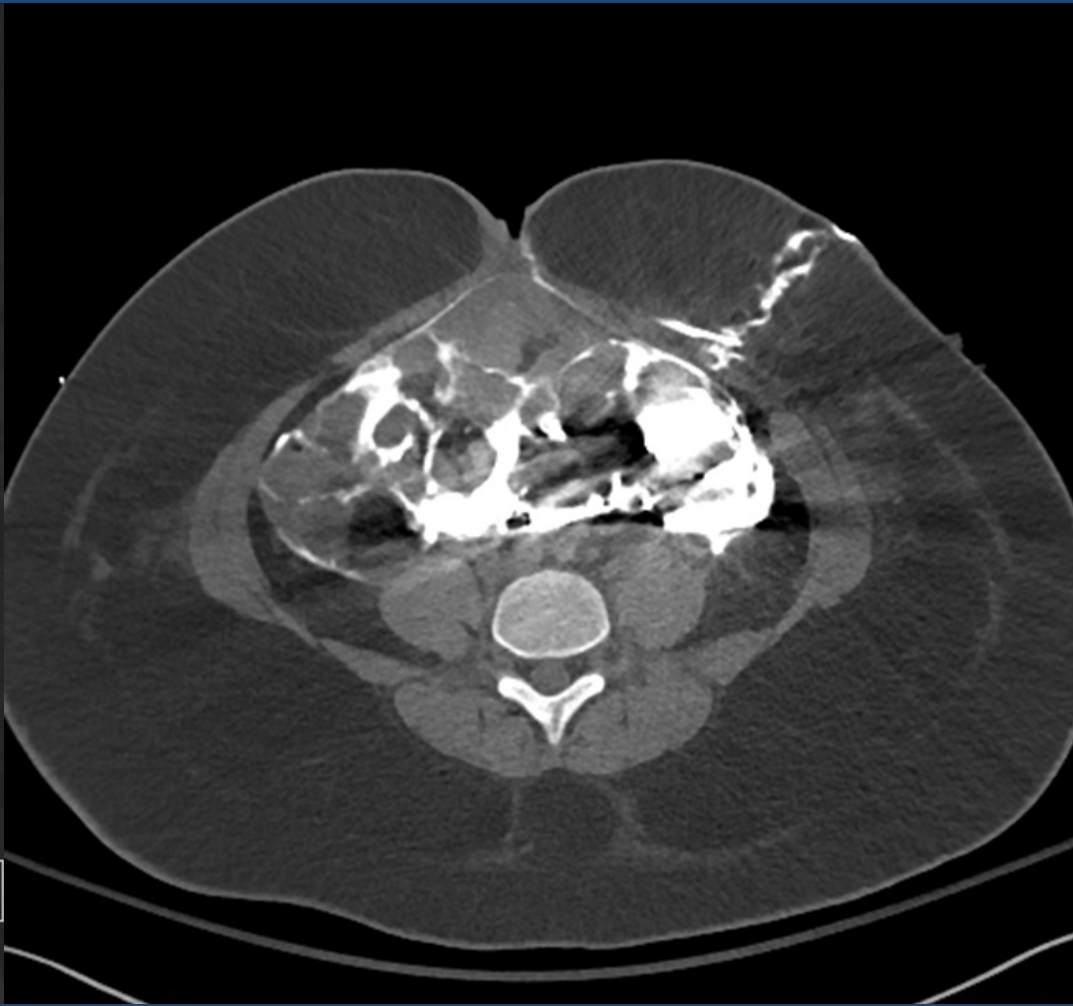
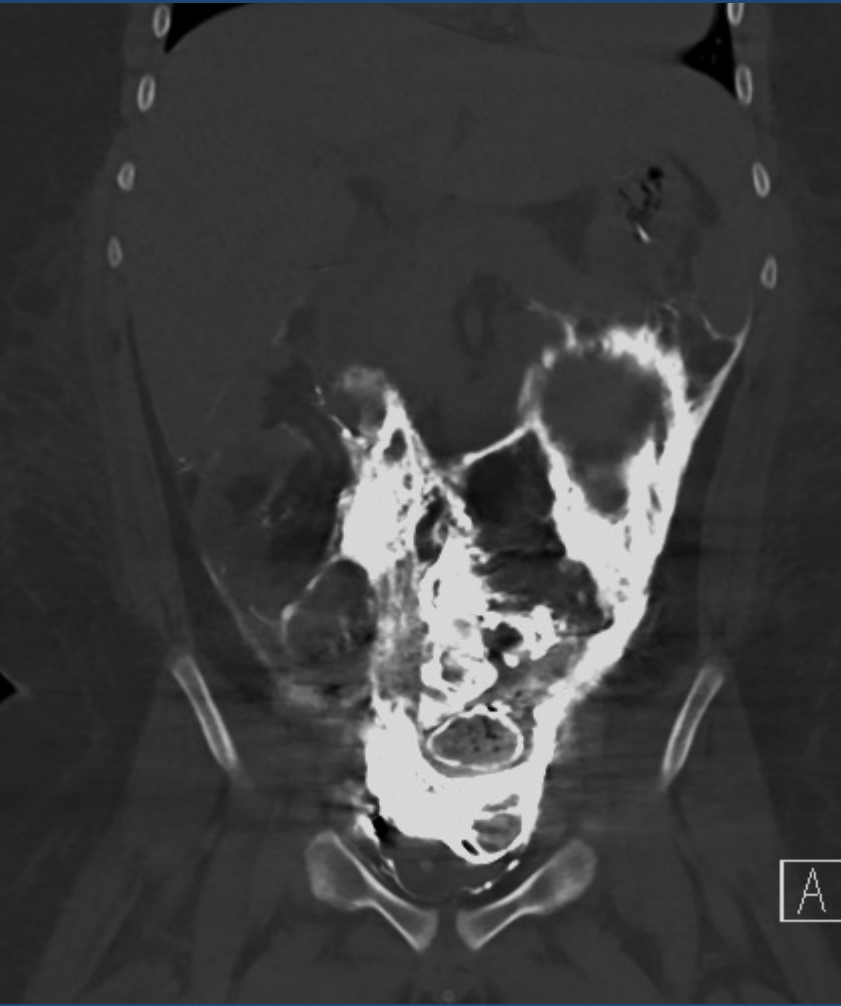


10 yr male with history of Hirschsprungs disease, s/p colostomy, evaluate for stricture





Days later, CT attempted

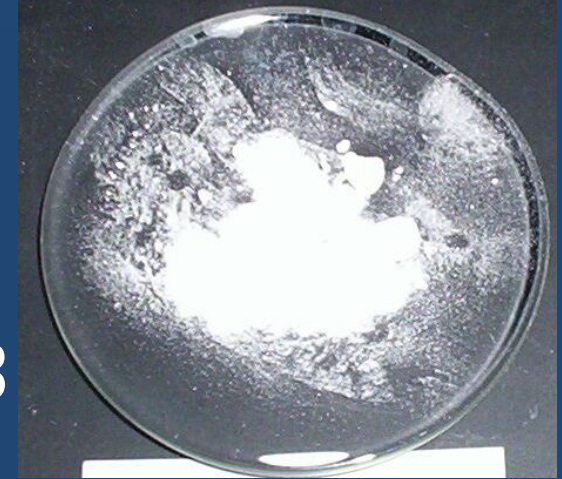


2 years after ARM surgery, complains of continuous ostomy prolapse and leakage, eval colon anatomy



Why not Barium?

- Chemical element Ba 56
- Insoluble in water
- Contrast – Barium sulfate 1908
- Low toxicity and high density
- Can cause granulomatous reaction in body cavities
- Bad for constipation and bowel leak



The Art of the Enema



Contrast Enema



Foley 18-24 fr with 15-30-60
balloon

Gravity Drip

Dilute Gastrograffin 1/3

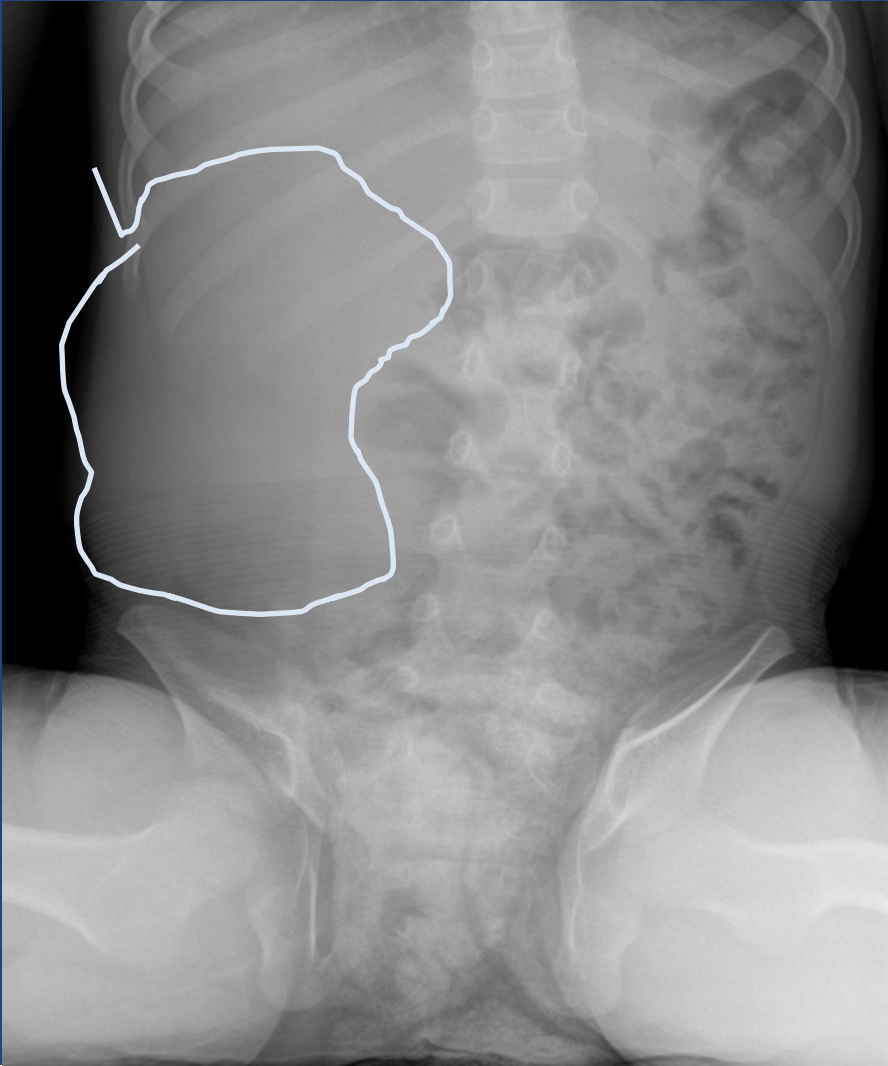
Fill cecum

Record volume

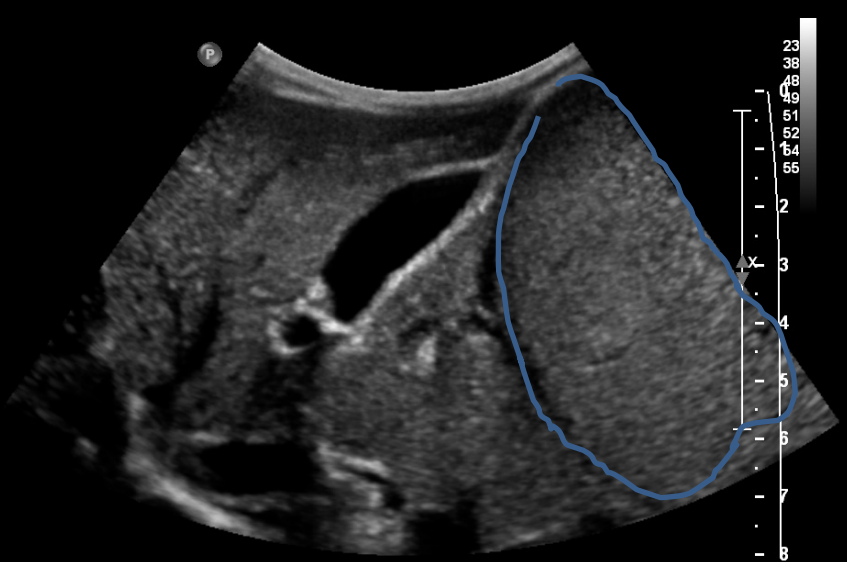
Post evac – 25-30 min

***Leave balloon inflated fecally
incontinent

2 yr RUQ pain ? Constipation

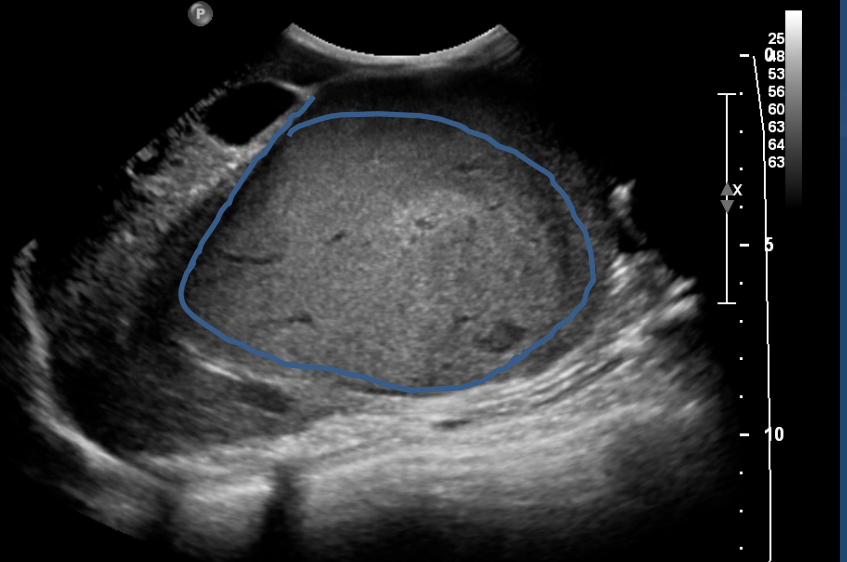


FR 40Hz
RS
2D
49%
C 50
P Low
HGen



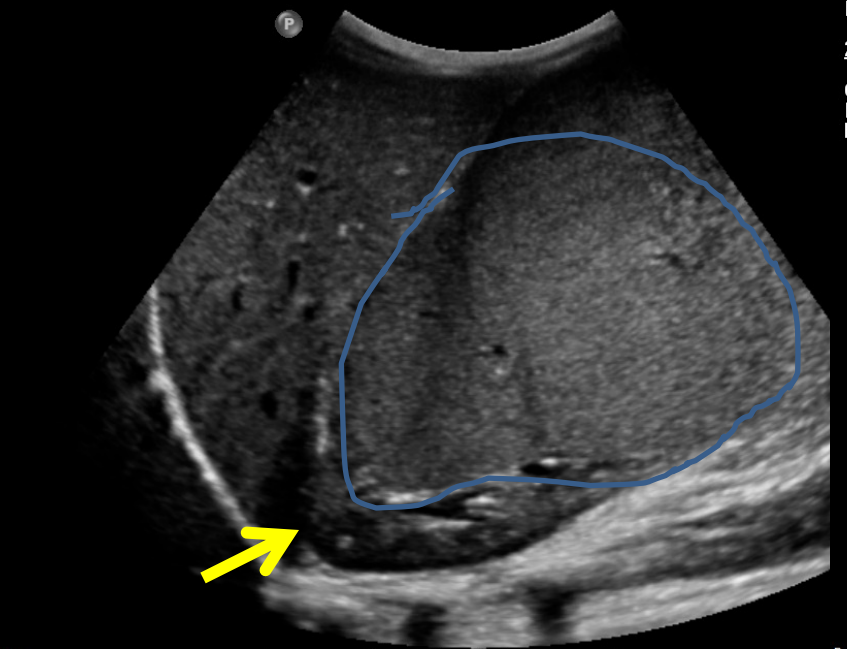
Long GR

FR 29Hz
RS
2D
57%
C 50
P Low
HGen



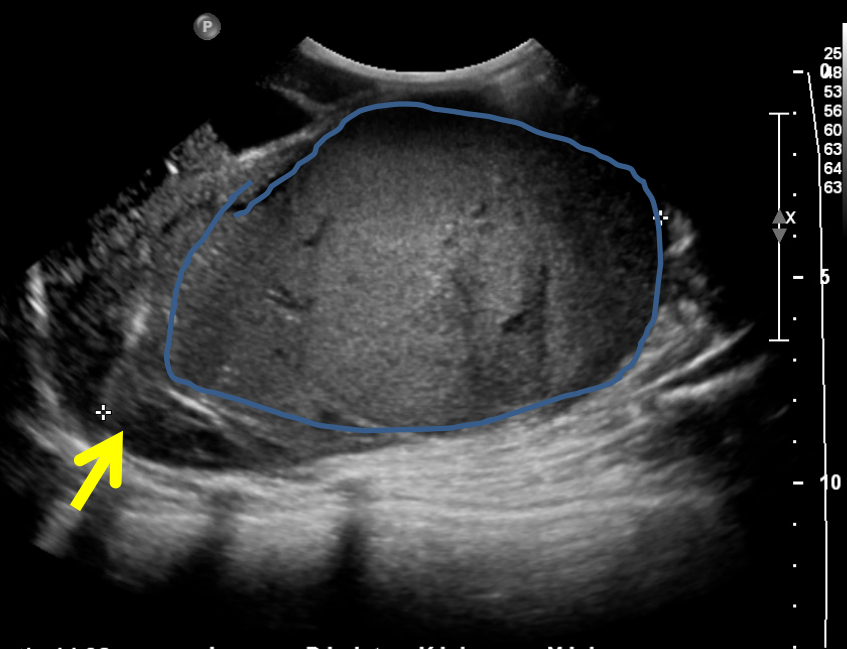
Long Right Kidney Sup

Page: 38 of 114
FR 32Hz
RS
2D
53%
C 50
P Low
HGen



Long Right Kidney Sup

IM: 38 Page: 50 of 114
FR 29Hz
RS
2D
57%
C 50
P Low
HGen



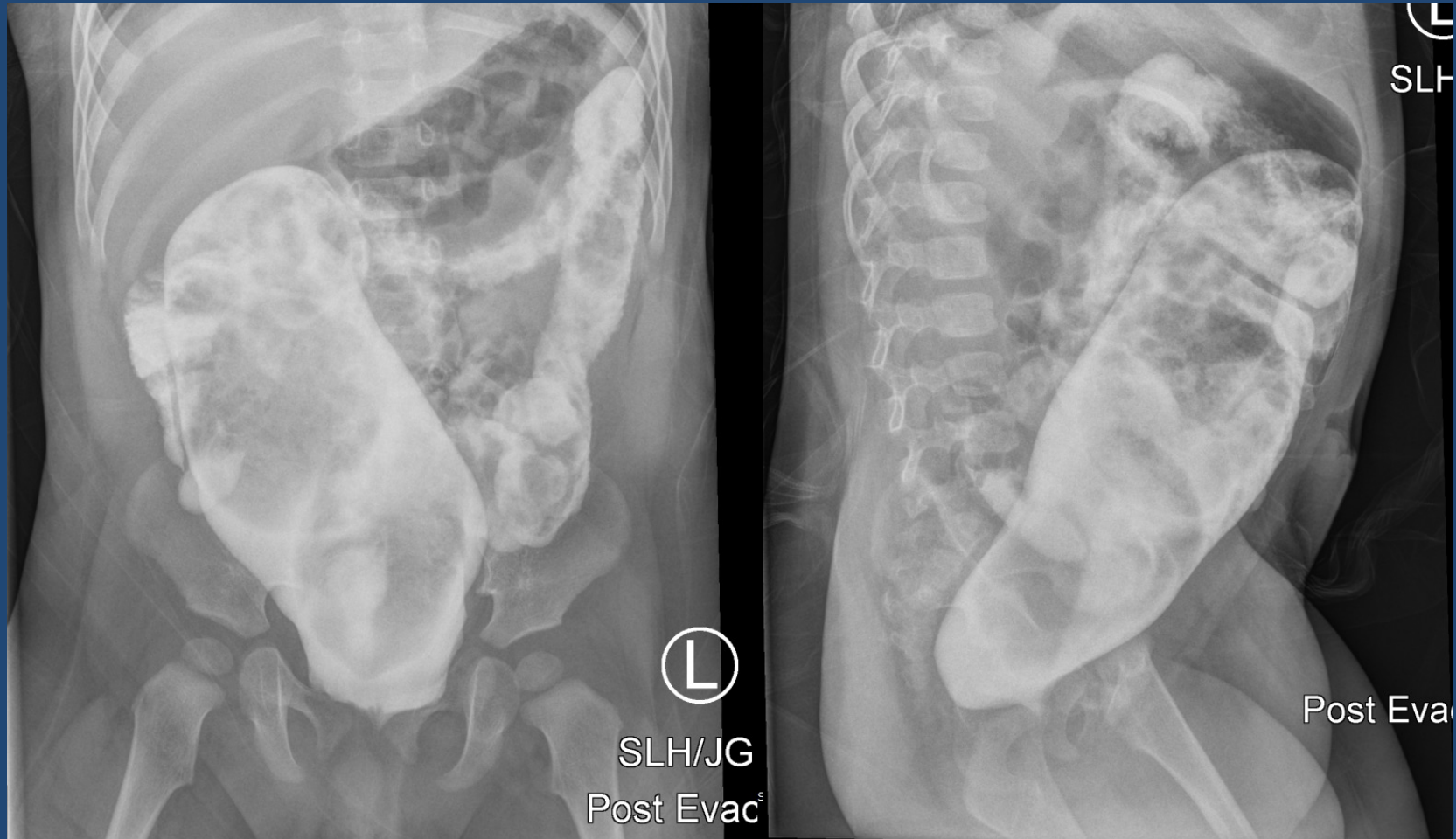
Long Right Kidney Mid

Right Kid Length 14.32 cm

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Constipated?



Anal stricture s/p psarp for perianal fistula

12 yr old with abdominal pain and distension, evaluate stool burden

Q: Is this patient constipated?

- A. Yes**
- B. No**
- C. There is something besides stool that will be a burden**



Radiology Conclusions

- 1. Teamwork – Share Physical Exam and History (Purpose)**
- 2. Perform sacral films prior to a contrast study**
- 3. Get a good quality high pressure distal colostogram**
- 4. Do not use BARIUM in pediatric colon studies**
- 5. Tips – use balloon, NPO 2 hours, Have a plan for Evacuation**



BRISTOL STOOL FORM SCALE

The Bristol Stool Form Scale was developed at the University of Bristol in the United Kingdom. It is a medical tool designed to classify one's bowel movements into seven distinct categories. There is a direct correlation between the form of the stool and the amount of time food wastes have spent in the gastrointestinal tract.

If stools stay in the gut for too long, the body may not be able to eliminate wastes efficiently.
If stools are runny and hard to contain, the body is unable to fully absorb water and nutrients from food.

Type 1		Separate hard lumps, hard to pass, known as "rabbit droppings"	CONSTIPATION These stools are difficult to pass and require a lot of straining. Constipation could be caused by many reasons, including: <ul style="list-style-type: none"> • Imbalanced diet lacking in fruit and vegetable fibre and high in animal proteins, fats, processed foods; • Stress both physical and emotional often causing Irritable Bowel Syndrome (IBS); • Scarring or adhesions in the bowel; • Parasites; • Street drugs and some medications; • Imbalance of gut flora (bacterial dysbiosis); • Allergies and intolerances; • Long-term laxative abuse etc.
Type 2		Sausage-shaped, lumpy, uncomfortable to pass	
Type 3		Like a sausage, with cracks on its surface	HEALTHY STOOLS This type of stool slides out easily without leaving marks or strong smells. There is no need to strain. It is typical of people on a balanced vegetarian diet.
Type 4		Like a sausage or snake, smooth and soft	HEALTHY STOOLS This type of stool also slides out easily without leaving marks or strong smells. There is not need to strain either. It is typical of people on a balanced diet including a small amount of high-quality animal food.
Type 5		Soft blobs with clear-cut edges, passes easily	PRECURSOR TO DIARRHOEA Although occasionally everyone has soft blobby skiddy foul-smelling stools, if this is a regular occurrence then one should re-evaluate their diet: reduce intake of alcohol, processed products, animal fats; in some rare cases reduce fruit intake; watch sugar intake and make sure that there is an overall balance of proteins, vegetables and grains in the diet.
Type 6		Fluffy pieces with ragged edges, a mushy stool	DIARRHOEA This type of stools is difficult to control. There is always urgency and immediacy associated with diarrhoea. Watery stools mean that the body was unable to extract water, electrolytes and nutrients from the food, causing malnutrition and dehydration. In severe diarrhoea, a medical practitioner needs to be consulted immediately. Some causes of diarrhoea include: <ul style="list-style-type: none"> • Food poisoning; • Stress both physical and emotional often causing Irritable Bowel Syndrome (IBS); • Allergies and intolerances; • Parasitic invasions; • Use of antibiotics; • Laxative abuse; • Anorexia, bulimia and other psychosomatic disorders.
Type 7		Watery stool, virtually no solid pieces, entirely liquid	