Appendicitis in children

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FRCSI
Consultant surgeon

- The appendix is a blind-ending structure arising from the cecum.
- Acute appendicitis is one of the most common causes of abdominal pain and is the most frequent condition leading to emergent abdominal surgery in children.

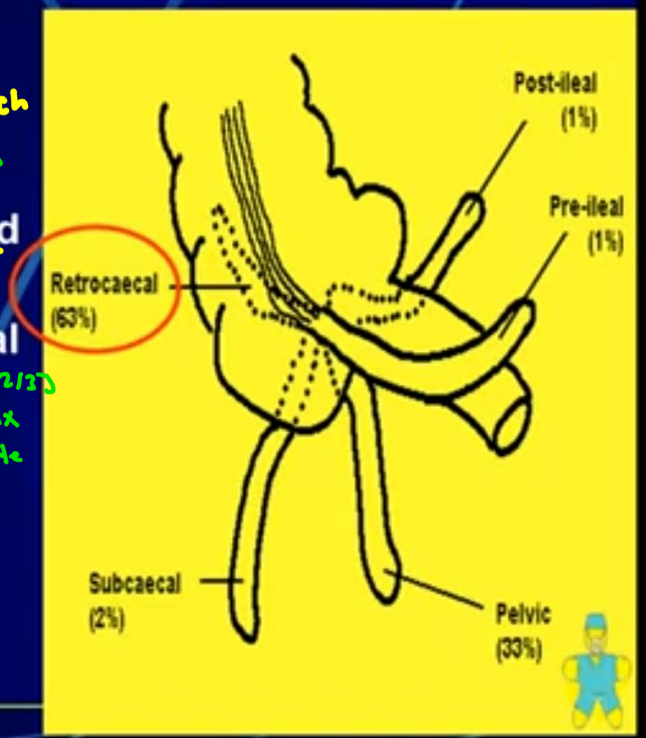


Child presentation:-
Sad . withdrawn
ألم بطن ناتج
عن عجب تاب ما بيخرج

Anatomy

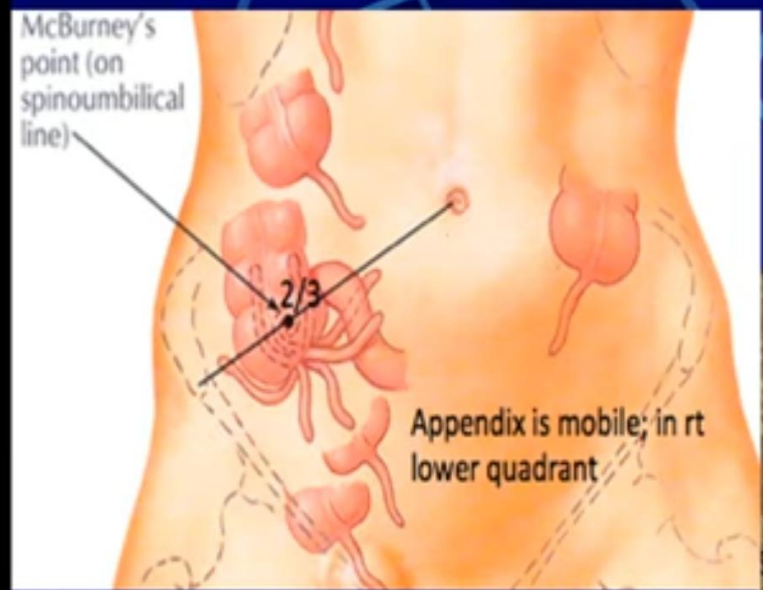
- The vermiform appendix is generally 9 cm in length average 5-35 cm. and may reach the sub hepatic region → misdx as cholecystitis...
- Base of the appendix is fixed to the cecum, the Tip can be located in the pelvis, retrocecal, or extra peritoneum.
  - 1st mc site [2/3] pelvic appendix
  - 2nd mc site
- Anatomic position of the appendix determines the symptoms and the site of tenderness when the appendix becomes inflamed.

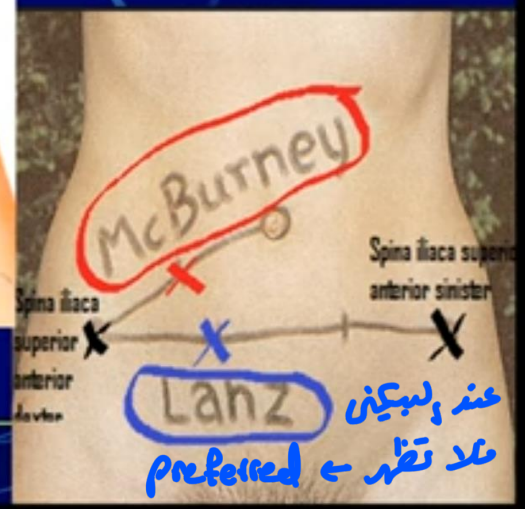
MacBurney Point [2/3 away down from umblicus or 1/3 away up of ASIS]...



* The retrocecal appendix symptoms mainly → Atypical..
* The pelvis appendix lead to rectum or UB irritation → diarrhea - frequant urination - hematuria [as UTI]

McBurney's point



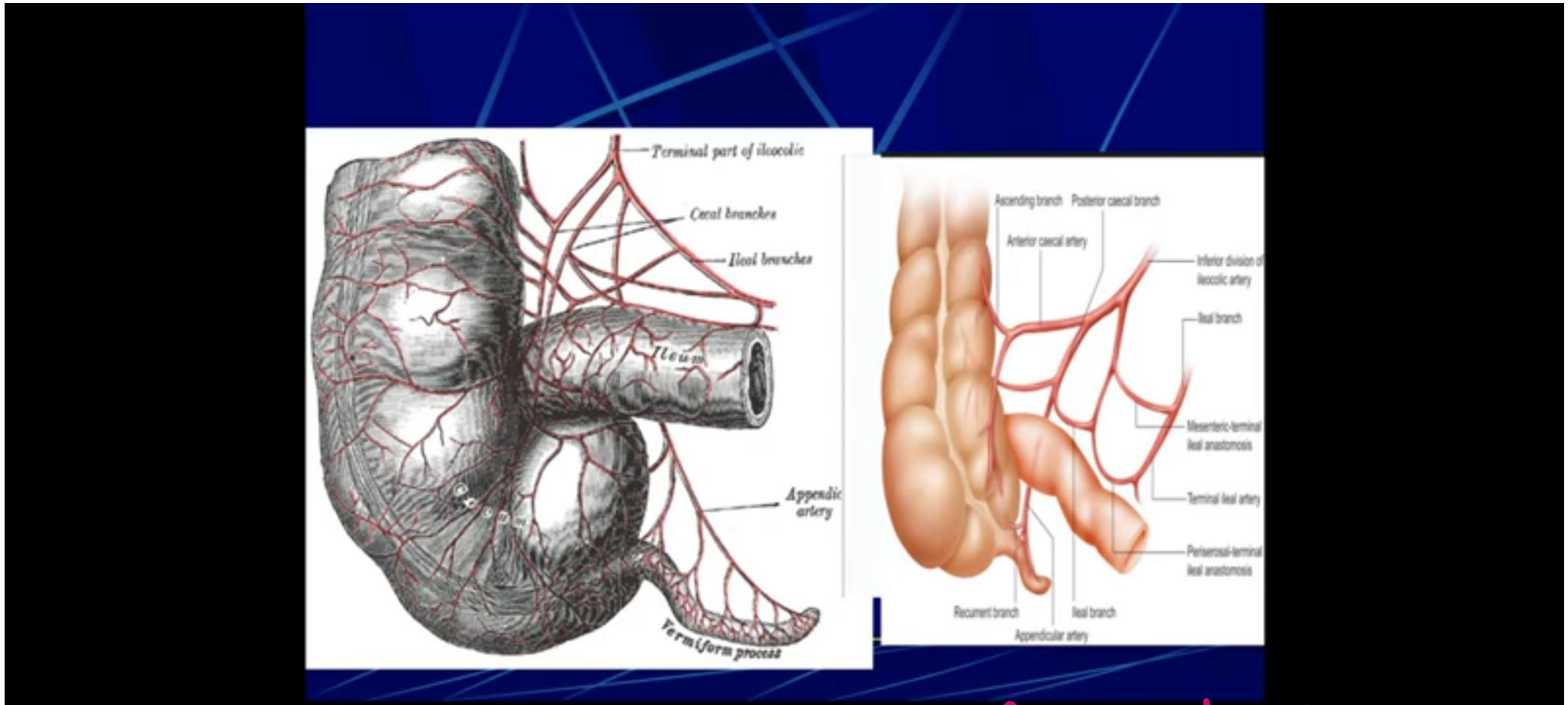


* The SMA → ileocolic A → appendicular A. OR IMA → post devision of caecal A. → appendicular A.

* The proximal 1/2 of appendicular A. far from appendix But the distal 1/2 on the surface of the appendix

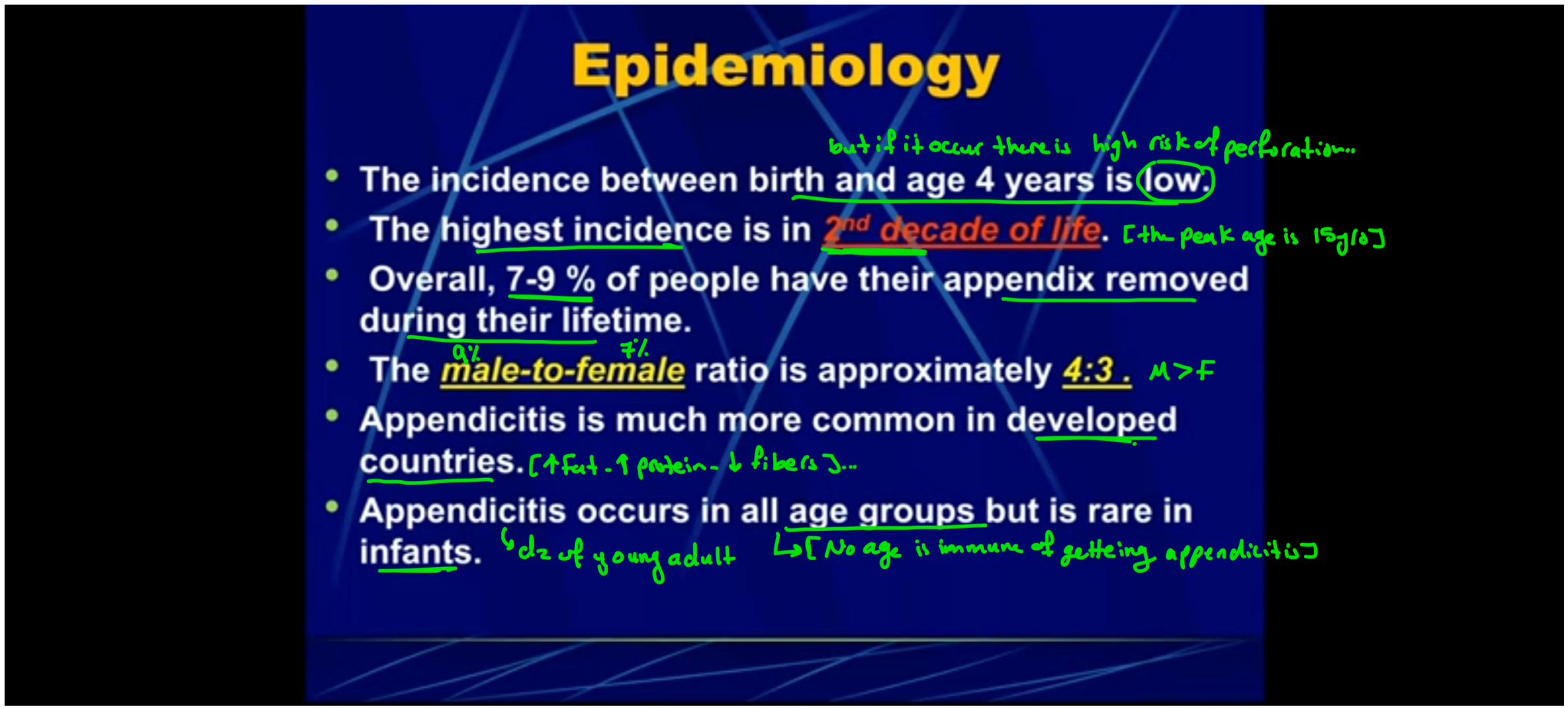
↳ patent جيد

↓ may be obstruct if there is swollen...

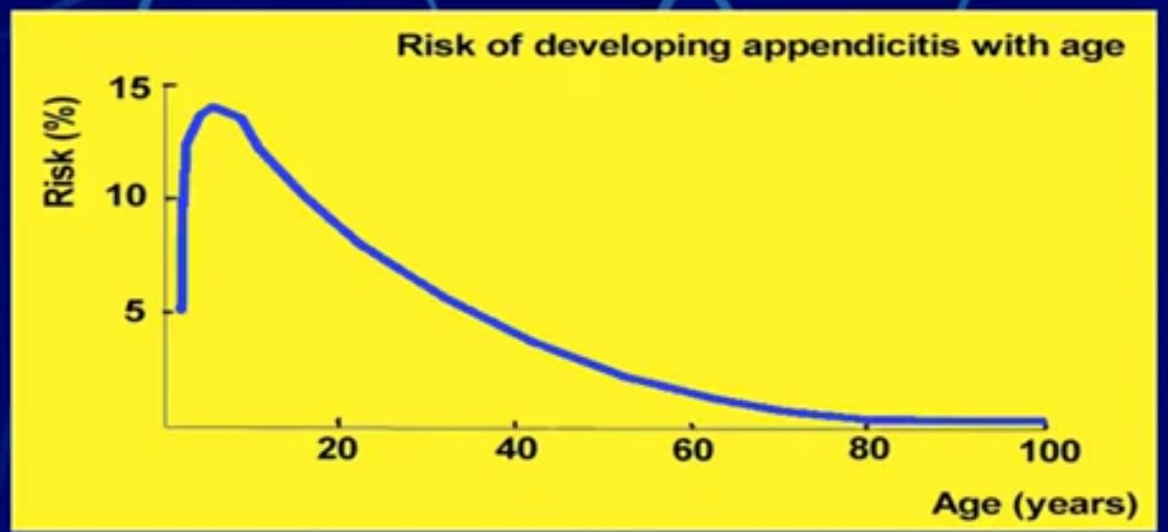


* The perforation of the appendix occur usually at the middle of the appendix [where the appendicular A become at the surface of the appendix...

* The perforation rarely occur in the Base of the appendix...
Usually Clear...



RISK OF DEVELOPING APPENDICITIS WITH AGE



* At birth there is ↓ lymphatic follicle in the submucosa of the appendix + with aging it will increase and may reach 200 at age 10-20 y/o then decreased [at age 30 y/o will decreased 50%]...

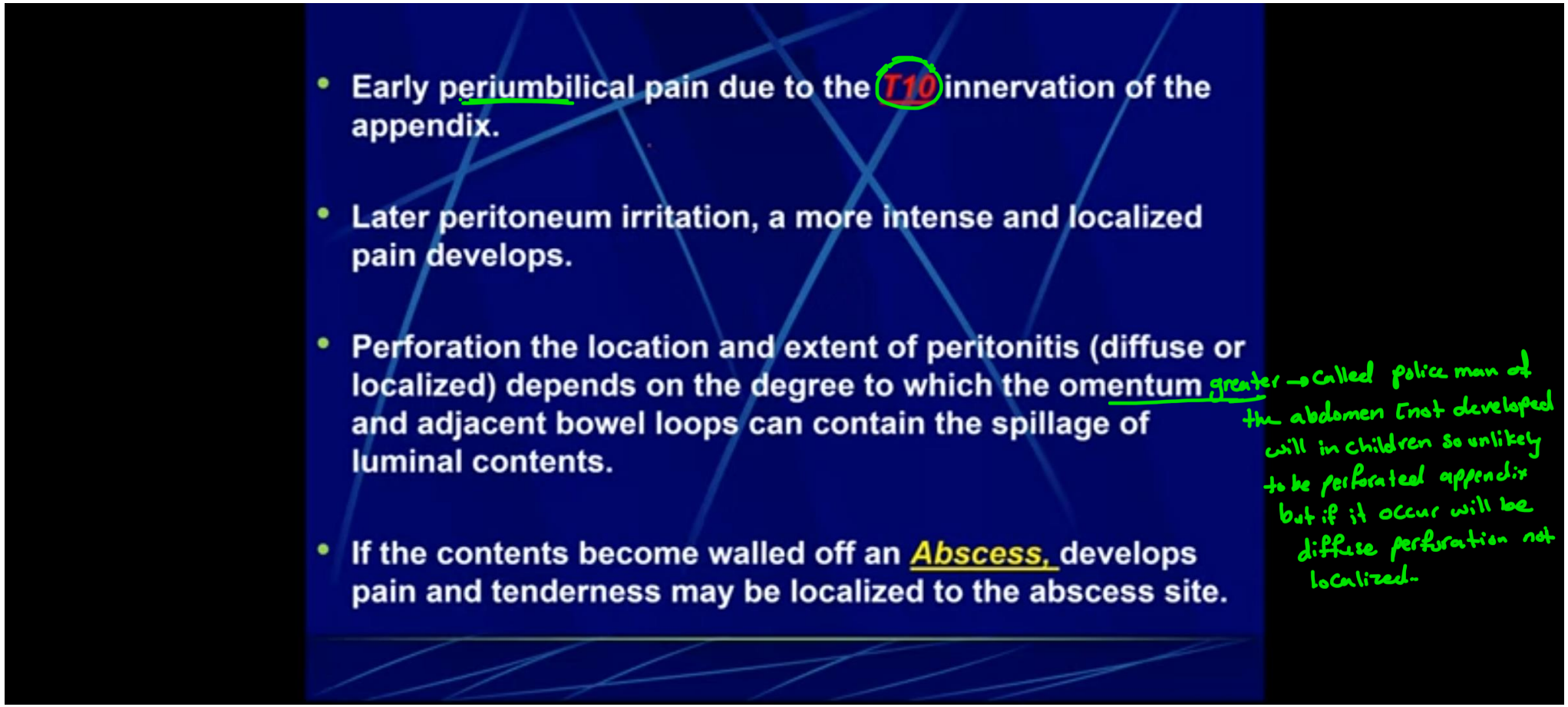
* The obstructive appendicitis occur in 1/3 cases in children + the perforation happen faster...

* Non obstructive appendicitis due to inflammation [Ecoli - nonerobic Bacteria]..
↳ so give them antibiotic cover the gram -ve Bacili: and Bacteroid
ex: metronidazole - flagyl...

Pathophysiology

- Obstruction of lumen, Bacteria Multiply, and the appendix becomes distended distal to obstruction.
- The increased intraluminal pressure obstructs venous drainage, and lead to arterial insufficiency the appendix becomes congested and ischemic.
- The combination of bacterial infection and ischemia produce inflammation, which progresses to necrosis and gangrene.
- The progression from obstruction to perforation usually takes place over 48- 72 hours.
- While perforation was directly related to the duration of symptoms before surgery, the risk was associated more with pre-hospital delay than within-hospital delay.

① due to hard feces or hyperplasia of the lymphoid follicle in the submucosa..
② venous congestion..
③ then necrosis then gangrene..
④
unlikely occur in hospital


Early periumbilical pain due to the T10 innervation of the appendix.
Later peritoneum irritation, a more intense and localized pain develops.
Perforation the location and extent of peritonitis (diffuse or localized) depends on the degree to which the omentum and adjacent bowel loops can contain the spillage of luminal contents.
If the contents become walled off an Abscess, develops pain and tenderness may be localized to the abscess site.
greater → called police man of the abdomen (not developed will in children so unlikely to be perforated appendix but if it occur will be diffuse perforation not localized..

Prognosis

- Generally, the prognosis is excellent. At the time of diagnosis, the rate of appendicular perforation is 20-35%. overall
- The rate of perforation is 80-100% for children younger than 3 years, compared with 10-20% in children 10-17 years old.
- Children with ruptured appendicitis are at risk for intra-abdominal abscess formation and small bowel obstruction.
- The mortality rate for children with appendicitis is 0.1-1%. and less

in children

due to delayed dx: البيبي ما بعرف يشرح التكرب

كل ما كان عمر الطفل أقل راح يزيد perforation الاحتمالية الـ

١ ٢

History

* good apetite → good health [not appendicitis]

The classic history

- Anorexia and Malaise.
- Vague periumbilical pain, followed by Migration of pain to the right lower quadrant (RLQ).
- Fever and Vomiting, is observed in about 60% of patients.
- *Retrocecal appendix:*, signs and symptoms may not localize to the RLQ but instead to the psoas muscle, the flank or right upper quadrant.
- *Pelvic appendicitis :*, and the signs and symptoms localize to the rectum or bladder resulting in pain with defecation or voiding. [UTI symptoms]

high grade fever ← low grade
think about appendicular complication or other diagnosis

Symptoms

- Pain. [flex the knee + drawn الاجنب + على البطن + صادي]
- Nausea and vomiting.
- Diarrhea and loose stool.
- Low grade fever .
- Flushing of cheeks



Physical examination

- The physical examination findings in children may vary depending on age. [↓age → ↑risk of perforation]
- *Irritability is the only sign of appendicitis in a neonate.*
- Older children often seem uncomfortable or Withdrawn. They lie still due to peritoneal irritation. [كل ما يتحرك بيزيد الوجع]
- Teenaged patients often present in a classic or near-classic fashion.
- Examination of the child requires skill, patience, and warm hands.
- The examination should be thorough and start with areas other than the abdomen. [start away of tender area]
- It is also important to exclude Urinary Tract Infection (UTI) as a cause of abdominal pain.

Abdominal examination

- Full exposure of the abdomen is key.
- Ask child to point with *One Finger* to the site of maximal pain.
- Begin palpation of the abdomen at a *Site Distant* to this, with the most tender area examined last..
- *Distracting Questions* maybe helpful to relieve anxiety during the examination.
- Observing the child's *Facial Expressions* during exam is critical.
- Palpation of the abdomen should be performed with a *Gentle and Light Touch*, searching for involuntary guarding

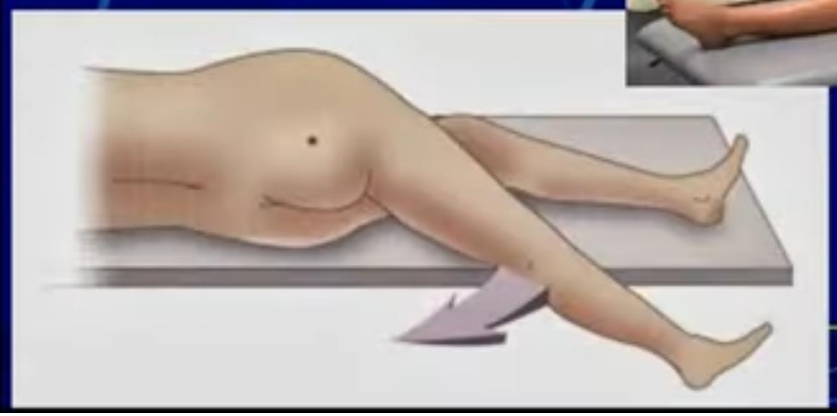
continue

- *Avoid eliciting Rebound Tenderness.*
- Peritonitis can be confirmed with gentle percussion over the right lower quadrant.
- Involuntary guarding and tenderness can be elicited with minimal stress or discomfort to the child.
- Asking the patient to sit up in bed, cough, jump up and down.

Specific signs

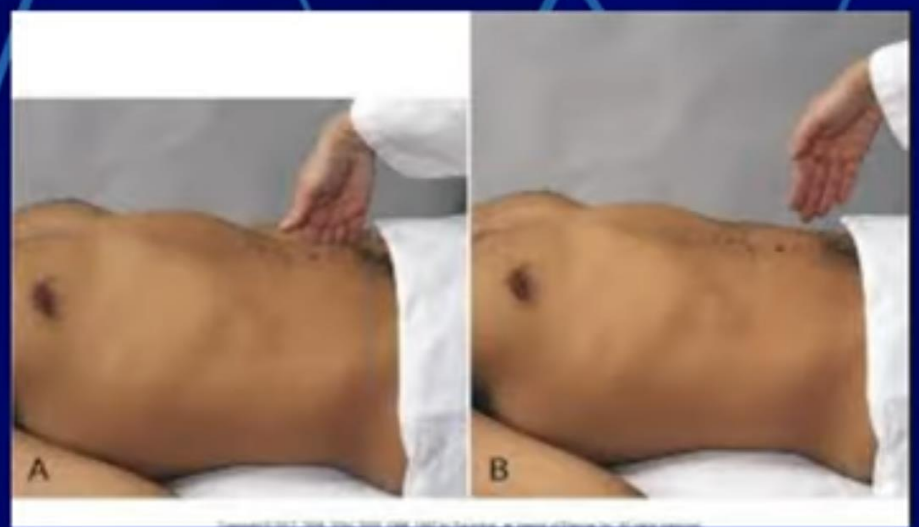
- PR exam. (not advisable in children but do it in adult)
- Blumberg sign. (to rebound tenderness)
- Rovsing's sign.
- ***Psoas sign.***
- Obturator sign.





Blumberg sign

if the pain increase ايبنا تشيل ايدك ← +ve sign



① supine Position
خليه يرفع الـ hip لفوق واطول
اضغط انا و اشوف لو كمان تلاقي
+ve sign. ← pain

② lateral position.
extention of hip ممكن
lead to pain indicate
+ve sign.

Psoas sign. done in

supine position

lateral position.

Iliopsoas muscle test. The patient raises the leg from the hip while the examiner pushes downward against it.



CLINICAL FEATURES

PSOA'S SIGN

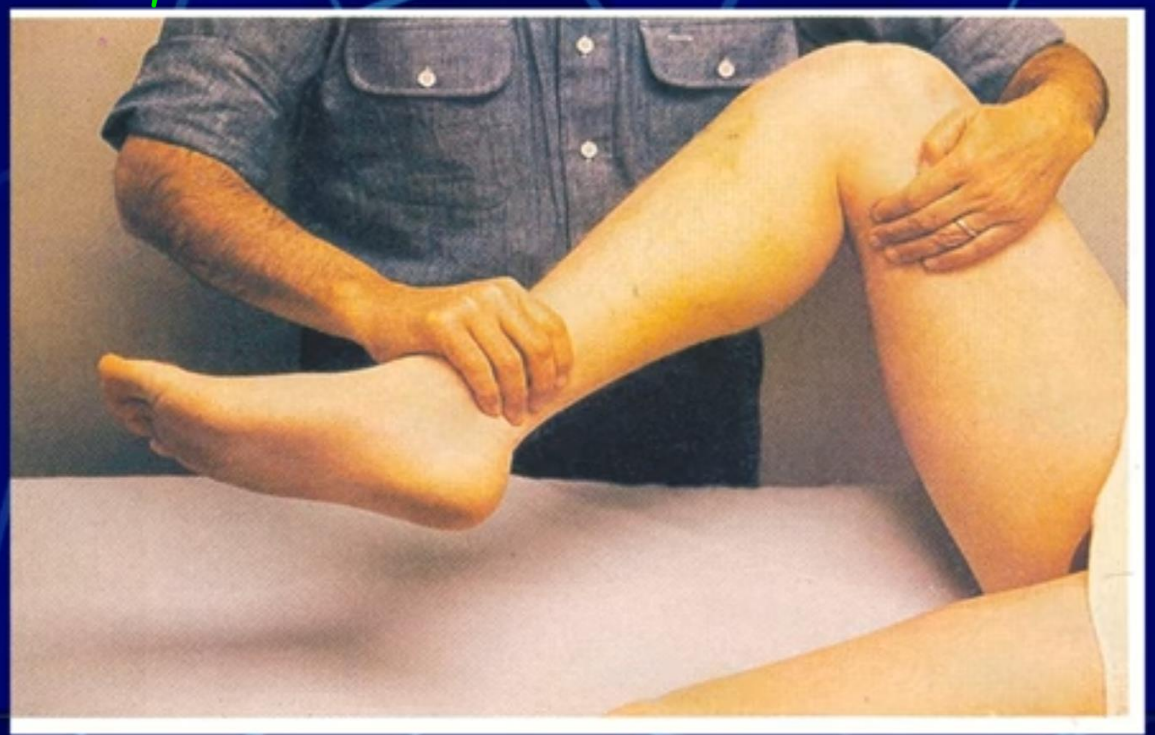




Psoas sign is right lower-quadrant pain that is produced with the patient extending the hip due to inflammation of the peritoneum overlying the psoas muscles and inflammation of the psoas muscles themselves. Straightening out the leg causes the pain because it stretches the muscles, and flexing the hip into the "fetal position" relieves the pain.

Obturator Sign

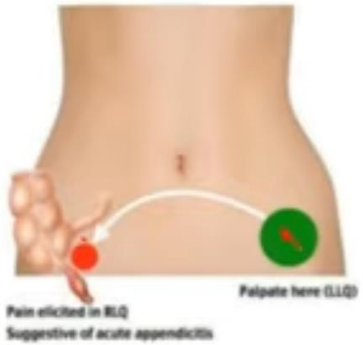
irritation of internal O. m. ← Obturator Sign → if we do external rotation of foot → produce pain +ve sign...



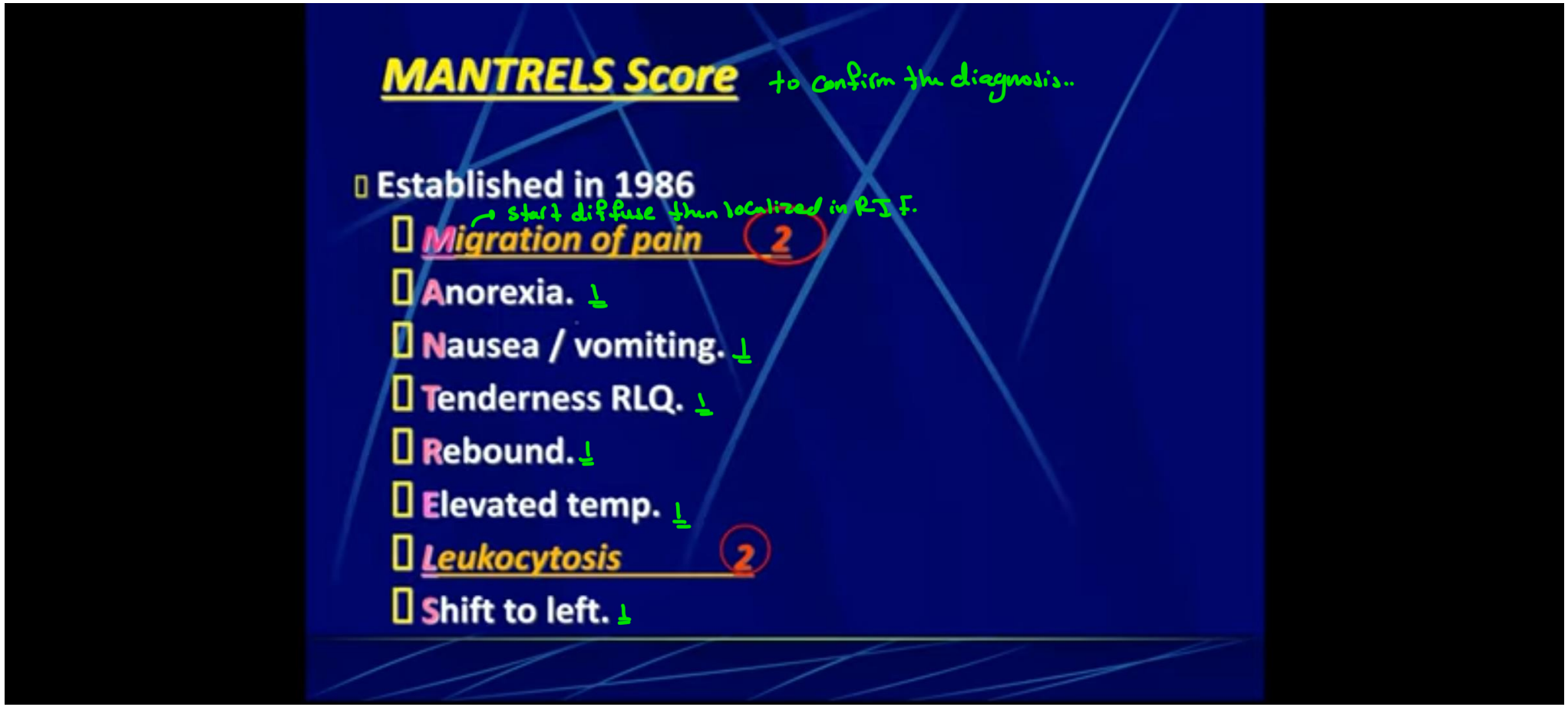
Rovsing's sign. pressure on LIF lead to RIF tenderness [true sign]

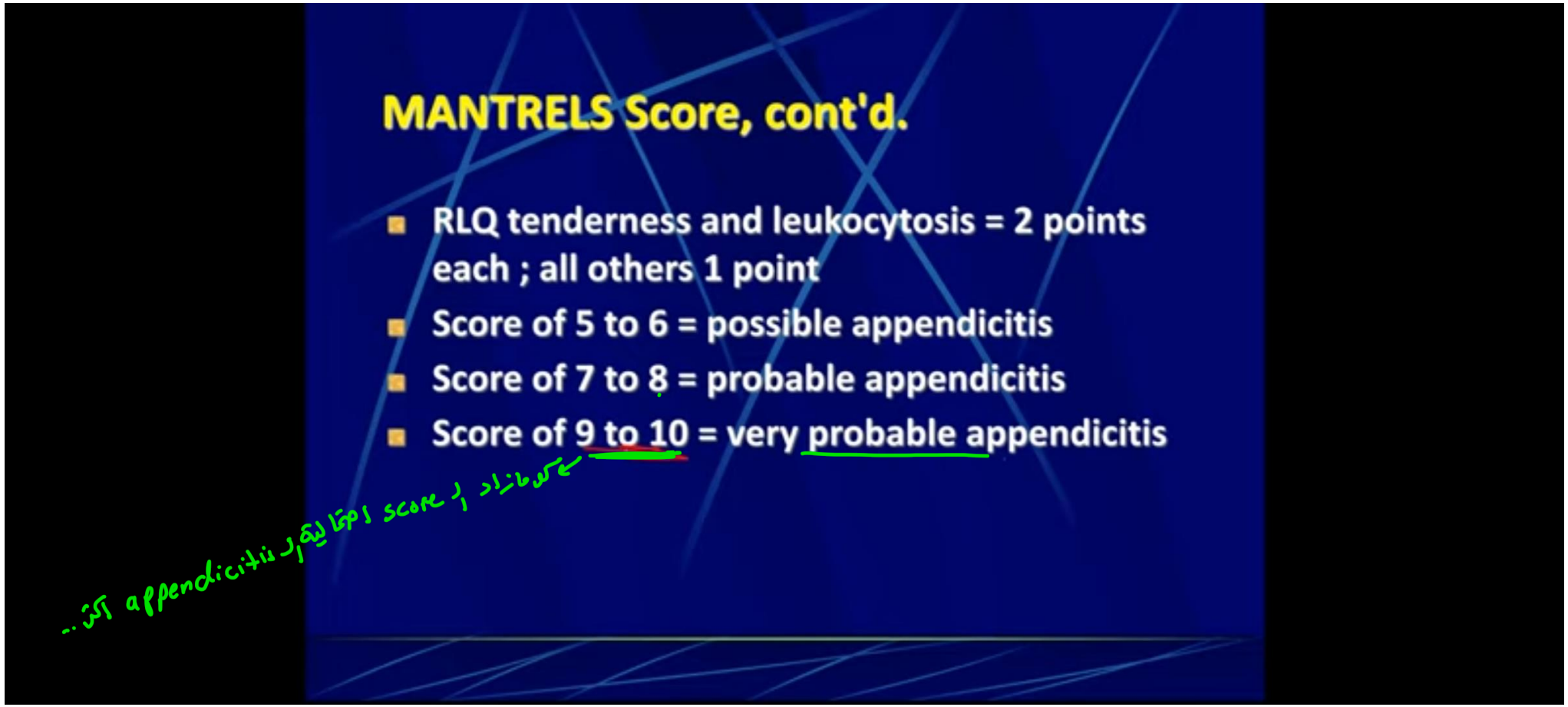
ROVSING'S SIGN

- Palpating in the left lower quadrant causes pain in the right lower quadrant



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MANTRELS Score
to confirm the diagnosis..
Established in 1986
start diffuse then localized in RIF.
Migration of pain 2
Anorexia. 1
Nausea / vomiting. 1
Tenderness RLQ. 1
Rebound. 1
Elevated temp. 1
Leukocytosis 2
Shift to left. 1


MANTRELS Score, cont'd.
RLQ tenderness and leukocytosis = 2 points each ; all others 1 point
Score of 5 to 6 = possible appendicitis
Score of 7 to 8 = probable appendicitis
Score of 9 to 10 = very probable appendicitis

Alvarado Score



The Alvarado Score

Signs	
Right lower quadrant tenderness	2
Elevated temperature (>99.1 F)	1
Rebound tenderness	1
Symptoms	
Anorexia	1
Nausea or vomiting	1
Migration of pain to right lower quadrant	1
Laboratory Values	
Leukocytosis (>10,000 WBC)	2
Left shift (>75% neutrophils)	1

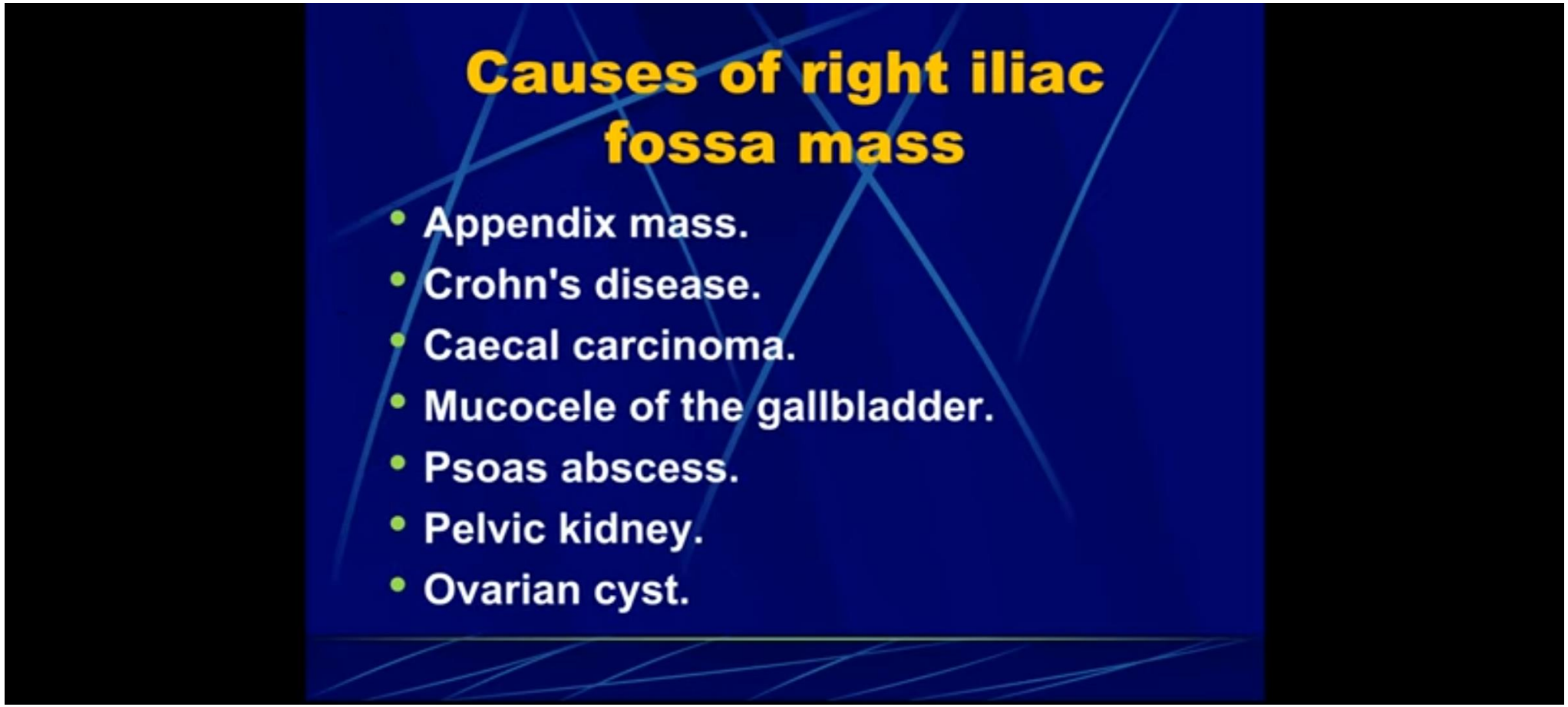
↳ occurs in 1st day of appendicitis

Diagnosis

- ***Classic Triad***
- WBC 11-16000/mm³ significantly higher in cases of perforation.
- RBC's, WBC's and protein common in urine.
- CRP
- ***N.B*** Normal WBC and CRP doesn't exclude Diagnosis
- ***BHCG.***
  - for female to exclude the gynecological cases.. [as ectopic pregnancy]
    - married

Causes of right iliac fossa pain

- Non-specific abdominal pain . 50%
- Appendicitis. 30%
- Urinary tract infection.
- Pelvic inflammatory disease .
- Renal colic .
- Ectopic pregnancy .
- Constipation.


Causes of right iliac fossa mass
Appendix mass.
Crohn's disease.
Caecal carcinoma.
Mucocele of the gallbladder.
Psoas abscess.
Pelvic kidney.
Ovarian cyst.

Abdominal radiology

* we do plain film abdomen.

- Low sensitivity and specificity.
- Appendicolith (crucial) → indicate obstruction specific, appendicitis

but seen in only 10 %

- May see local air-fluid levels, psoas obliteration, soft tissue mass, gas in appendix : all nonspecific.

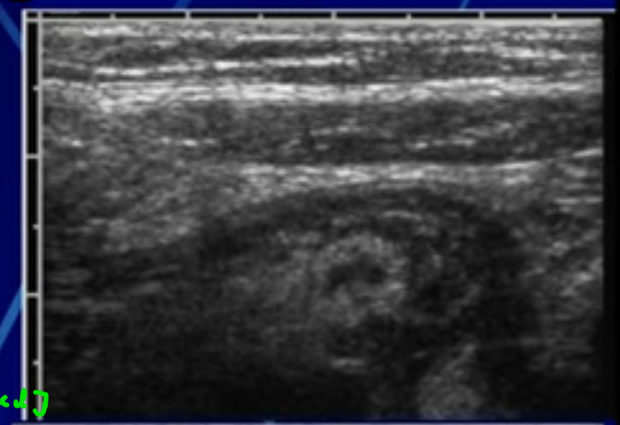
or sentinal gas on Rt I.F...

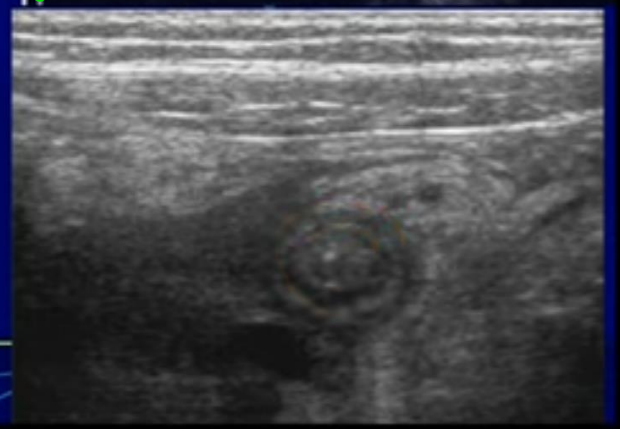


US

Appendicitis features

- Appendicular diameter > 6-7 mm (sensitivity 100%, specificity 64%)
- Target sign.
- Non- comprisable.
- Loculated peri-caecal fluid (rupture).
- Appendicolith.
- Absence of gas in appendix lumen.



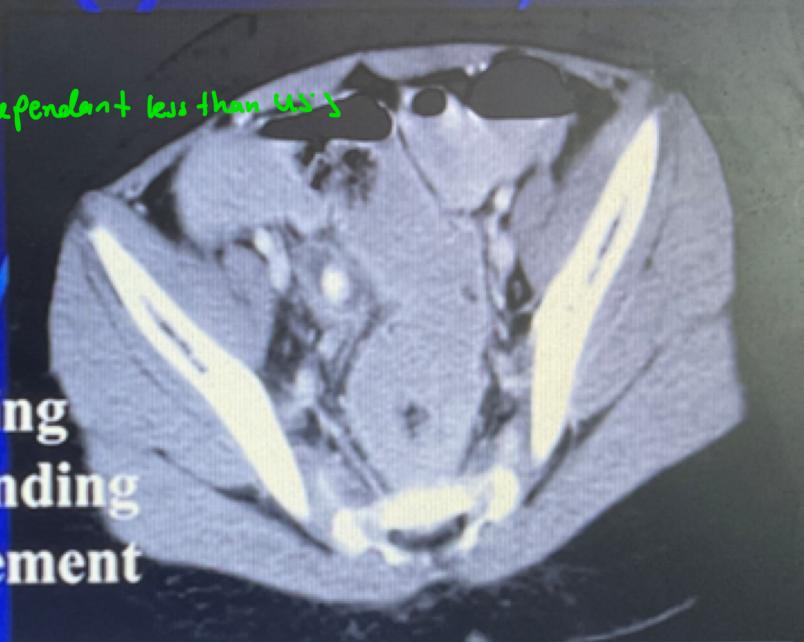


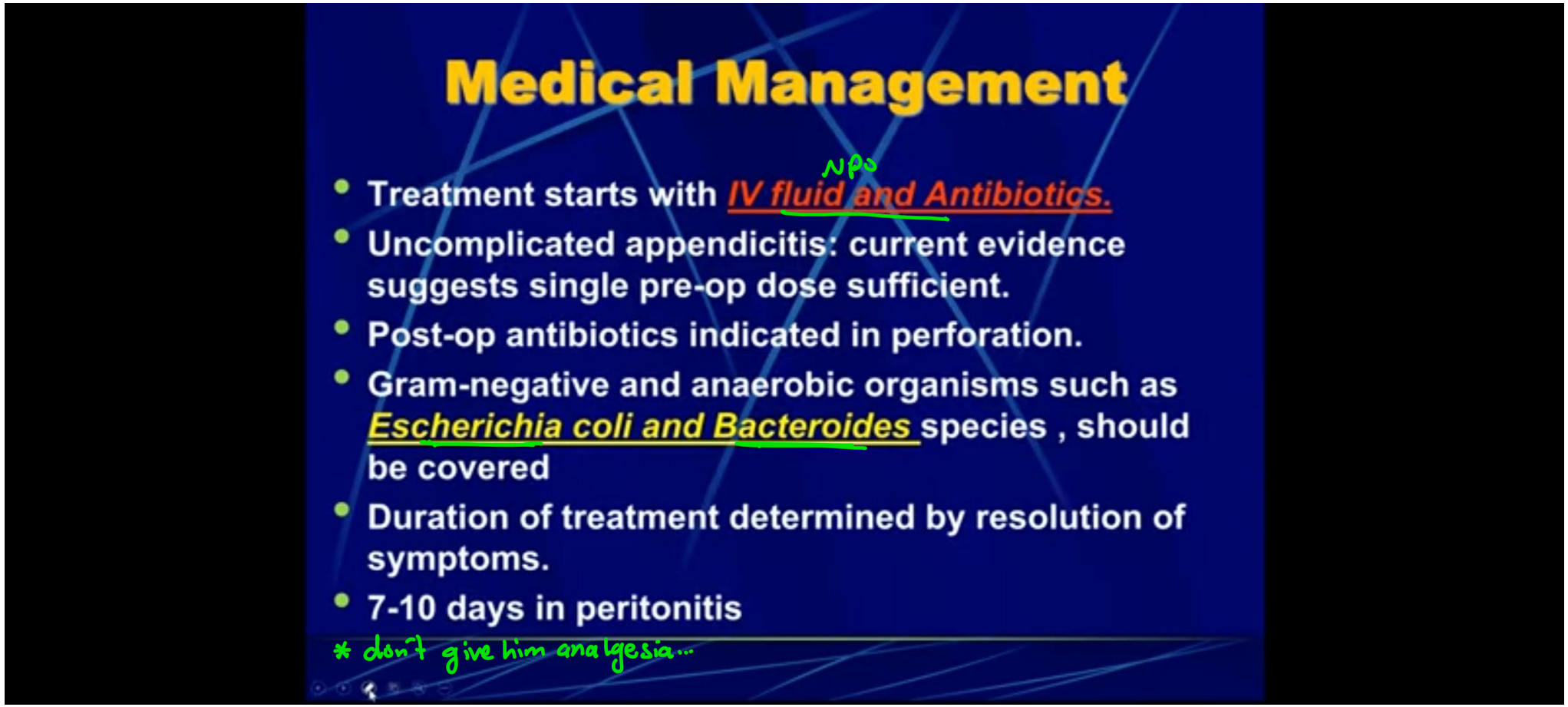


Longitudinal view by ultrasound of enlarged appendix with diameter equal to 13 mm (normal is less than 6 mm).

CT scan

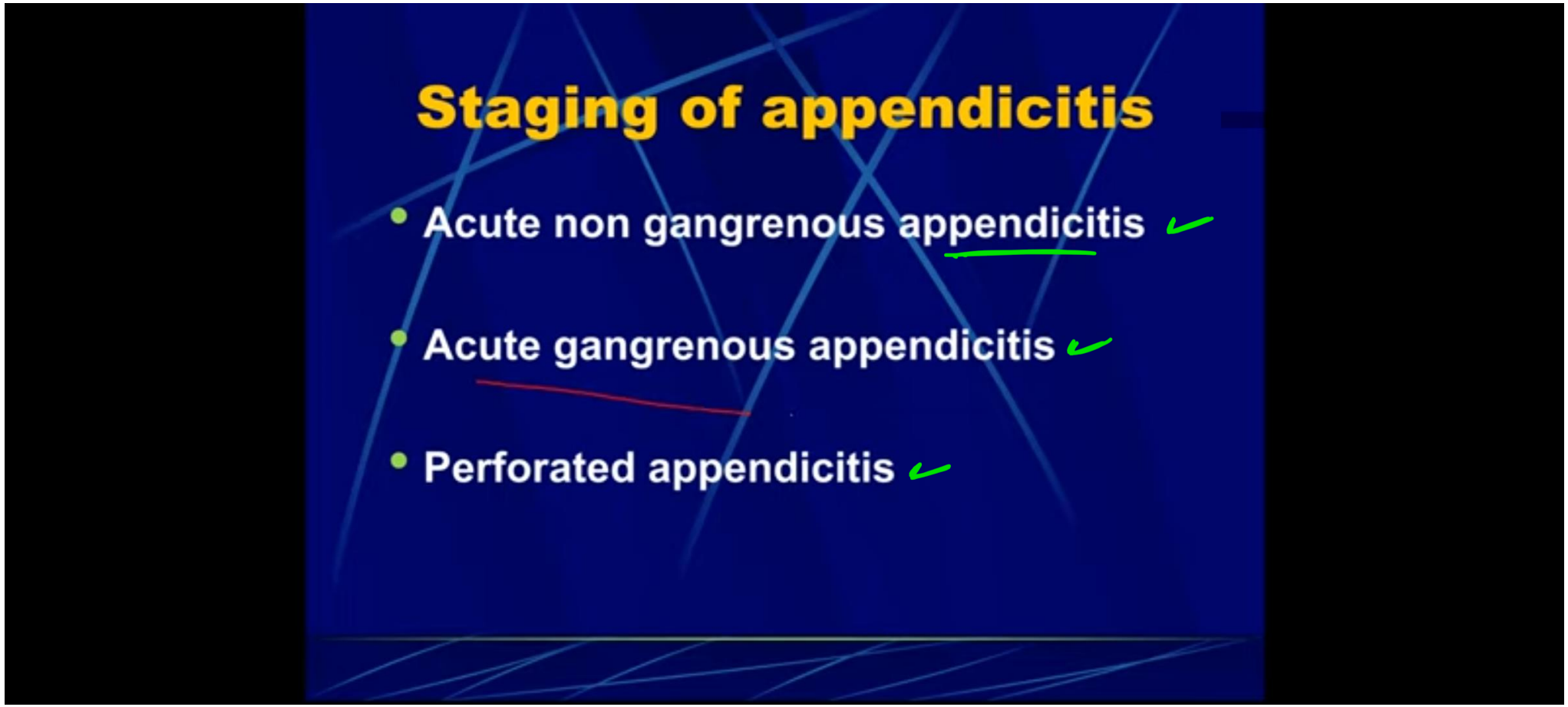
- Accuracy of 93-98%
- Sensitivity 87-100%
- Specificity 95 -99%
- Enlarged appendix.
- Appendicular wall thickening
- Peri- appendicular fat stranding
- Appendicular wall enhancement

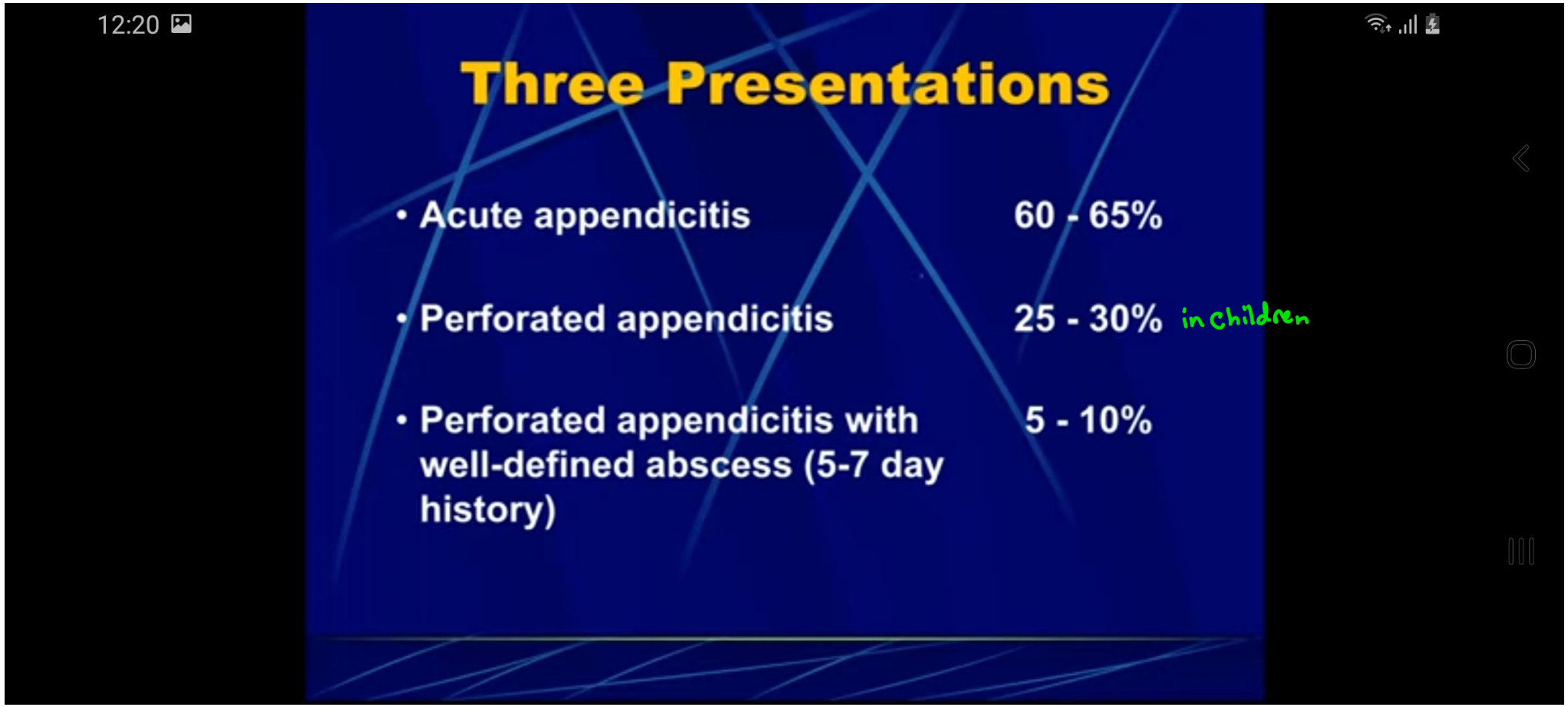


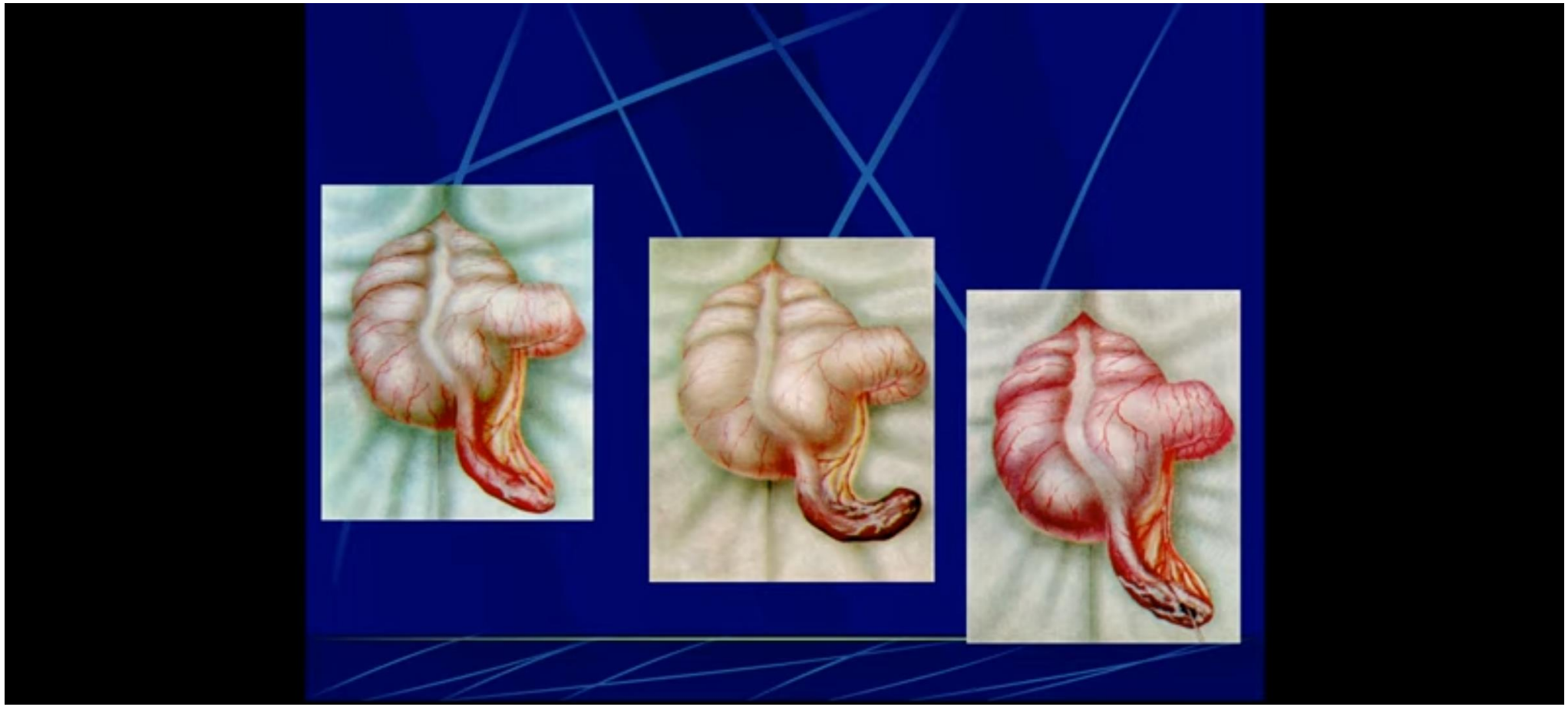

Medical Management
Treatment starts with IV fluid and Antibiotics.
Uncomplicated appendicitis: current evidence suggests single pre-op dose sufficient.
Post-op antibiotics indicated in perforation.
Gram-negative and anaerobic organisms such as Escherichia coli and Bacteroides species , should be covered
Duration of treatment determined by resolution of symptoms.
7-10 days in peritonitis
* don't give him analgesia...

Antibiotic regimens

- Triple therapy(Ampicillin ,Gentamycin Metronidazole)
- Third generation cephalosporin, and metronidazole
- Early transition to Oral Antibiotics as effective as prolonged IV's .


Staging of appendicitis
Acute non gangrenous appendicitis
Acute gangrenous appendicitis
Perforated appendicitis


12:20
Three Presentations
• Acute appendicitis 60 - 65%
• Perforated appendicitis 25 - 30%
in children
• Perforated appendicitis with well-defined abscess (5-7 day history) 5 - 10%



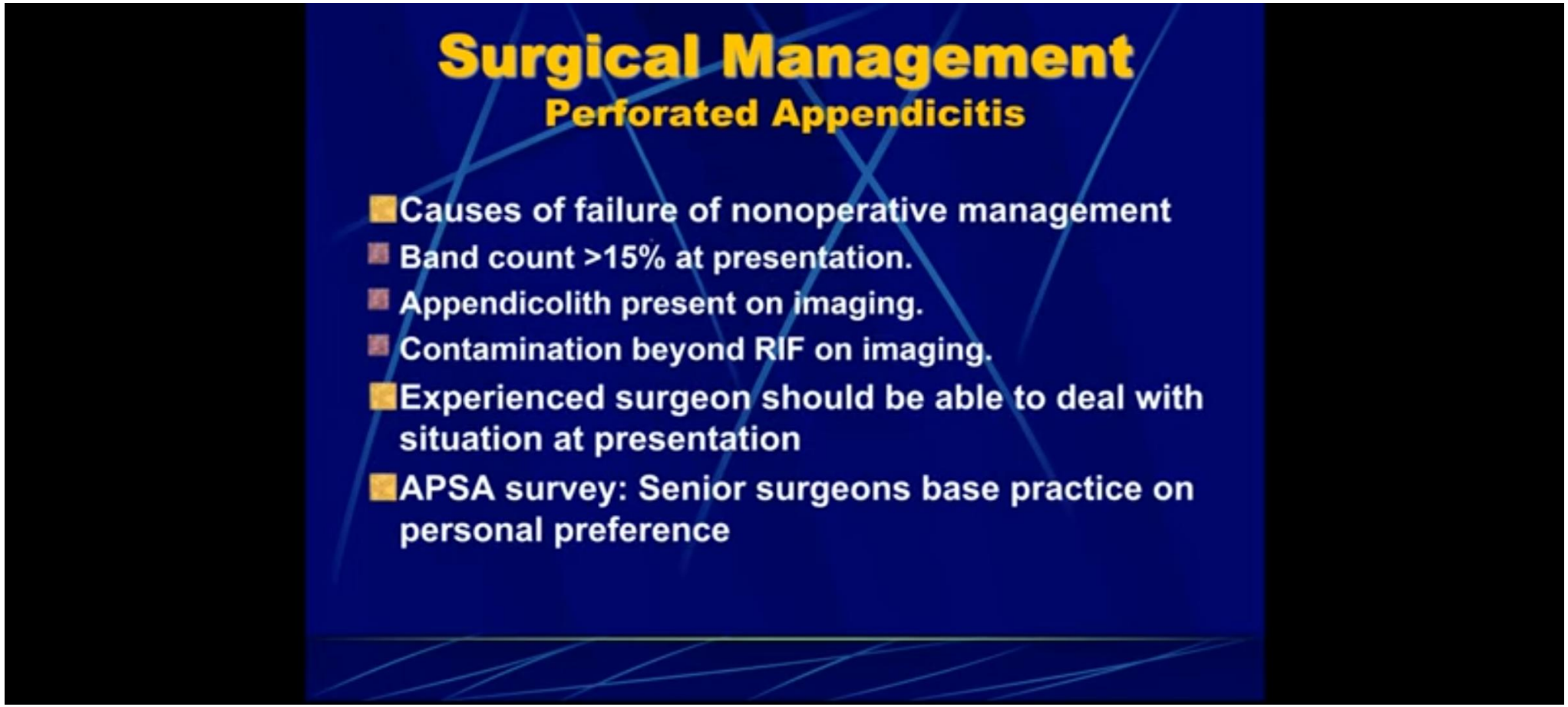
Surgical Management

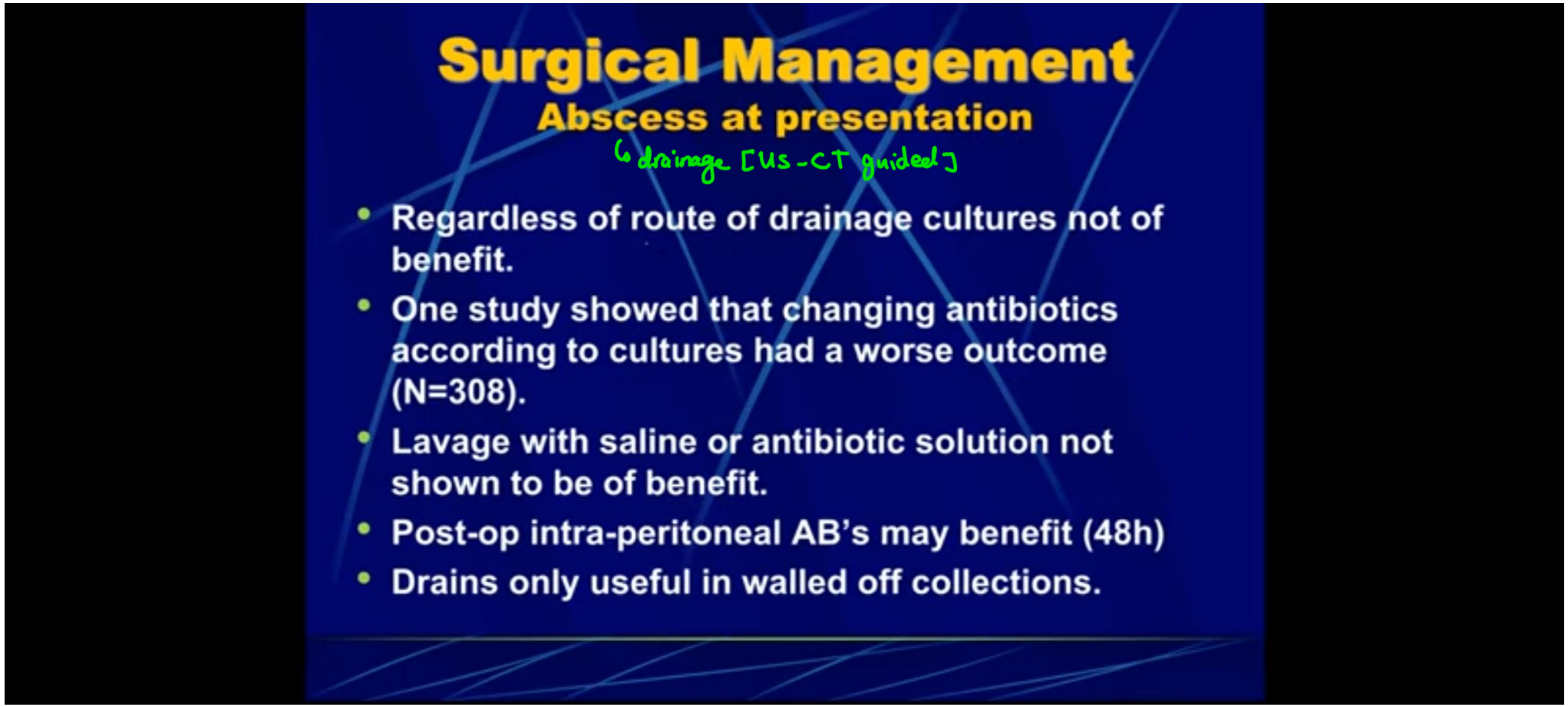
Acute Appendicitis

- Acute appendicitis cured with surgery.
- *Prompt appendectomy is treatment of choice.*
- Appendicitis can be treated with Antibiotics alone.
- Antibiotics change from Emergency to Elective.
- Appendectomy in the middle of the night is not justified.

Surgical Management
Perforated Appendicitis

- *Appendectomy in the presence of known perforation is Controversial.*
- Antibiotics alone : Antibiotics and interval appendectomy; Appendectomy at presentation
- Recurrent appendicitis(8-14%) short term .
- APSA 86% responders perform interval appendectomy.


Surgical Management
Perforated Appendicitis
Causes of failure of nonoperative management
Band count >15% at presentation.
Appendicolith present on imaging.
Contamination beyond RIF on imaging.
Experienced surgeon should be able to deal with situation at presentation
APSA survey: Senior surgeons base practice on personal preference


Surgical Management
Abscess at presentation
drainage [US-CT guided]
Regardless of route of drainage cultures not of benefit.
One study showed that changing antibiotics according to cultures had a worse outcome (N=308).
Lavage with saline or antibiotic solution not shown to be of benefit.
Post-op intra-peritoneal AB's may benefit (48h)
Drains only useful in walled off collections.

Surgical Management

Abscess at presentation

- Open surgery high morbidity.
- Percutaneous drainage and interval appendectomy.
- Long course of treatment, cost burden.
- Prospective trial currently in progress comparing early laparoscopic surgery with percutaneous drain and delayed surgery.

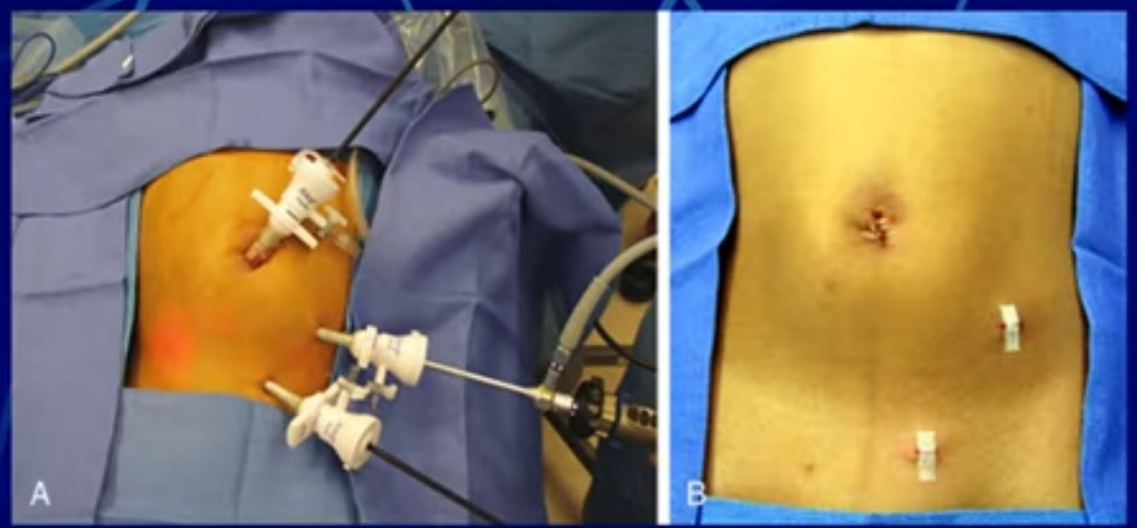
Laparoscopic Appendectomy

↳ ↑ risk of abcesses

- Umbilical port and two working ports (open)
- Initial data, longer operative time and more intra-abdominal complications .
- Newer evidence suggests no difference in operative time and IAC in the 2 groups.
- *Risk of abscess formation justification for continued use of open surgery.*
- *Substantially lower risk of wound infection.*

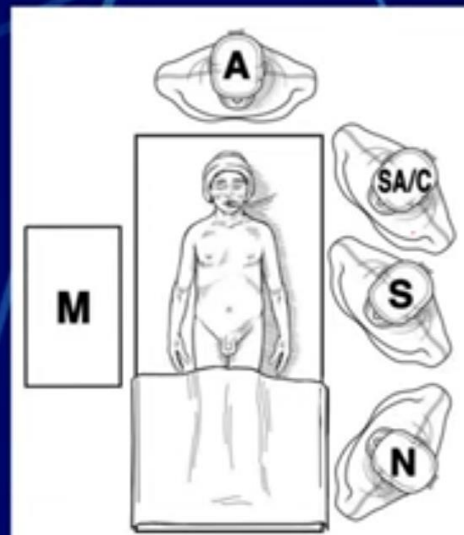
↳ ↑ risk of wound infection.

Laparoscopic Appendectomy



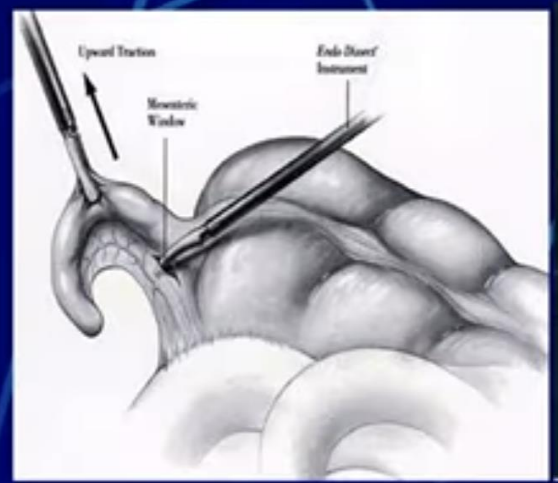
Laparoscopic Appendectomy

Personnel/Port Positions



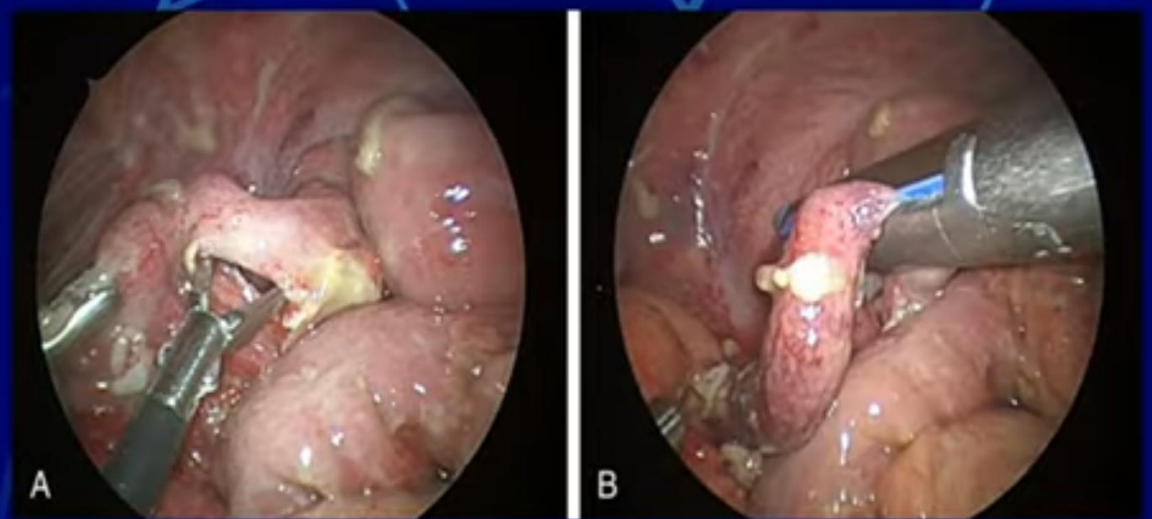


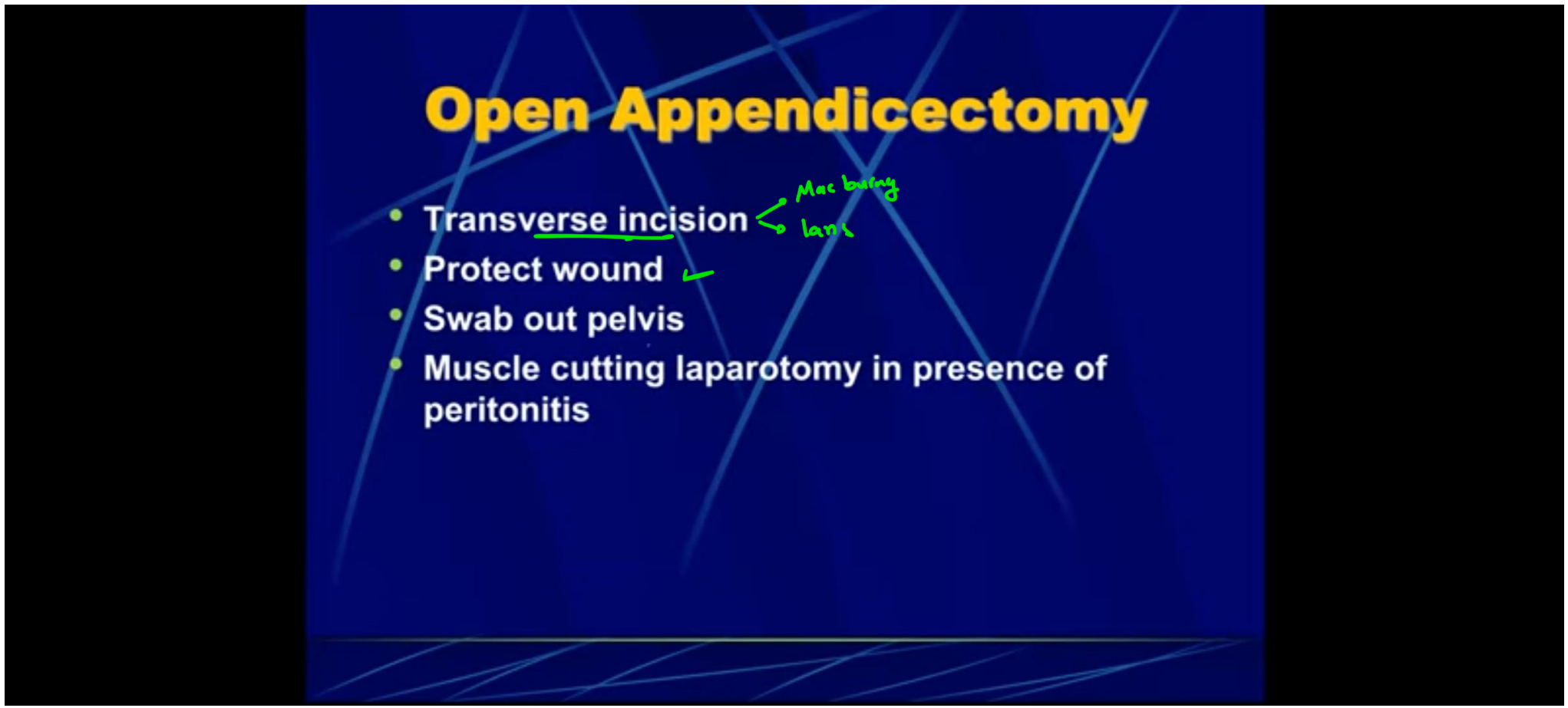
Laparoscopic Appendectomy





Laparoscopic Appendectomy




Open Appendicectomy
Transverse incision
Mac burney
lanz
Protect wound
Swab out pelvis
Muscle cutting laparotomy in presence of peritonitis

Medical Pitfalls:

- Performing a complete examination including the genitals is important.
- Symptoms and signs of *Testicular Torsion* and *Ectopic pregnancy* overlap with appendicitis. so we should exclude them
- Patients with *NSAP* (non specific abdominal pain) should be diagnosed with abdominal pain of unknown etiology. Patients should be instructed to be reevaluated in 8-12 hours.
- Patients should not be diagnosed with the *Gastroenteritis* unless they have nausea, vomiting, and diarrhea. مش موجود فيه
- Patients with an equivocal examination should be kept for observation and followed-up by *Serial Abdominal Examinations.*
  Avoid treating patients with vague abdominal pain with *Parenteral Opiates* and then discharging them. so not give the pt analgesia...
- Misdiagnosed patients were younger and more likely to have vomiting before pain onset, constipation, diarrhea, dysuria, and signs and symptoms of upper respiratory infections.


Thank You