

Abdominal Ultrasound.
Gallbladder pathology: Gallstones and Polyps

Doctor of Medical Sciences
Peresypkina T.V.

Plan of seminar

- Actuality
- History of ultrasound method
- how it works?
- epidemiology features of digestive pathology
- Modern guidelines
- gallbladder stones and polyps (anatomy of GB, reasons for the appearance, US features)
- Gallbladder stones vs polyps

actuality

- Imaging methods in the diagnosis of diseases are widely used in various fields of medicine: therapy, surgery, cardiology, nephrology, endocrinology and gastroenterology.
- A sufficiently wide range of instrumental imaging methods and their rational use in various clinical situations can provide rapid and accurate recognition of the disease.

actuality

- In modern clinical practice, regardless of the doctor's specialization, radiation diagnostic methods have become leading in the recognition of diseases.
- About 70.0% of cases when establishing a diagnosis take into account the results of radiation imaging methods

actuality

- Modern imaging methods provide significant opportunities for their use not only for diagnostic purposes, but also for therapeutic purposes - interventional procedures or surgical interventions under X-ray, ultrasound or MR control.
- The use of various imaging methods is enshrined in numerous clinical recommendations, protocols, algorithms and guidelines used in practical medicine.

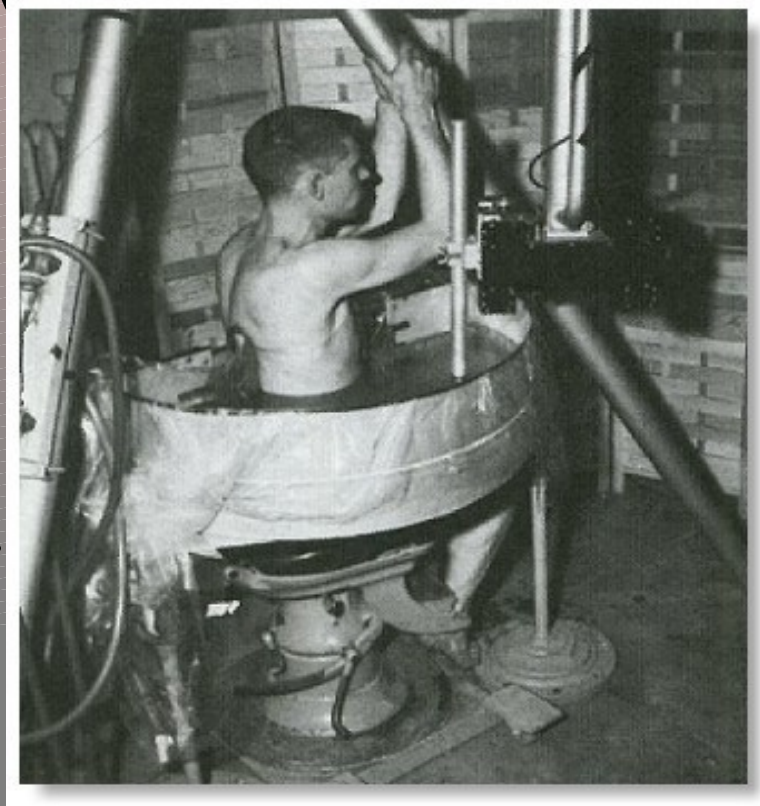
- The main imaging methods most commonly used in the practice of a doctor, which are used to diagnose or treat diseases of internal organs, include: diagnostic ultrasound, Doppler echocardiography; radiation diagnostic methods (X-ray, radioscopy, scintigraphy); high-precision methods of visualization of diseases of internal organs (nuclear magnetic resonance and computed tomography).

- Thus, the most commonly used imaging method, the most accessible, inexpensive and highly informative, is the ultrasound method.



History of Ultrasound

- The founder of this method is the botanist Lazzarro Spallanzani, who drew attention to the use of ultrasound by bats. The first ultrasound machines were very large and inconvenient to use.
- It was a reservoir of fluid, where the patient sat for a long time and motionless while the abdominal scanner moved around him.



- Modern devices have changed their appearance, become more mobile, have a simple and ergonomic design, and modern developments take the form of a scanner-tablet or have the ability to interpret the image on the phone screen



Modern ultrasound device



how it works

- Ultrasound is mechanical waves propagating in an elastic medium with a frequency of more than 2×10^4 Hz.
- The sensor generates an impulse that is reflected from the biological structure, and the reflected signal is then received by the sensor and further converted and reproduced on the screen of the device in the form of echograms.
- This process is repeated in many directions, making it possible to form an image of the object on the screen in real time.

epidemiology features of digestive pathology

- Diseases of the biliary system account for more than 25% (up to 50%) of patients with organ pathology digestion.
- According to surgeons, gallbladder stones were found in 60-80% of patients with cholecystitis.
- In Europe, the United States over the age of 50, about 1/3 of women and about 1/4 of men suffer from gallstone disease.

British society of gastroenterology

- This guideline covers diagnosing and managing gallstone disease in adults. It aims to reduce variation in care by promoting the most effective treatments, and to improve the advice given to people with gallstone disease before and after treatment

<https://www.bsg.org.uk/clinical-resource/gallstone-disease-diagnosis-and-management/>

The screenshot shows the BSG website interface. At the top, there is a navigation bar with links for 'Discover', 'Clinical Resources', 'Strategic Areas', 'BSG Sections', 'Web Education', and 'Events'. Below this, a breadcrumb trail reads 'Home > Clinical Resources > Liver > Liver Guidelines > Gallstone disease...'. The main heading is 'Gallstone disease: diagnosis and management'. Below the heading, a paragraph states: 'This guideline covers diagnosing and managing gallstone disease in adults. It aims to reduce variation in care by promoting the most effective treatments, and to improve the advice given to people with gallstone disease before and after treatment.' A section titled 'Recommendations' follows, with the text 'This guideline includes recommendations on:'.

EASL Clinical Practice Guidelines on the prevention, diagnosis and treatment of gallstones[☆]

European Association for the Study of the Liver (EASL)*

Introduction

Gallstones or cholelithiasis are a major public health problem in Europe and other developed countries and affect up to 20% of the population. Gallstone disease is the most common gastrointestinal disorder for which patients are admitted to hospitals in European countries [1]. The interdisciplinary care for patients with gallstone disease has advanced considerably during recent decades thanks to a growing insight into the pathophysiological mechanisms and remarkable technical developments in endoscopic and surgical procedures. In contrast, primary prevention for this common disease is still in its infancy.

The EASL Clinical Practice Guidelines (CPG) on the prevention, diagnosis and therapy of gallstones aim to provide current recommendations on the following issues:

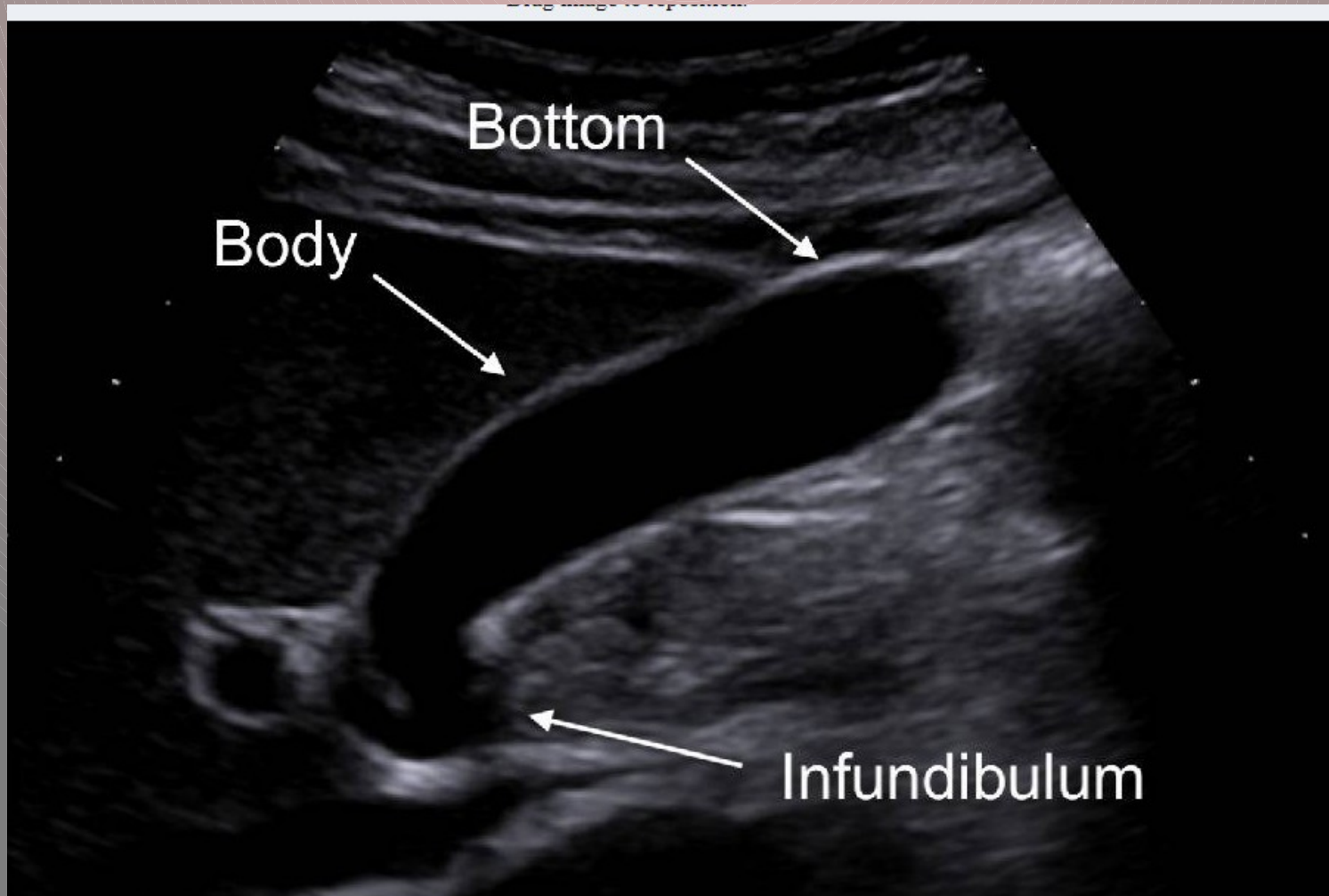
1. Prevention of gallstones
2. Diagnosis of gallbladder stones
3. Medical therapy of gallbladder stones
4. Surgical therapy of gallbladder stones
5. Diagnosis of bile duct stones

and Evaluation (GRADE) [2–5]. We considered within-study risk of bias (methodological quality), directness of evidence, heterogeneity, precision of effect estimates, and risk of publication bias. Each recommendation has been qualified by giving the grade of evidence underlying the recommendation. The evidence is graded as follows: (A) high quality evidence: further research is very unlikely to change our confidence in the estimate of effect (randomized trials or double-upgraded observational studies); (B) moderate quality evidence: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate (downgraded randomized trials or upgraded observational studies); (C) low quality evidence: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate (observational studies or double-downgraded randomized trials); and (D) very low quality evidence: we are very uncertain about the estimate (case series/case reports, downgraded observational studies, triple-downgraded randomized trials). The strength of the recommendations is based on both the aggregate evidence quality and an assessment of the anticipated benefits and harms. A strong recommendation has

Conclusion of guidelines is:

- «..... Abdominal ultrasonography is the imaging of choice in patients with upper abdominal quadrant pain. Its accuracy for detecting gallbladder stones is in excess of 95%.....»

Anatomy of GB



- Both cholesterol and pigment gallstone diseases originate from the complex interaction of genetic, environmental, local, systemic and metabolic abnormalities .
- In Western populations cholesterol gallstones account for 90–95% of all gallstones.

REASONS FOR THE APPEARANCE

- The following processes lead to the appearance of the first stones in the gallbladder: production and stagnation of lithogenic bile (unbalanced by components);
- loss of the ability of the bladder walls to normal contraction;
- inflammation in the bile ducts;
- metabolic disorders associated with diseases that are accompanied by high levels of cholesterol.

- In addition to malnutrition, predisposing factors are:
- heredity;
- abuse of protein and fatty foods;
- obesity; dyskinesia;
- hormonal contraceptives;
- Crohn's syndrome;
- diseases of the endocrine system (hypothyroidism and others);
- after removal of part of the intestine;
- chronic cholecystitis; chronic hemolysis - the destruction of red blood cells (erythrocytes);
- parasitic infestations;
- alcoholic liver disease (cirrhosis, hepatitis).

- Stones in the gallbladder are often formed during a long stay in a hypodynamic state. Additional risk factors for stone formation in humans are: age disorders; female.

STONE FORMATION PROCESS

- The formation of gallstones is preceded by the appearance of biliary sludge (putty bile).
- It consists of derivatives of bilirubin, cholesterol and mucin.
- Sludge tends to dissolve on its own or turn into gallstones that accumulate in the gallbladder or migrate into the ducts, blocking them and causing symptoms of an attack of hepatic colic.
- The formation of stones does not happen quickly, it takes long months or years.
- On average, gallstones increase by 1-2 mm per year. It takes more than 5-20 years for the stones to become large and manifest clinically.
- Most of them are mainly formed in the cavity of the bladder, but brown pigment-type formations can appear in the bile ducts.

Types of stones

There are 4 types of gallstones:

- Cholesterol - the most common education. They appear due to high levels of cholesterol in bile, when an excess amount settles in the form of solid microcrystals. They combine and form concretions.
- Lime - mainly from calcium salts.
- Pigmentary - are divided into black and brown. Black stones are hard formations of calcium salts and bilirubin derivatives. Browns have a soft and oily texture. Includes a mixture of fatty acids and other substances.
- Mixed - mostly stones have a combined chemical composition with a predominance of lipids.

Types of stones



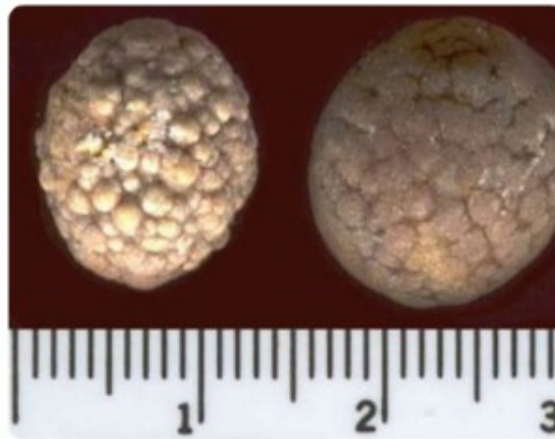
Mixed
Смешанные

Виды желчных
конкрементов

Пигментные
Pigmentary



Cholesterol
Холестериновые



- By type, stones are primary and secondary.
The formations that appeared in the unchanged bile ducts under the condition of an incipient pathological process are called primary.
- If cholesterol stones were the result of a delay in the outflow of bile in an already developed gallstone disease, these are secondary.

The shape of the stones is also different.

There are stones:

- spherical;
- with multiple edges;
- ovoid;
- subulate;
- barrel-shaped.
- By consistency - strong, brittle and soft stones.

CHARACTERISTIC SYMPTOMS

- Most patients with the appearance of the first stones in the gallbladder do not experience any discomfort.
- This continues until the stones become large, they manifest themselves with typical signs:
 - bitterness in the mouth;
 - the appearance of heaviness,
 - pain in the right hypochondrium and abdomen;
 - belching;
 - hepatic colic, which is accompanied by manifestations of dyspepsia (nausea, rarely vomiting).

- mechanical jaundice - the skin turns yellow;
- light stool and dark urine;
- disruption of the intestines - diarrhea, constipation, flatulence;
- poor appetite;
- intolerance to certain foods;
- the appearance of a white or brown coating on the tongue;
- the appearance of pain in the liver at the time of shaking;
- subfebrile fever - an increase in temperature to 37.1-37.3 degrees;
- weakness, chronic fatigue.



US diagnostic

- In abdominal ultrasound, gallstones appear as echogenic foci with a hypoechoic distal shadow.
- Mobility differentiates stones from polyps and should be proven by examining the patient in different positions such as supine, left lateral decubitus or upright.
- Biliary sludge is also detected by ultrasound as sand-like small echogenic foci

Ultrasound is considered the gold standard for detecting gallstones :

- greyscale ultrasound
 - highly reflective echogenic focus within gallbladder lumen, normally with prominent posterior acoustic shadowing regardless of pathological type (acoustic shadowing is independent of the composition and calcium content)
 - gravity-dependant movement is often seen with a change of patient position (the [rolling stone sign](#))
- color Doppler
 - may demonstrate a [twinkling artifact](#) and is particularly useful for identification of small stones

Differential diagnosis

- Possible imaging differential considerations in selected situations include
- ingested iron tablets (pseudogallstones) on plain radiograph
- gallbladder polyp
- echogenic bile (sludge) and tumefactive sludge
: non-shadowing
- gallbladder carcinoma
- pneumobilia on MRCP

Gallbladder stone. Obstruction of choledoch





MI 1.2 TIs 1.0 C1-5
Abdomen

FR 27
AO% 100
CHI
Frec. 4.0
0° Gn 63
S/A 3/2
Mapt F/0
D 15.0
DR 78

LOGIO
P3



5"

10"

15"





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Gallbladder polyps

- Gallbladder polyps are growths that protrude from the lining of the inside of the gallbladder.
- They typically cause no noticeable symptoms and are often detected on imaging studies done for other reasons.
- Polyps can be cancerous, but they rarely are.
- About 95% of gallbladder polyps are benign.

- The size of a gallbladder polyp can help predict whether it's cancerous (malignant) or noncancerous (benign).
- Small gallbladder polyps that are less than 1/2 inch — about 10 millimeters (mm) — in diameter are unlikely to be cancerous and generally don't require treatment.
- Gallbladder polyps larger than 1/2 inch (about 10 mm) in diameter are more likely to be cancerous or turn into cancer over time, and those larger than 3/4 inch (18 mm) in diameter may pose a significant risk of being malignant.

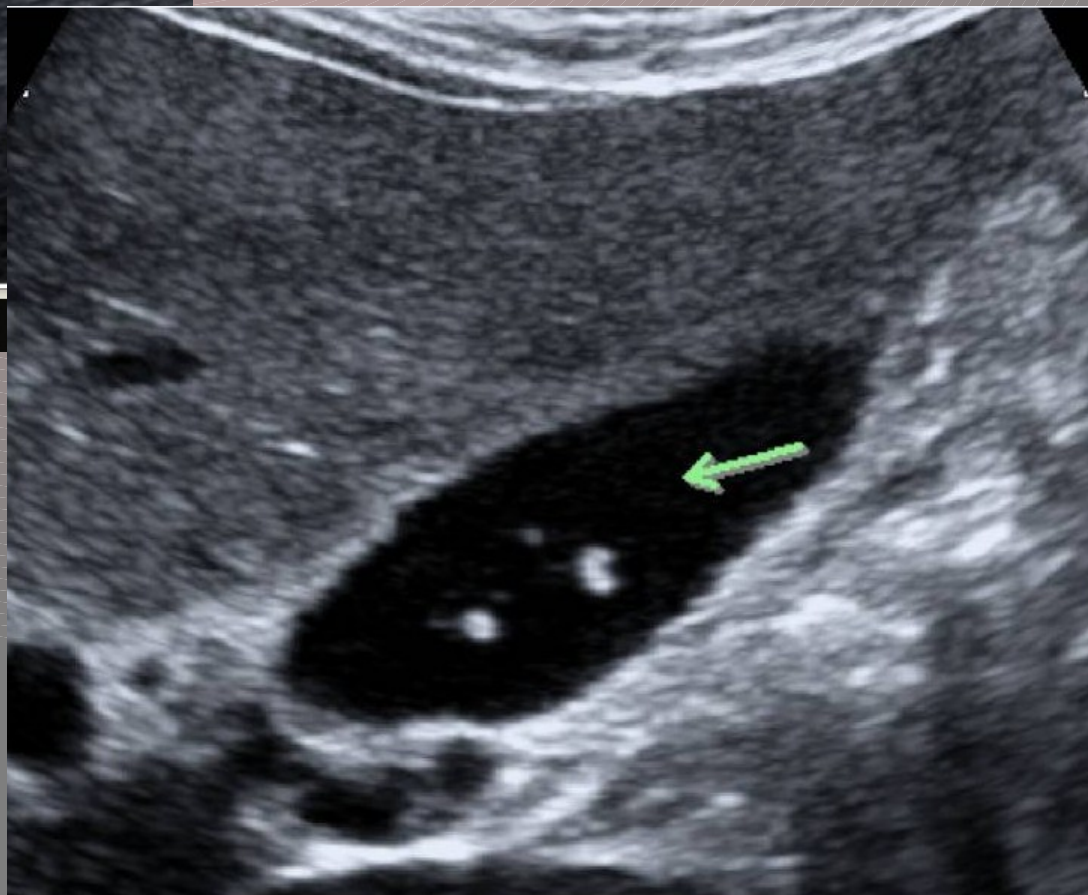
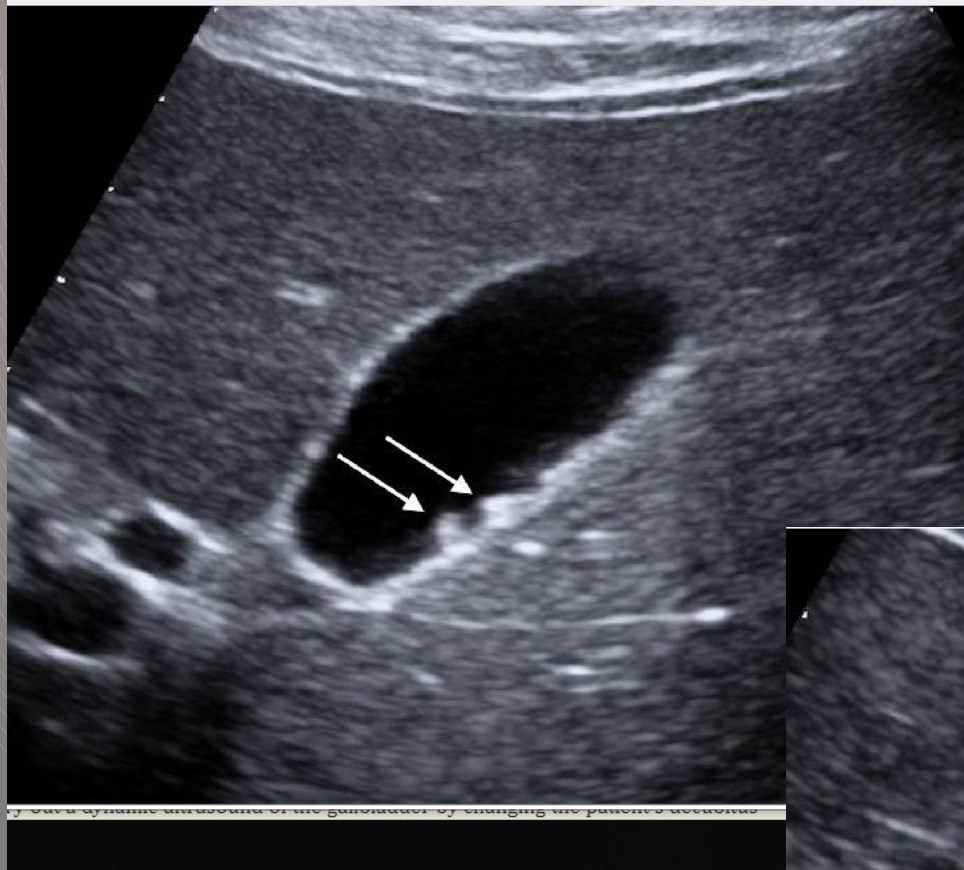
Ultrasound features

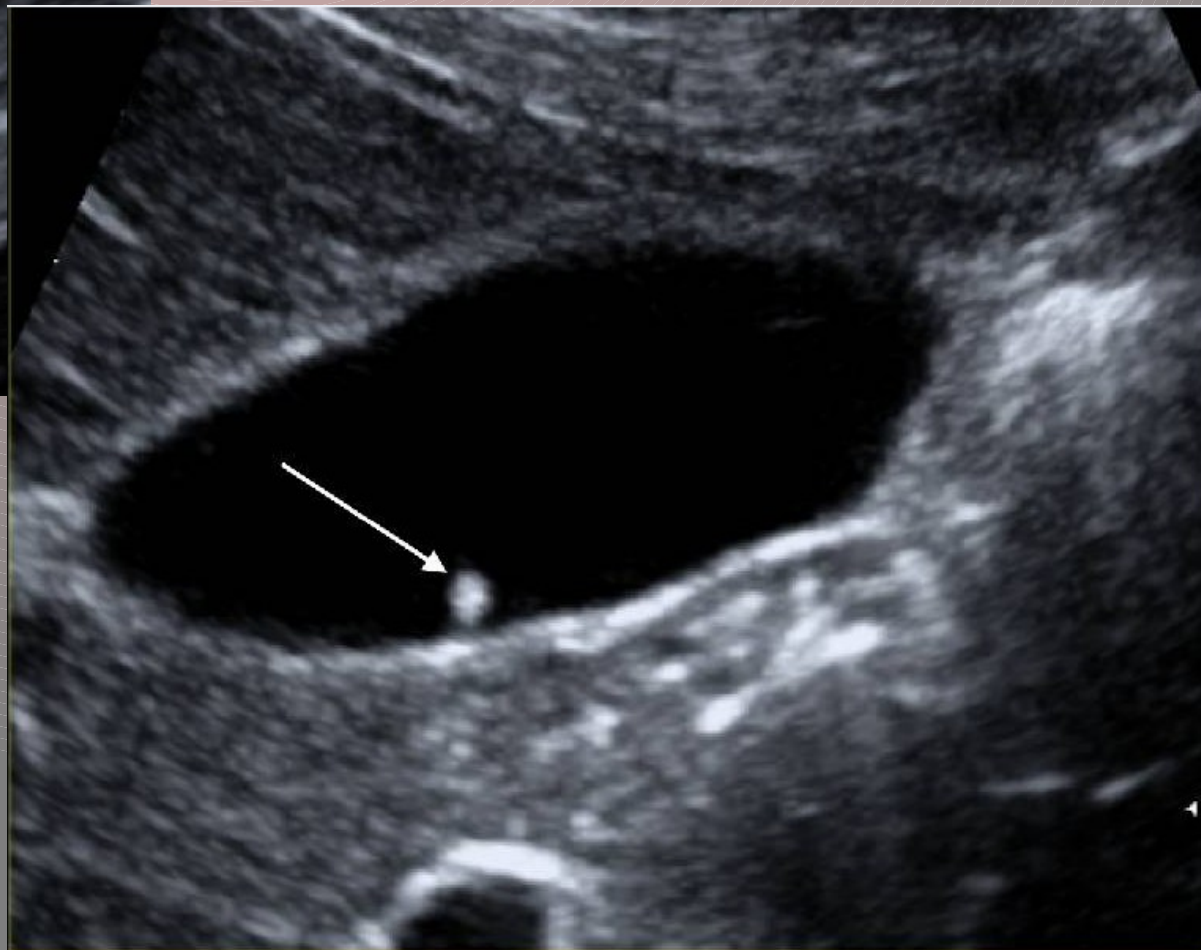
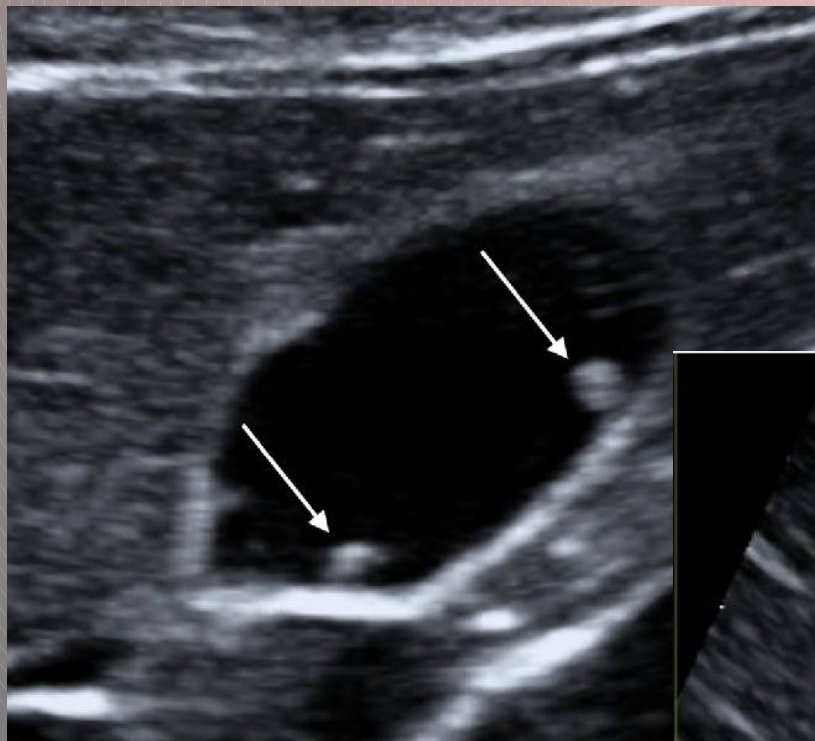
- Gallbladder polyps are not mobile and do not demonstrate posterior acoustic shadowing; they may be sessile or pedunculated.
- Gallbladder polyps may be divided into pseudopolyps and true polyps.
- Pseudopolyps are benign and include cholesterolosis, cholesterolic polyps, inflammatory polyps, and localised adenomyomatosis.
- True gallbladder polyps can be benign or malignant.
- Benign polyps are most commonly adenomas, while malignant polyps are adenocarcinomas and metastases. There are also rare types of benign and malignant true gallbladder polyps, including mesenchymal tumours and lymphomas.
- Ultrasound is the first-choice imaging method for the diagnosis of gallbladder polyps, representing an indispensable tool for ensuring appropriate management. It enables limitation of secondary level investigations and avoidance of unnecessary cholecystectomies.

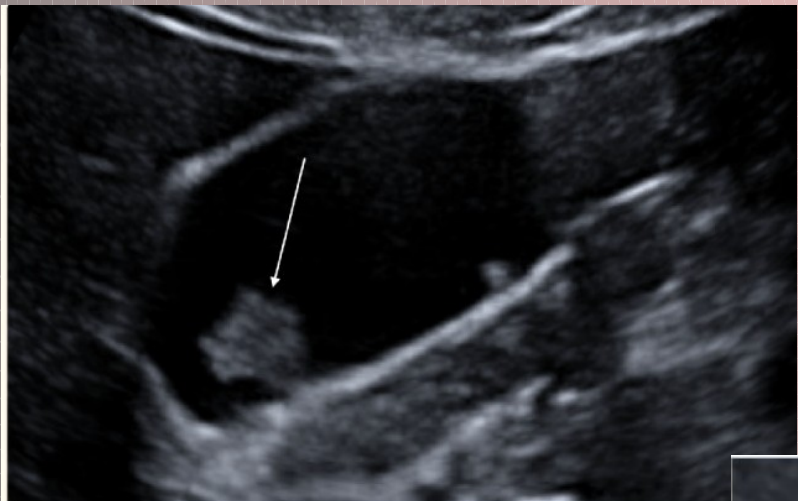
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Gallbladder polyps ultrasound: what the sonographer needs to know

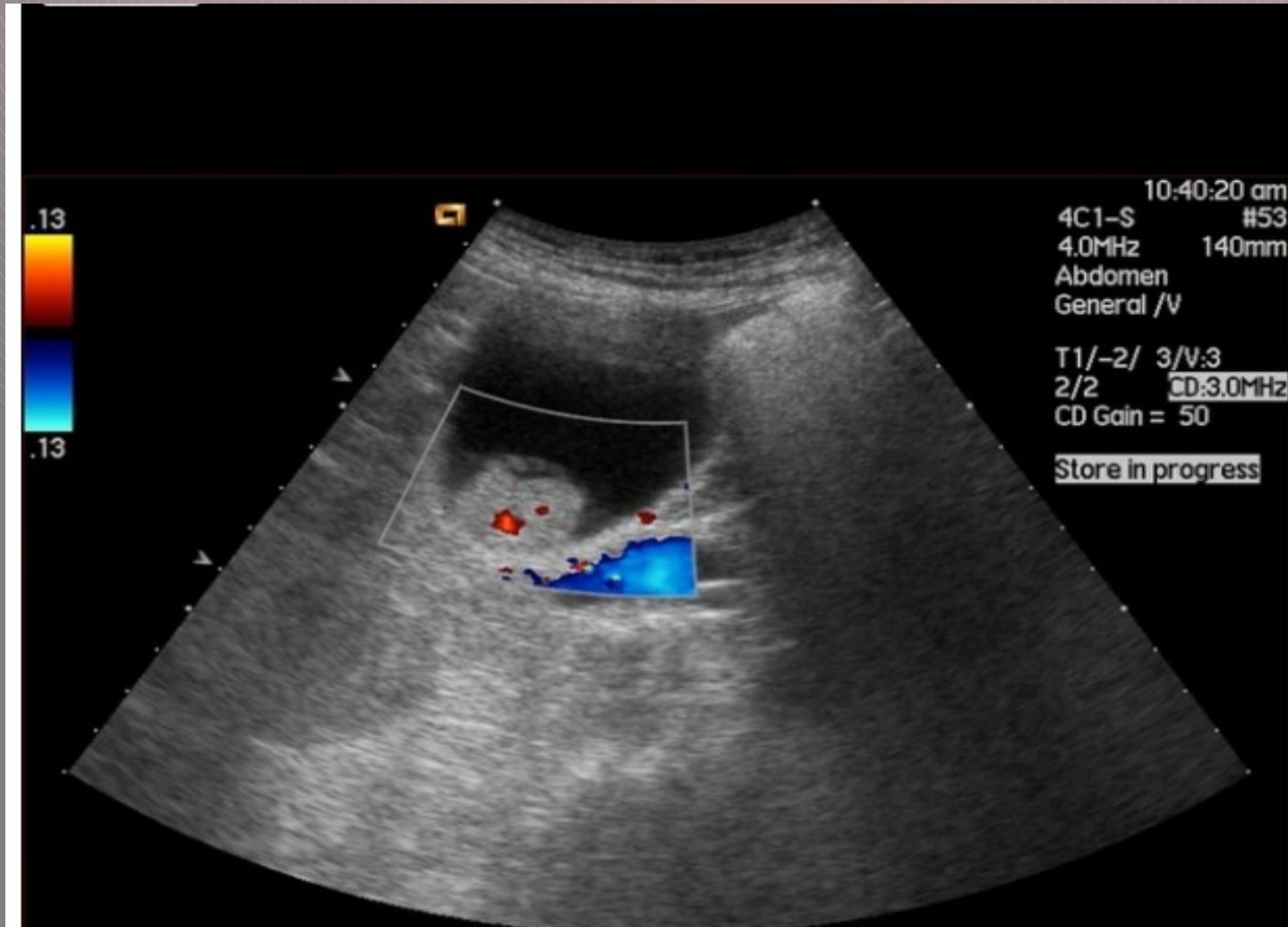
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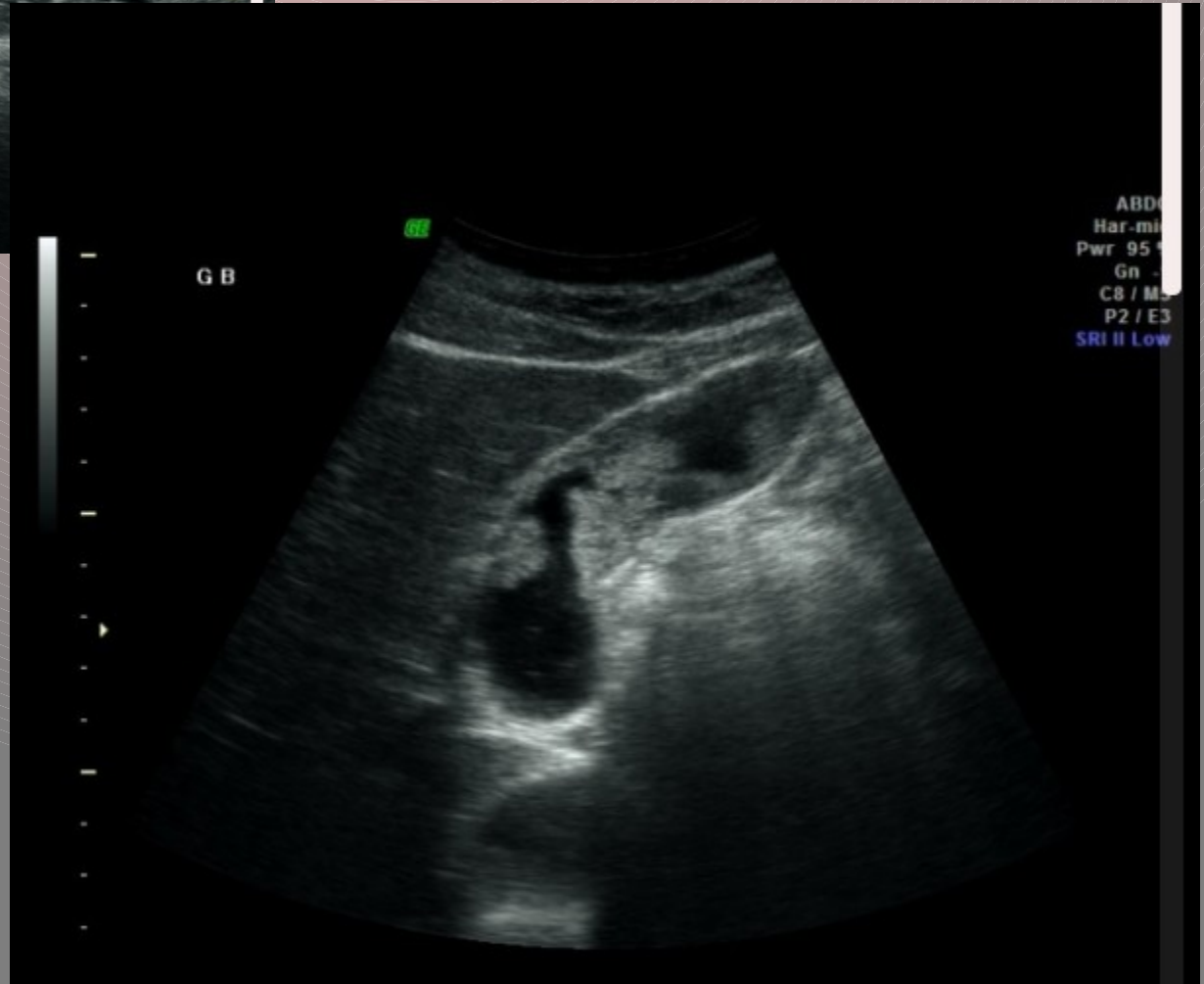
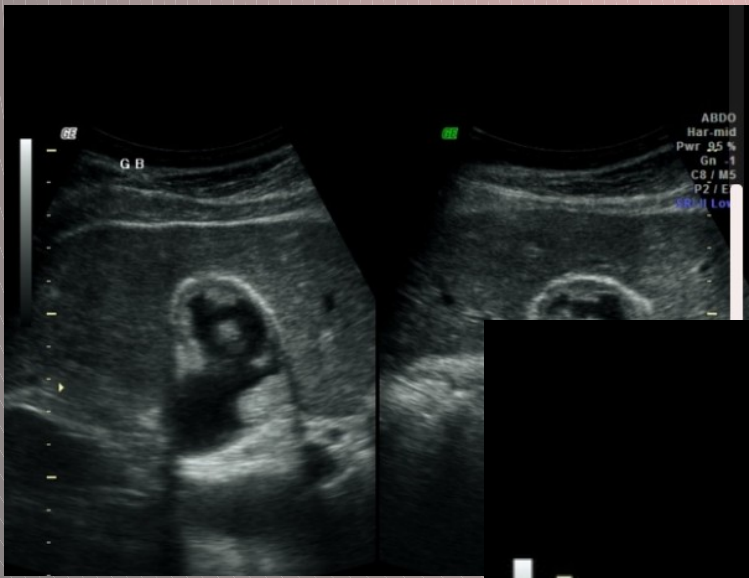
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Comparing imagines: stone and polyp



polyps



There are multiple polypoid lesions of the gallbladder measuring over 10mm.

Negative symptom of rolling stone



Polyp in the
anterior wall
of gall
bladder

In the end, of doctor US not sure

- Magnetic resonance imaging (MRI) has been recommended when ultrasound findings are inconclusive.
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Thanks for your attention

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- Gallbladder stones vs polyps

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Types of stones

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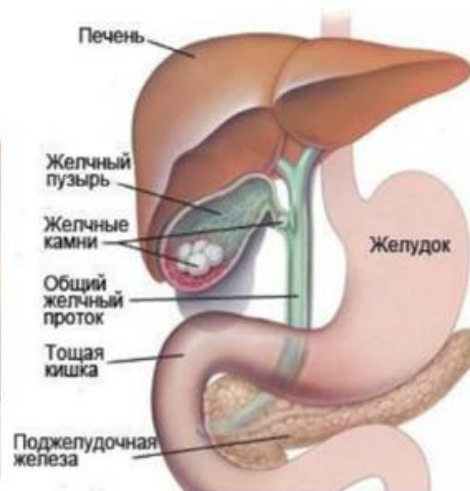
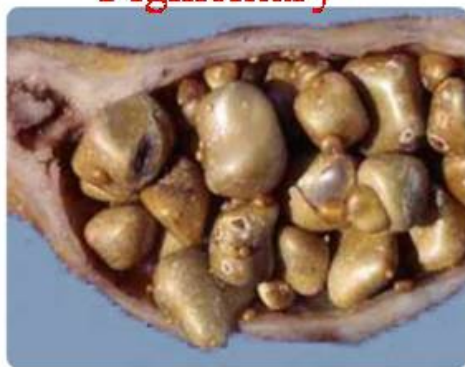
Виды желчных
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0° Gn 63
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LOGIQ
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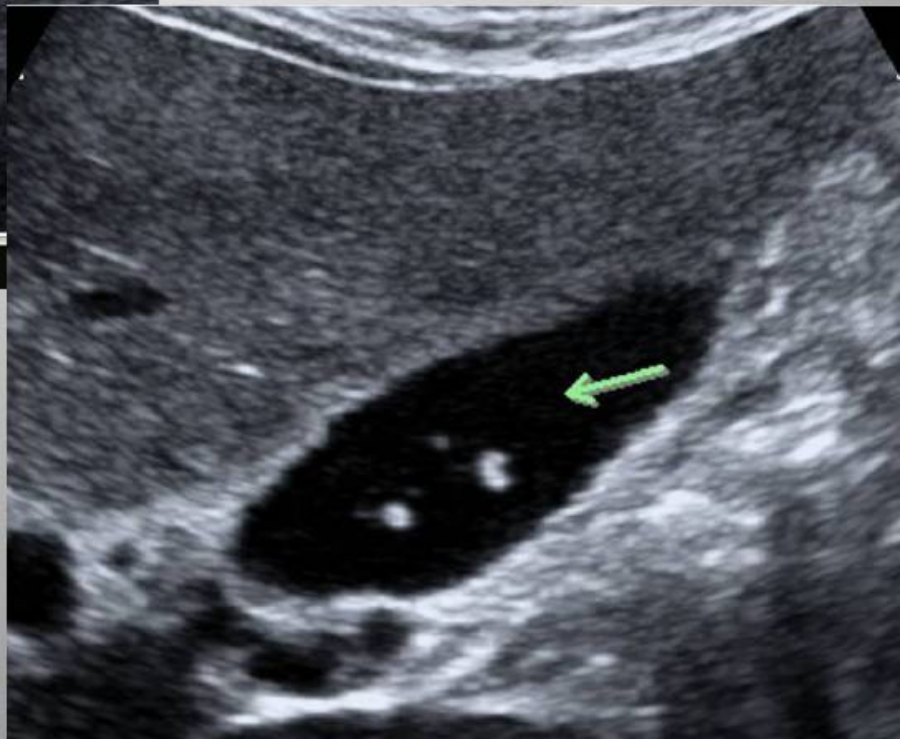
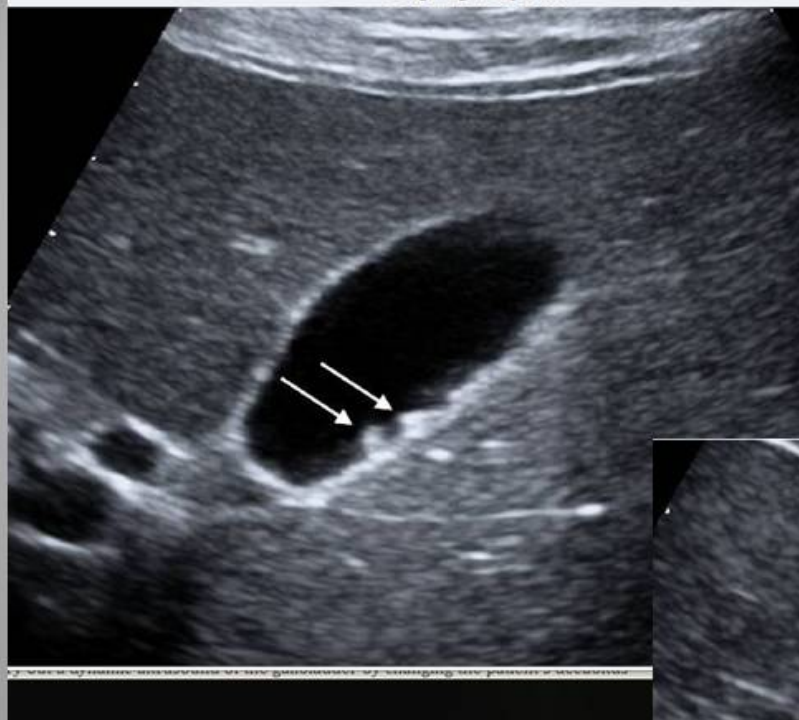
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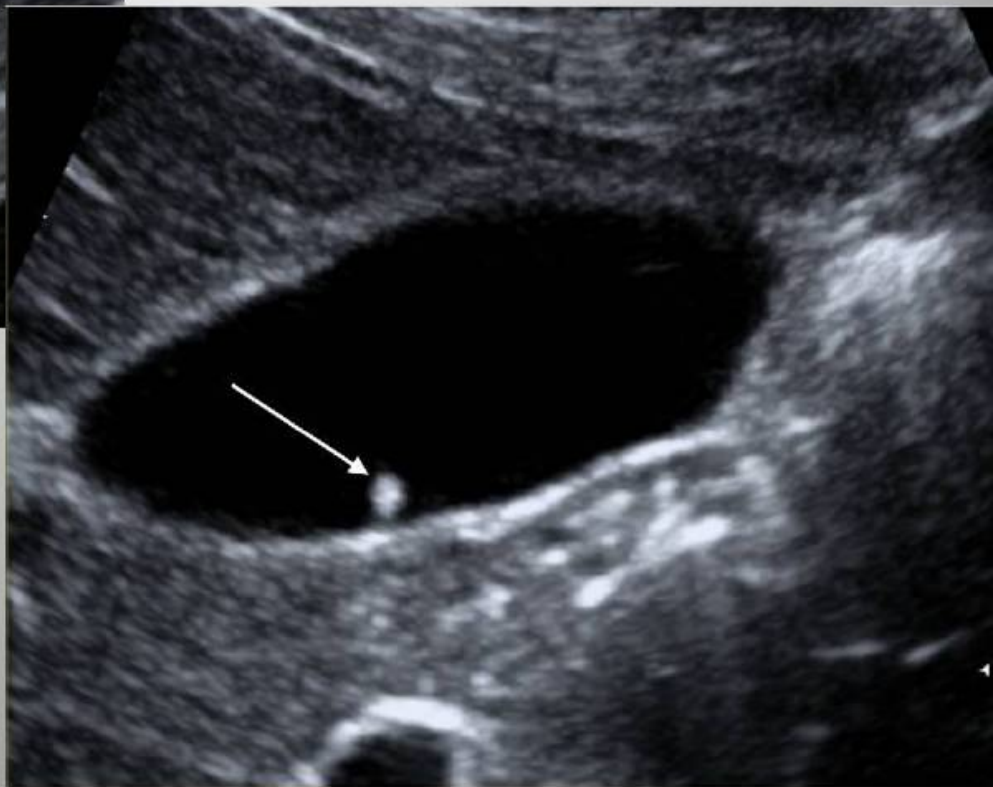
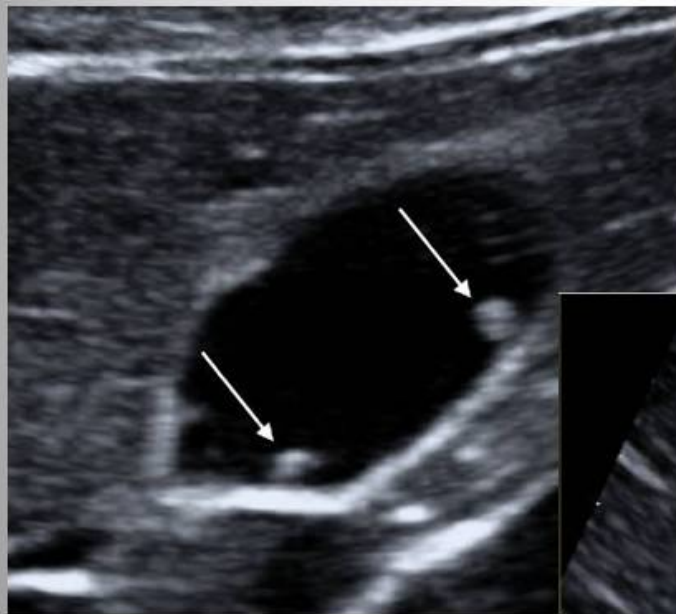
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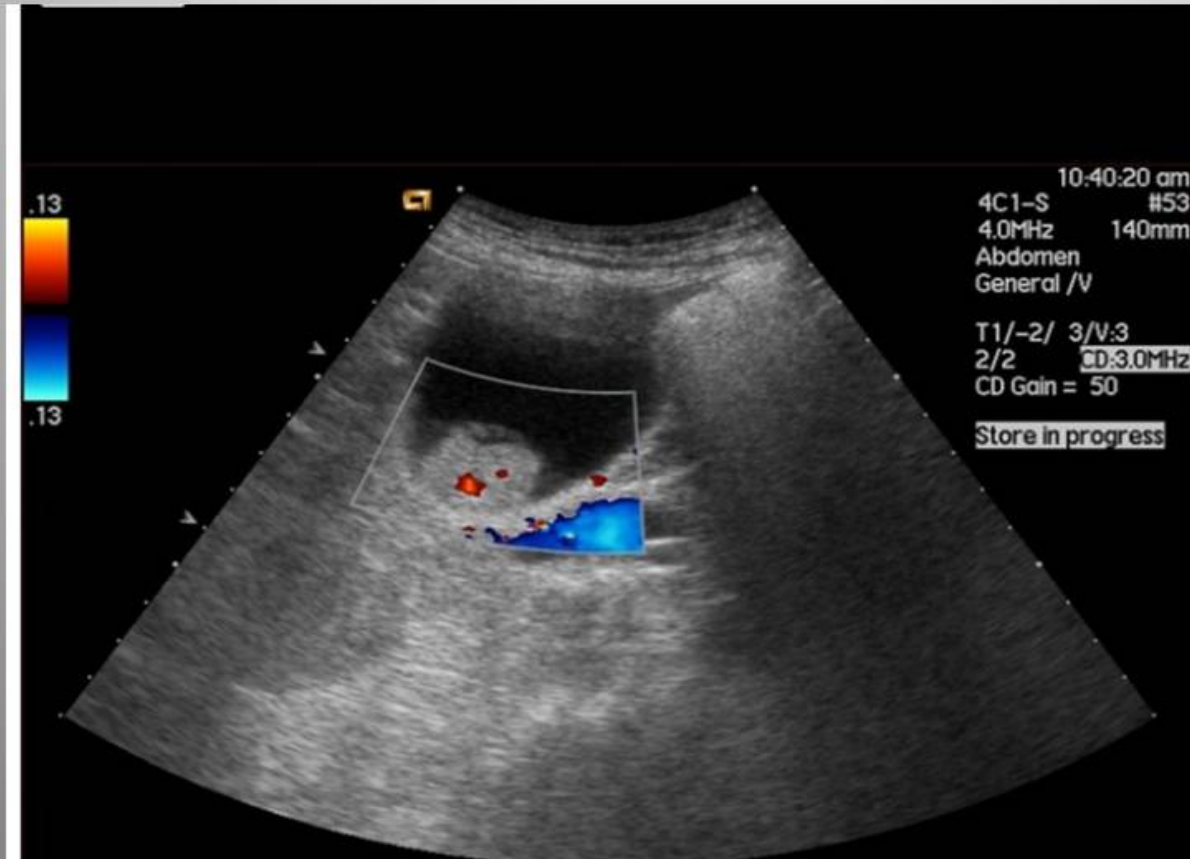
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Comparing imagines: stone and polyp



polyps



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Negative symptom of rolling stone



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