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noise ratio while adhering to ALARA principles, but resolution is preserved by avoiding higher frequencies that attenuate more rapidly. Harmonic imaging could improve contrast but not penetration in this scenario, and reducing dynamic range would compress grayscale without addressing depth issues.

Question: 1393

A 40-year-old female presents with a palpable mass and tenderness in her lower abdominal wall after undergoing abdominal surgery 2 weeks ago. Ultrasound reveals a hypoechoic lesion with increased peripheral vascularity on Doppler. Which condition best explains these ultrasound findings?

A. Post-surgical seroma
B. Abscess
C. Abdominal wall hematoma
D. Lipoma

Answer: B
Explanation: A hypoechoic lesion with increased peripheral blood flow in the abdominal wall in a post-surgical patient is consistent with an abscess. Hematomas are typically avascular or have minimal flow; seromas are anechoic and lack vascularity; lipomas are usually hyperechoic and avascular.

Question: 1394

A 28-year-old male motorcyclist presents after a high-speed collision with a vehicle, exhibiting hypotension (BP 82/50 mmHg), tachycardia (HR 128 bpm), and a GCS of 12. Initial labs reveal hemoglobin of 9.2 g/dL, lactate of 4.8 mmol/L, and base deficit of -8 mEq/L. During the primary survey, eFAST is initiated. A moderate anechoic collection is noted in the pericardial space with right

ventricular diastolic collapse, while a small hypoechoic area appears in Morison's pouch. Given the hemodynamic instability and these sonographic findings, what is the most immediate prioritized intervention to address the life-threatening condition?

A. Transfusion of 4 units packed red blood cells and transfer to CT suite
B. Emergent pericardiocentesis followed by sternotomy
C. Immediate exploratory laparotomy for hemoperitoneum
D. Administer 2L crystalloid bolus and perform serial eFAST in 15 minutes

Answer: B
Explanation: In polytrauma patients with hemodynamic instability, eFAST prioritizes detection of pericardial effusion with signs of tamponade, such as right ventricular diastolic collapse, over smaller peritoneal collections. This indicates acute cardiac tamponade, a rapidly fatal condition requiring immediate decompression via pericardiocentesis and surgical exploration (e.g., sternotomy) per ATLS guidelines. Crystalloid boluses or laparotomy would delay addressing the tamponade, and CT is contraindicated in instability. Lactate and base deficit underscore shock, but sonographic evidence directs pericardial intervention first, improving survival by reducing time to definitive care.

Question: 1395

A chest ultrasound of a patient with advanced metastatic cancer and anasarca reveals a large pleural effusion with septations and echogenic debris. What is the preferred next step?

A. Chest X-ray only
B. Empiric antibiotic therapy
C. Thoracentesis guided by ultrasound
D. Observation with diuretics

Answer: C

Explanation: Ultrasound-guided thoracentesis is indicated to drain symptomatic and complex pleural effusions, especially with septations and debris suggesting infection or malignancy. Chest X-ray is less sensitive, empiric antibiotics without diagnosis are not advised, and diuretics alone may be insufficient.

Question: 1396

Gallbladder sludge in 50-year-old TPN patient (bilirubin 2.0 mg/dL) shows layered echoes with comet tails. What artifact is tails, and what frequency would minimize for layering assessment?

A. Reverberation from wall, minimized by 4 MHz
B. Ring-down from gas, minimized by 3 MHz
C. Comet tail from crystals, minimized by 5 MHz
D. Enhancement from bile, minimized by 2 MHz

Answer: C

Explanation: Tails are comet tail from biliary cholesterol precipitates; hyperbilirubinemia from stasis. Minimize by 5 MHz for better resolution of layers.

Question: 1397

Post-SMA stent for stenosis, patient has diarrhea and weight loss. Pre-stent PSV 320 cm/s, post 95 cm/s. Jejunal wall thickening 4 mm. No gas patterns. What restenosis risk assessment via hemodynamic surveillance and technique is indicated?

A. Volume flow >500 mL/min confirmation and document waveform sharpening

B. Intramural gas detection with harmonic imaging and measure pulsatility >3.0
C. Collateral flow grading in pancreaticoduodenal arcade and sample at 45° angle
D. Serial RAR monitoring <2.0 and use fasting state for baseline flow

Answer: C
Explanation: Post-stent surveillance uses PSV <150 cm/s and RAR <2.0, but collaterals (e.g., pancreaticoduodenal) persist if in-stent restenosis >50%, causing ischemic bowel. Hilum landmark; 45° optimizes velocity. Symptoms suggest malperfusion; technique detects early failure, preventing infarction.

Question: 1398

A 32-year-old female post-laparoscopic cholecystectomy develops fever and leukocytosis (WBC 16,000/µL). Color Doppler interrogation of the hepatic artery at the porta hepatis using a 4 MHz curvilinear transducer shows turbulent flow with a peak systolic velocity (PSV) of 180 cm/s and resistive index (RI) of 0.45, suggesting possible stenosis. To accurately measure this without aliasing (Nyquist limit 120 cm/s), what pulsed wave Doppler manipulation is most appropriate?

A. Angle correct to 0 degrees and enable power Doppler overlay
B. Decrease sample volume size to 1 mm and apply high-pass wall filter at 200 Hz
C. Raise color gain to 60% and widen the color box to full screen
D. Increase PRF to 8 kHz and shift baseline to display full waveform envelope

Answer: D
Explanation: Aliasing in pulsed wave Doppler occurs when flow velocity exceeds the Nyquist limit (PRF/2), wrapping the spectrum. Increasing PRF to 8 kHz raises the limit to ~400 cm/s, allowing accurate PSV measurement in high-velocity post-surgical flows. Shifting the baseline unwraps the envelope for bidirectional display without losing data. Decreasing sample volume improves specificity but not aliasing; wall filter removes clutter, not high velocities; power Doppler lacks

velocity quantification; color adjustments aid mapping but not spectral accuracy.

Question: 1399

An ultrasound of the neck for a 45-year-old woman reveals multiple enlarged hypoechoic lymph nodes with loss of the central echogenic hilum. The nodes measure up to 2 cm. What is the most concerning diagnosis?

A. Lymphoma
B. Reactive lymphadenopathy
C. Normal variant
D. Tuberculous lymphadenitis

Answer: A
Explanation: Loss of the central echogenic hilum and large size are suspicious for malignant lymphadenopathy such as lymphoma. Reactive nodes usually retain the hilum and are smaller. Tuberculous nodes may have necrosis but usually with other clinical signs.

Question: 1400

A 58-year-old female post-pancreatectomy presents with jaundice (bilirubin 4.2 mg/dL). Doppler ultrasound shows absent flow in the portal vein confluence, echogenic thrombus, and reversed hepatic artery diastolic flow with RI 0.85. Splenic vein is patent with velocity 45 cm/s. What vascular abnormality is associated with these changes, and what scan adjustment evaluates compensatory flow?

A. Biliary obstruction without vascular involvement
B. Portal vein thrombosis with hepatic arterial buffer response

C. Inferior vena cava compression
D. Splenic artery aneurysm rupture

Answer: B
Explanation: Postoperative portal vein thrombosis causes acute occlusion with echogenic thrombus and absent flow, triggering hepatic arterial buffer response—arterial vasodilation with reversed diastolic flow and high RI from parenchymal hypoperfusion. Jaundice stems from biliary stasis secondary to edema. Compensatory flow is evaluated by increasing hepatic artery scale and sampling multiple segmental branches with pulsed Doppler for velocity mapping. Splenic aneurysm shows peripancreatic hematoma; biliary obstruction lacks flow changes; IVC compression affects venous return without arterial reversal. Technique: Respiratory suspension in inspiration for confluence view.

Question: 1401

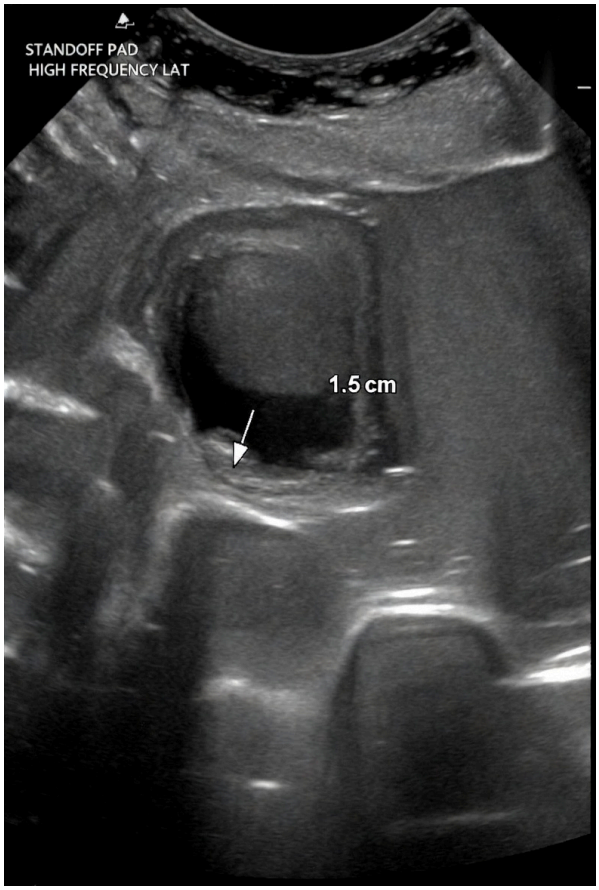
Which of the following lab results is most consistent with acute hepatitis on ultrasound liver findings?

A. Elevated bilirubin; hepatic cysts
B. Elevated alkaline phosphatase with fatty infiltration
C. Elevated ALT, AST; hypoechoic liver with increased echogenicity
D. Normal liver enzymes; coarse liver texture

Answer: C
Explanation: Acute hepatitis is associated with elevated transaminases (ALT, AST) and can show a diffusely hypoechoic liver due to inflammation and edema. Fatty infiltration usually shows increased echogenicity, alkaline phosphatase elevation suggests cholestasis or biliary disease. Coarse liver texture corresponds to chronic liver disease. Hepatic cysts typically do not alter liver enzymes significantly.

Question: 1402

A 55-year-old male post-motor vehicle collision with steering wheel impact presents with penile swelling and inability to void. BP is 110/70 mmHg, but he reports a "snap" sensation during erection. Labs reveal hematuria (RBC >50/hpf). Ultrasound demonstrates a ventral discontinuity in the corpus cavernosum with periurethral hematoma. What sonographic feature distinguishes this from a simple contusion, and what is the urgent intervention?



A. Urethral wall thickening; retrograde urethrogram
B. Presence of Buck's fascia breach; emergent cystoscopy
C. Extrusion of cavernosal tissue; immediate surgical repair
D. Absent cavernosal flow; intracavernosal irrigation

Answer: C

Explanation: The imaging depicts a classic penile fracture with tunica albuginea rupture and corporal tissue herniation, differentiated from contusion by the discontinuity and extrusion, which confirms full-thickness injury and risk of permanent deformity (Peyronie's) or erectile dysfunction if untreated. Hematuria raises concern for associated urethral injury (10-20% incidence), but the primary sonographic hallmark is the tear itself. Urgent surgical repair within 24 hours restores anatomy and function, outperforming conservative therapy. Urethrogram evaluates urethra but delays fracture repair; irrigation is for priapism, not trauma.

Question: 1403

Post-cholecystectomy patient with RUQ pain. Ultrasound shows fluid collection 4 cm with internal debris, no vascularity on Doppler. Labs: WBC 12,000/µL, amylase 300 U/L. What biliary complication?

A. Retained stone migration
B. Sphincter of Oddi dysfunction
C. Bile leak with biloma
D. Clip migration erosion

Answer: C

Explanation: Pericholecystic fluid collection with debris post-op indicates bile leak forming biloma, with mild pancreatitis (elevated amylase) from irritation. Infection suggested by WBC. Retained stone causes dilation; clip erodes chronically; SOD causes pain without collection.

Question: 1404

A 70-year-old with Paget's disease has elevated alkaline phosphatase (450 U/L)

and a lytic bone lesion in iliac wing with soft-tissue mass on ultrasound. What metastatic process involves pelvic fluid, and what Doppler finding indicates hypervascularity?

A. Hyperemia from reparative response
B. Osteoblastic mets with sclerotic foci
C. Sarcomatous degeneration with invasion
D. Lytic destruction with pathologic fracture

Answer: C
Explanation: Paget's sarcomatous change (osteosarcoma) erodes bone, forming soft-tissue mass with hypervascular stroma from angiogenic factors (VEGF). Elevated ALP reflects turnover; fluid from microfractures. Finding: Chaotic low-resistance flow (PI <1.0) in mass vessels; document for biopsy, as mimics infection.

Question: 1405

A 50-year-old diabetic with steatohepatitis has ultrasound-guided liver biopsy; post-procedure shear wave velocity 2.8 m/s (F3 fibrosis). What lab guides repeat biopsy?

A. Platelet <100,000/mm³
B. ALT flare >100 U/L
C. Fib-4 score >3.25
D. TE progression >1 m/s

Answer: C
Explanation: Fib-4 (>2.67 high-risk) combines age, ALT/AST, platelets for fibrosis progression in NAFLD, indicating repeat biopsy or alternative (MRE). ALT nonspecific; platelet portal HTN; TE trend monitors.

Question: 1406

A 27-year-old female presents with a palpable right inguinal swelling worsened by Valsalva maneuver. Ultrasound shows a defect in the inguinal canal with herniated omentum showing no peristalsis. What is the most likely diagnosis?

A. Spigelian hernia
B. Direct inguinal hernia
C. Femoral hernia
D. Indirect inguinal hernia

Answer: D
Explanation: An indirect inguinal hernia occurs through the deep inguinal ring along the course of the spermatic cord or round ligament, contains omentum or bowel, and is exacerbated by straining. Femoral hernias are located below the inguinal ligament lateral to the pubic tubercle. Direct hernias protrude through abdominal wall medial to inferior epigastric vessels. Spigelian hernias occur along the linea semilunaris.

Question: 1407

A 38-year-old post-lung transplant waitlist liver candidate has TIPS ultrasound with shunt velocity 28 cm/s and hepatofugal portal flow. Encephalopathy present. What?

A. Overshunting
B. Stenosis
C. Undershunting
D. Thrombosis

Answer: A

Explanation: Low shunt velocity with reversed portal flow and encephalopathy indicates overshunting, diverting excessive portal blood and causing hepatic hypoperfusion. Undershunting elevates gradient; stenosis increases velocity; thrombosis absent flow. Stent reduction manages.

Question: 1408

A 70-year-old female with a history of colorectal cancer presents with intermittent right lower quadrant pain and weight loss. Labs include CEA 12 ng/mL (normal: <5 ng/mL), normal liver enzymes, and mild anemia (hemoglobin 11.2 g/dL). Ultrasound identifies multiple hypoechoic liver masses (largest 3.4 cm in segment VII) with target-like appearance, peripheral halo, and increased vascularity on color Doppler. The inferior vena cava is patent, but periportal lymphadenopathy is noted. No biliary dilatation. What is the most likely etiology of the liver lesions?

A. Metastatic disease from primary colorectal adenocarcinoma
B. Focal nodular hyperplasia with central scar
C. Benign hemangiomas with fatty infiltration
D. Pyogenic abscesses from ascending cholangitis

Answer: A
Explanation: Elevated CEA in a colorectal cancer patient with weight loss, anemia, and ultrasound findings of multiple hypoechoic liver lesions with bull's-eye/target appearance (eccentric target sign), peripheral halo (edema/compression), and hypervascularity indicate metastatic colorectal cancer, commonly via portal vein hematogenous spread. Hemangiomas are hyperechoic; abscesses show debris and fever; FNH is solitary with central scar. Contrast-enhanced CT confirms diagnosis and assesses resectability for potential curative metastasectomy.

Question: 1409

In the context of abdominal trauma, which sonographic feature differentiates Morel-Lavallée lesions from simple subcutaneous hematomas?

A. Fluid confined within muscle boundaries
B. Fluid crossing fascial planes with internal septations
C. Anechoic simple fluid collection
D. Absence of surrounding edema

Answer: B
Explanation: Morel-Lavallée lesions show fluid collections that extend across fascial planes with complex septations, distinguishing them from hematomas which are typically localized within muscle or tissue planes.

Question: 1410

A 30-year-old male with sickle cell disease and priapism undergoes penile ultrasound, revealing cavernosal arteries with PSV 45 cm/s, EDV -2 cm/s, and echogenic foci in corpora cavernosa without tunica rupture. Pain score 8/10 persists. What vascular pattern confirms?

A. Neurogenic erectile dysfunction
B. Penile fracture
C. High-flow priapism
D. Ischemic low-flow priapism

Answer: D
Explanation: Negative EDV and high RI (>0.9) with normal PSV in prolonged erection indicate ischemic (low-flow) priapism from venous occlusion, common in sickle cell, risking fibrosis if >4 hours. High-flow shows elevated EDV from

arteriocavernosal fistula, fracture discontinuity with hematoma. Aspiration and phenylephrine injection are emergent.

Question: 1411

Grayscale kidney in 70-year-old with hydronephrosis (BUN 40 mg/dL) shows filled calyces with linear distal echoes from stone. What artifact is linear echoes, and what gel application would reduce for stone burden?

A. Comet tail from crystals, reduced by thin gel layer
B. Ring-down from gas, reduced by warm gel
C. Slice from beam, reduced by scented gel
D. Reverberation from wall, reduced by thick gel layer

Answer: D
Explanation: Linear echoes are reverberation from calyceal wall-stone interface, mimicking pyelitis; azotemia indicates obstruction. Reduce by thick gel to dampen superficial bounces.

Question: 1412

A 52-year-old male has a pancreatic head mass with associated biliary dilation. Lab values show elevated CA 19-9 and bilirubin. On ultrasound, the mass is hypoechoic with irregular borders, and Doppler shows encasement of the superior mesenteric artery. What is the probable diagnosis?

A. Pancreatic pseudocyst
B. Autoimmune pancreatitis
C. Pancreatic adenocarcinoma
D. Neuroendocrine tumor

Answer: C

Explanation: Pancreatic adenocarcinoma typically appears as a hypoechoic irregular mass causing bile duct obstruction with elevated CA 19-9 and arterial encasement on Doppler. Autoimmune pancreatitis shows diffuse enlargement without arterial encasement. Pseudocysts are cystic. Neuroendocrine tumors are more vascular and do not usually cause vessel encasement.

Question: 1413

In a 70-year-old male 3 months post-liver transplant, MELD score rises to 22 with encephalopathy. Doppler shows portal vein velocity 15 cm/s (normal >20 cm/s), dampened hepatic artery waveform, and ascites. Pre-TIPS gradient 18 mmHg. What TIPS-related complication is evident from these hemodynamics?

A. Hepatic encephalopathy alone
B. Stent thrombosis
C. Overshunting with low gradient
D. Biliary obstruction

Answer: B

Explanation: Low portal velocity and dampened arterial waveform indicate thrombosis or stenosis, increasing gradient >12 mmHg and portal hypertension signs (ascites, encephalopathy). Normal post-TIPS gradient is <12 mmHg. Overshunting shows hepatofugal flow. Recanalization via angioplasty is indicated.

Question: 1414

A 52-year-old male with neck swelling and elevated ESR 60 mm/hr has

ultrasound of bilateral submandibular glands showing diffuse hypoechoicity, enlarged (>1.5 cm) with heterogeneous texture, and sialectasia. No masses or stones. Anti-SSA positive. What systemic association?

A. Metastatic squamous cell carcinoma
B. Primary Sjögren's syndrome
C. Mumps parotitis
D. Isolated sialolithiasis

Answer: B
Explanation: Bilateral glandular enlargement with hypoechoic parenchyma, ductal dilation, and autoimmune markers like anti-SSA characterize Sjögren's syndrome, causing xerostomia and arthritis. Sialolithiasis shows hyperechoic stones with shadowing, mumps unilateral acute, metastases focal masses. Rheumatology referral for immunosuppression prevents lymphoma risk.

Question: 1415

Post-penetrating penile trauma from a glass shard, a 22-year-old male has urinary retention and PSA 0.5 ng/mL. Ultrasound identifies a 1.5 cm hypoechoic defect in the corpora cavernosa with surrounding echogenic strands, but intact urethra on perineal view. What is the key sonographic parameter for assessing vascular integrity?

A. End-diastolic velocity in urethral arteries
B. Peak systolic velocity in dorsal arteries
C. Resistive index of cavernosal arteries
D. Acceleration time in crural veins

Answer: C
Explanation: The tunica defect confirms corporal fracture, but elevated resistive index (>0.9) in cavernosal arteries indicates traumatic arteriogenic impotence

risk, guiding embolization. Normal PSA excludes prostate involvement. This surpasses PSV (erectile function), EDV (venous leak), or AT (arterial stenosis) for acute trauma. Surgical repair within 24 hours optimizes outcomes.

Question: 1416

Ultrasound in a 62-year-old male with weight loss reveals multiple hypoechoic para-aortic masses >2 cm, with loss of fatty hilum and irregular borders. What lab abnormality is most expected?

A. Elevated PSA
B. Anemia with LDH elevation
C. Elevated alkaline phosphatase
D. Hypercalcemia

Answer: B
Explanation: Enlarged, hypoechoic nodes without hilum suggest metastatic lymphadenopathy or lymphoma, often with hemolytic anemia and LDH rise from tumor burden. PSA relates to prostate, hypercalcemia to bone mets, ALP to biliary obstruction.

Question: 1417

A 60-year-old male with pancreatic head mass (CA 19-9 150 U/mL, normal <37 U/mL) on contrast-enhanced ultrasound at 5 MHz, low MI 0.08, shows peripheral hypoechogenicity in the 3 cm lesion with internal speckled echoes on high frame rate (60 Hz). What propagation artifact is the speckling, and what MI increase would minimize it for rim enhancement evaluation?

A. Shadowing from desiccated tissue, minimized by switching to high-frequency

7 MHz

B. Speckle from scatterer interference, minimized by raising MI to 0.15

C. Enhancement from low attenuation, minimized by reducing bubble dose to 1 mL

D. Clutter from side lobe overlap, minimized by activating pulse inversion

Answer: B

Explanation: The internal speckled echoes represent speckle artifact, the granular texture from constructive/destructive interference of backscattered waves from distributed micro-reflectors, creating a "salt-and-pepper" pattern unrelated to true tissue heterogeneity; in pancreatic adenocarcinoma with elevated CA 19-9, speckle obscures subtle necrotic areas, hindering rim hyperenhancement diagnosis of vascularity. Speckle is inherent to coherent imaging. Minimize by raising MI to 0.15 to enhance nonlinear microbubble harmonics, suppressing fundamental scatter noise via pulse inversion while preserving contrast dynamics; clutter reduction needs specific filters; dose reduction weakens signal; frequency switch alters penetration but amplifies speckle.

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