Sonographic Sleuthing: Techniques to Distinguish Pathology from Artifact

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Course Description

Have you ever paused during a scan and asked yourself, "Is that real—or just an artifact?" You're not alone. In this session, we'll explore the various types of sonographic artifacts—both helpful and problematic—and review techniques to tell them apart from true anatomical or pathological findings. We'll walk through practical ways to make that distinction using tools and settings already at your fingertips, like harmonics, compounding, focal zone placement, and Doppler adjustments. Through case examples and image comparisons, you'll pick up useful tips to fine-tune your scanning technique and feel more confident knowing what's real, and what's not.

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Learning Objectives:

- Define and categorize common sonographic artifacts, identifying which are beneficial and which hinder diagnostic accuracy.
- Apply advanced image optimization techniques, including spatial compounding, harmonic imaging, and focal zone adjustment, to enhance diagnostic image quality.
- Differentiate true pathology from artifact using sonographic reasoning and pattern recognition in both grayscale and Doppler imaging.
- Evaluate the clinical significance of accurate artifact identification and discuss its impact on diagnostic confidence and patient outcomes.

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Artifact Foundations – Physics Meets Pattern Recognition

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What Are Artifacts?

- Artifacts are image features that do not accurately represent the anatomy or reflectors being scanned.
- They may appear as echoes that are misplaced, distorted, falsely enhanced, or entirely fictitious.
- Artifacts can be diagnostic (useful), nondiagnostic, or confounding (misleading).
- Artifact categories we will discuss include: Grayscale Artifacts, Doppler Artifacts, and Equipment-Related Artifacts.

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When Artifacts Are Helpful: Know Your Allies

- **Acoustic enhancement** deep to fluid-filled structures.
- **Posterior shadowing** is seen behind calcific reflectors like stones or bones.
- **Comet tail and ring-down** artifacts support diagnoses like adenomyomatosis or air-containing processes.
- **Twinkling artifact** on Doppler is a useful clue for detecting stones and areas of calcification.

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Grayscale Artifacts – Image-Based Illusions

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Attenuation-Based Artifacts

- **Posterior shadowing** occurs behind high-attenuation structures (e.g., bone, stones).
- **Acoustic enhancement** is seen posterior to low-attenuation structures (e.g., cysts, bladder).
- Artifacts result from varying tissue attenuation rates compared to surrounding tissue.
- Useful for diagnosis: Shadow = solid/dense; Enhancement = cystic/fluid-filled.

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Acoustic Enhancement

- Acoustic enhancement appears as increased echogenicity posterior to low attenuators (i.e., fluid-filled structures).
- It is also known as **through transmission** or **posterior enhancement**.
- Commonly seen behind cysts, bladder, vessels, etc.
- This artifact can **confirm the cystic nature** of a lesion and guide diagnostic decisions.

Case courtesy of Ian Bickle, Radiopaedia.org, rID: 41375

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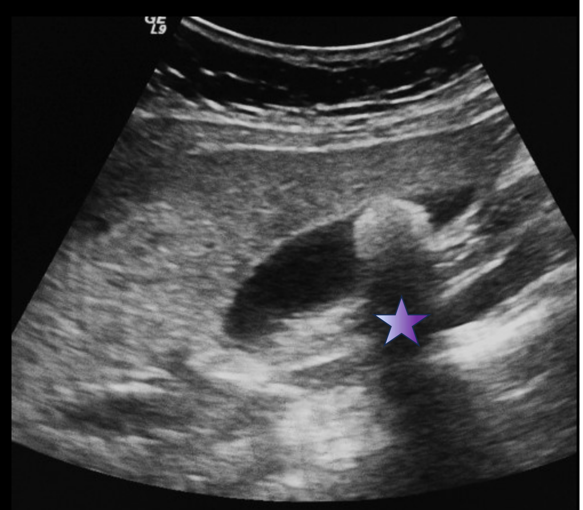
Acoustic Shadowing

- Occurs when sound waves are strongly attenuated by dense structures such as **bone, stones, or air**.
- Results in a hypoechoic or anechoic band posterior to the object.
- **Clean shadowing** (sharp and dark) typically indicates **bone or calculus**.
- **Dirty shadowing** (diffuse and noisy) suggests **air-containing structures**.



Case courtesy of Ian Bickle, Radiopaedia.org, rID: 41375

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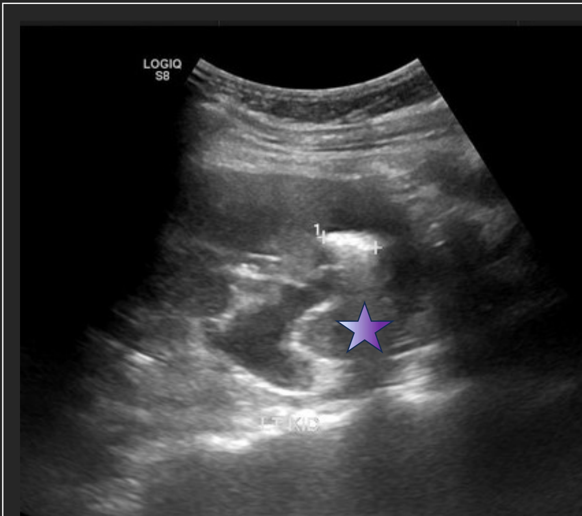

Dirty Shadow

Case of **echogenic foci of air in patient with emphysematous pyelonephritis**, courtesy of Safwat Mohammad Almoghazy, Radiopaedia.org, rID: 88419

Clean Shadow

Case of **gallstone**, courtesy of Ian Bickle, Radiopaedia.org, rID: 41375

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Edge Shadow Artifact

- Also known as *shadowing by refraction*.
- Occurs when an ultrasound beam strikes a rounded or curved interface.
- Refraction causes the beam to **bend along the structure's edge**.
- Most frequently seen at the **fetal skull, gallbladder wall**, or rounded structures.

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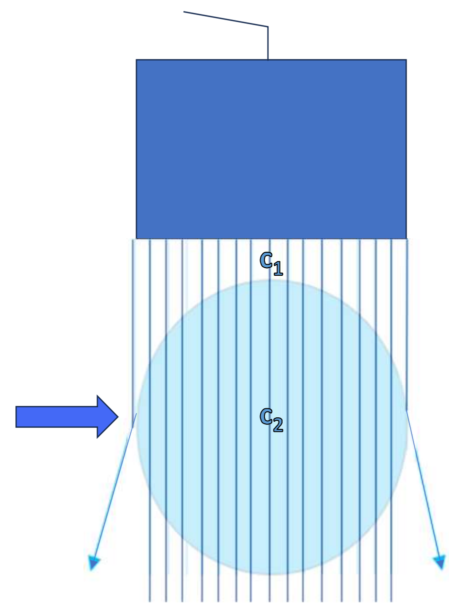
Edge Shadow Artifact

- Occurs at **curved boundaries** where the beam strikes at an **oblique angle**.
- Caused by a difference in **propagation speed** between two tissues.
- The beam **refracts** rather than reflected directly back to the transducer.
- Results in a **signal void** or shadow at the lateral margins of the structure.



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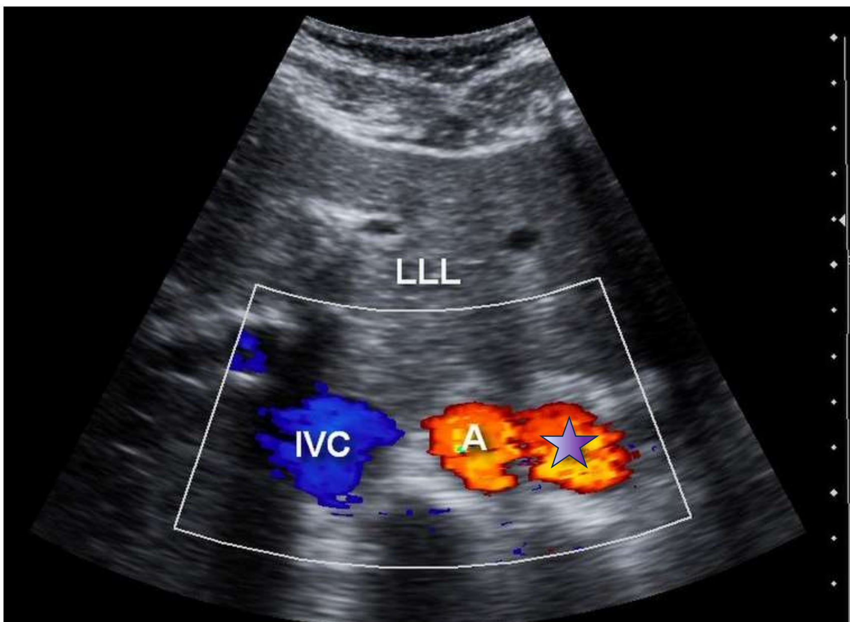

Artifactual duplication of the aorta due to refraction.

When Sound Takes A Detour: Refraction Artifact

- Refraction occurs when sound crosses tissue boundaries at an **oblique angle** and **different propagation speeds**.
- The beam transmits with a bend, misplacing returning echoes **laterally.**
- Produces **side-by-side duplication** of structures.

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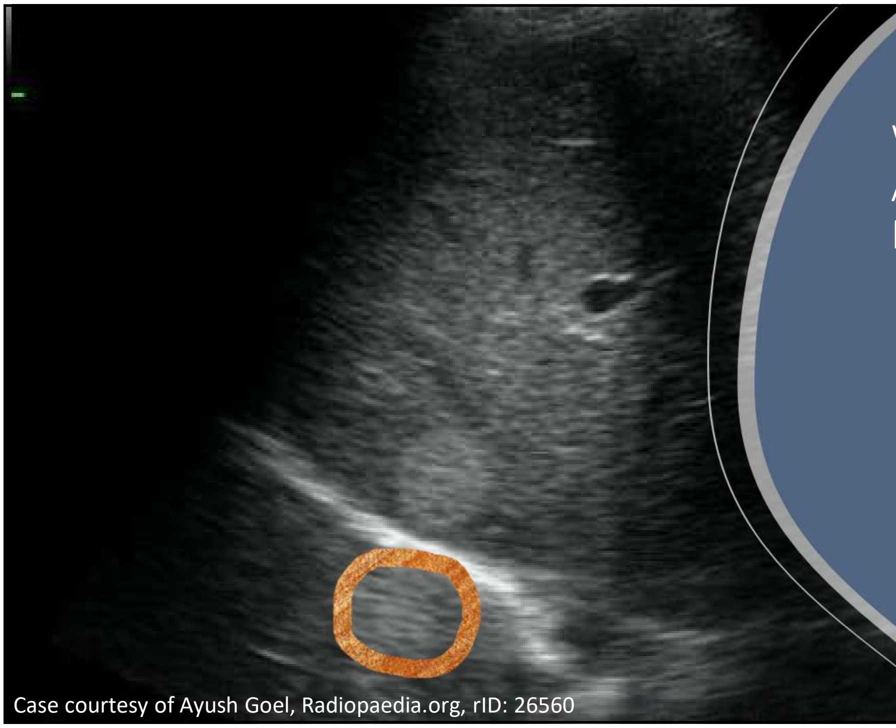

When Sound Takes A Detour: Mirror Image Artifact

- Caused by a **strong specular reflector** (e.g., diaphragm).
- Produces a **symmetrical, duplicated structure** across the reflector.
- The duplicated image appears **deeper** than the true structure.
- **Pathway:** sound reflects off a structure → bounces off the second reflector → returns to transducer with **extra travel time**.

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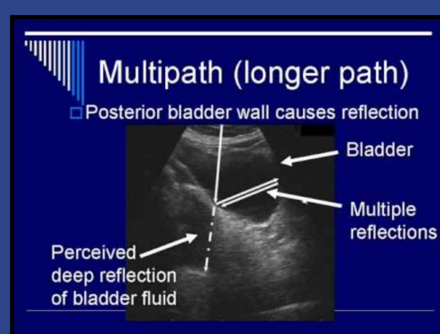
When Sound Takes A Detour: Multipath Artifact

- **Multipath Artifact** occurs when the incident acoustic beam reflects off multiple surfaces before returning to the transducer.
- These reflections take a longer, *indirect route*, which delays their arrival.
- The machine assumes all echoes return in a straight path, so the delayed echo is placed **too deep**.
- 📌 *Concept:* Depth error due to delayed time-of-flight from complex echo routes.



Physics of Ultrasound, Honors Ultrasound Group of The Ohio State University College of Medicine; www.youtube.com/@jchanmeister, 3:11-4:00.

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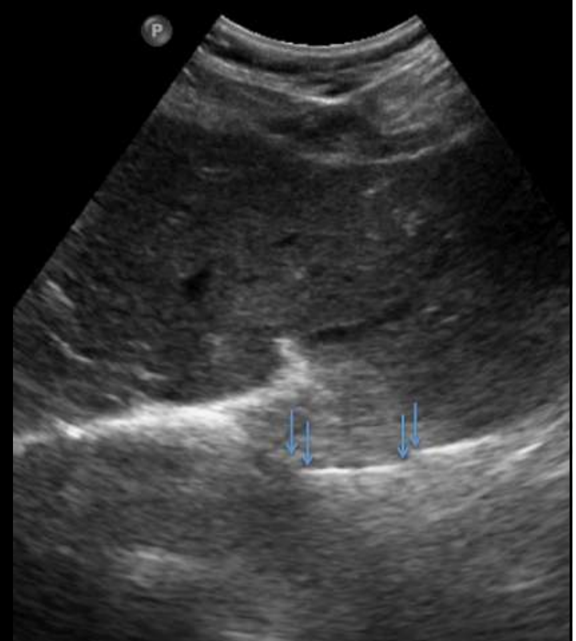
Speed Displacement Artifact

✳️ **What You Need to Know:**

- Occurs when ultrasound travels through tissue with a **propagation speed** that deviates from the assumed soft tissue average of 1540 m/s.
- Structures may appear **closer or farther** than they really are.
  - **Slower tissue (e.g., fat)** = structure appears too deep
    Faster tissue (e.g., muscle) = structure appears too shallow
- 🧠 *Remember: The system assumes a uniform speed of sound. Any deviation breaks that assumption!*



Apparent interruption of the liver–diaphragm interface due to speed displacement artifact. Case courtesy of Francesco Priamo, Radiopaedia.org, rID: 31691

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IUD/IUP; IUD creating reverberation artifact. Case courtesy of Mostafa Elfeky, Radiopaedia.org, rID: 78508

Reverberation Artifact: The Ping-Pong Effect

- Caused by **repeated reflections** between two strong, parallel reflectors.
- Produces **equidistant horizontal lines** decreasing in intensity.
- Seen near-field in structures like the **bladder, pleura, gallbladder**.
- Sound doesn't take a detour like in some of our previously reviewed artifacts—it **bounces back and forth**, like a ping-pong ball.

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Summary Comparison: Refreshing on Items We've Covered So Far

Artifact	Primary Cause	Echo Error	Common Appearance	Distinguishing Feature
Reverberation	Sound bouncing between two strong reflectors	Too many echoes (depth)	Horizontal, equally spaced lines	"Ladder-like" pattern; seen in bladder, gallbladder, pleura
Multipath	Echo takes indirect return via multiple surfaces	Echo arrives late	Deep, misplaced or duplicated structures	Deeper copy; less symmetrical than mirror image
Mirror Image	Echo bounces off strong reflector (e.g. diaphragm)	False copy across line	Symmetrical false duplicate	Common in liver/diaphragm or bladder; duplications look real
Refraction	Beam bends at oblique angle through speed-change zones	Echo shifted laterally	Side-by-side duplication	Requires different speeds + oblique angle; e.g., double aorta

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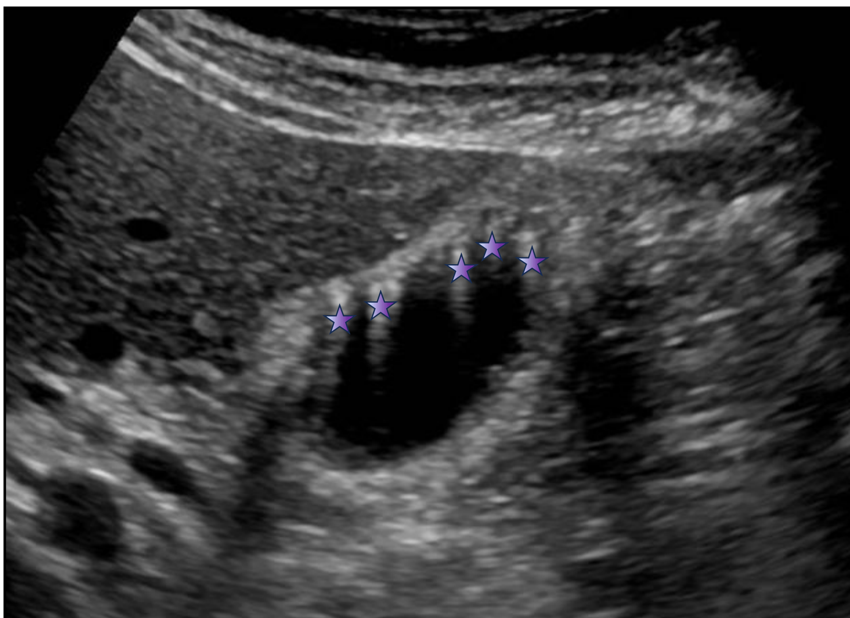

Comet-tail artifact from cholesterol crystals trapped in Rokitansky-Aschoff sinuses, gallbladder adenomyomatosis. Case courtesy of Vikas Shah, Radiopaedia.org, rID: 65505

Compressed Reverberation: Comet Tail Artifact

- **Cause:** Reverberations between two closely spaced, strong reflectors.
- **Common Sites:** Cholesterol polyps, surgical clips, metal fragments, IUDs.
- **Appearance:** Tightly spaced, tapering vertical lines distal to a strong reflector.
- **Clues:** Echogenic "tail" that diminishes with depth—short, sharp, and bright.

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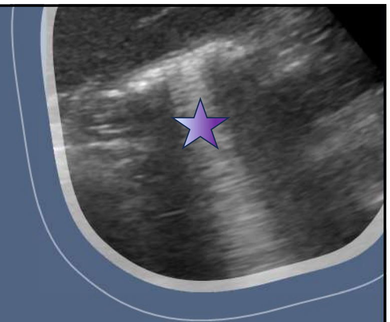
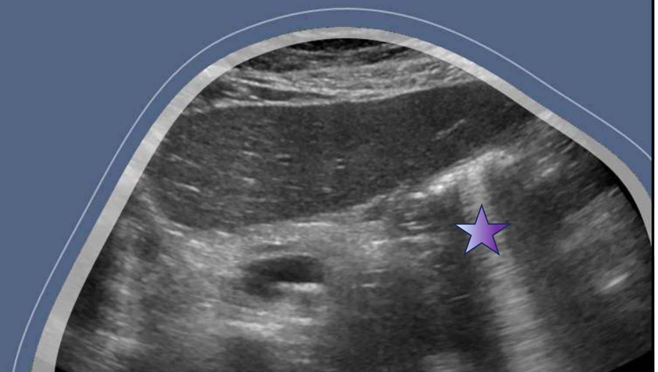
Compressed Reverberation: Ring Down Artifact

- **Cause:** Resonance of trapped gas bubbles within fluid.
- **Common Sites:** Gas-forming abscesses, pneumobilia, emphysematous cholecystitis.
- **Appearance:** Continuous vertical echogenic streak.
- **Clue:** Broad, sustained “pillar” of echoes posterior to gas.





Case courtesy of Matt A. Morgan, Radiopaedia.org, rID: 80953

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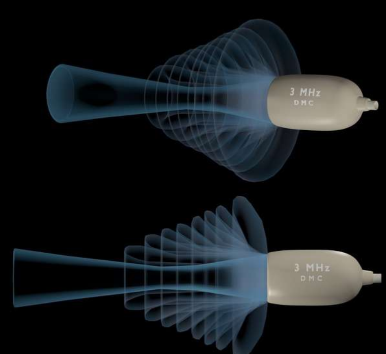
Lobe Artifacts

- **Cause:** Reflections from energy outside the main ultrasound beam (side lobes or beam width).
- **Appearance:** False echoes within anechoic or cystic structures.
- **Common Sites:** Gallbladder, bladder, cysts—any fluid-filled structure.
- **Diagnostic Tip:** Use TGC to lessen echo visibility from off-axis reflections, employ harmonics to suppress off-axis energy return, use proper focal zone placement.



Feature	*Side Lobes*	*Grating Lobes*
Occurs in	All transducers (mechanical & array)	Only in array transducers (linear, curvilinear, etc.)
Cause	Beam diffraction, secondary emissions	Improper element spacing, particularly >½ λ
Artifact Severity	Usually low-level echoes	Can produce **false duplicate structures**
Appearance	May cause fill-in of anechoic areas	Fill-in of anechoic areas; more disruptive, may mimic real structures
Suppression	**Apodization, focusing**	**Apodization** + **subdicing** (splitting crystals)
Example Artifact	Spurious echoes	Spurious or duplicate echoes

Case courtesy of David McGrath, Radiopaedia.org, rID: 46955

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Slice Thickness Artifact (Partial Volume)

- Caused by **partial volume averaging** in curved or fluid-filled spaces.
- Produces **false internal echoes, most noticeable in anechoic areas.**
- Most commonly seen at **fluid-tissue interfaces** or **curved boundaries**.
- To minimize: **choose a transducer with narrower beam width** and use appropriate focal zone placement.

Physics of Ultrasound, Honors Ultrasound Group of The Ohio State University College of Medicine; www.youtube.com/@jchanmeister, 6:08-7:17.

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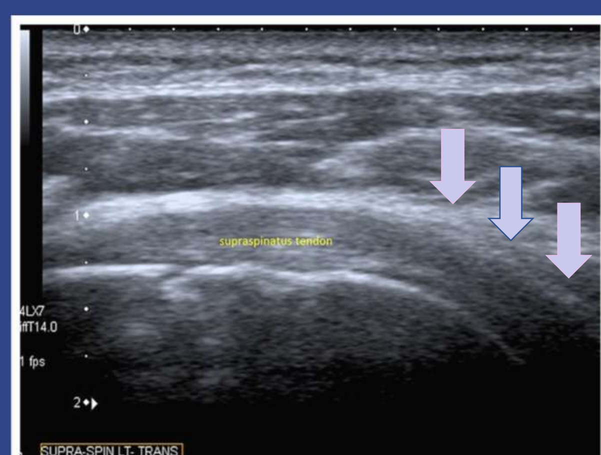
Anisotropy Artifact

- **Anisotropy** occurs when the ultrasound beam strikes linear fibrous structures—such as tendons, nerves, or muscles—at a non-perpendicular angle, leading to a hypoechoic appearance.
- Most commonly seen in **musculoskeletal imaging**, it can falsely mimic pathologies like tendon tears or fluid collections.
- The artifact results from angle-dependent reflectivity; echogenicity decreases as the transducer tilts away from 90° incidence.
- **Corrected by angle manipulation**—using the "heel-toe" or rock-and-tilt technique to restore perpendicular insonation and eliminate this decrease in echogenicity.



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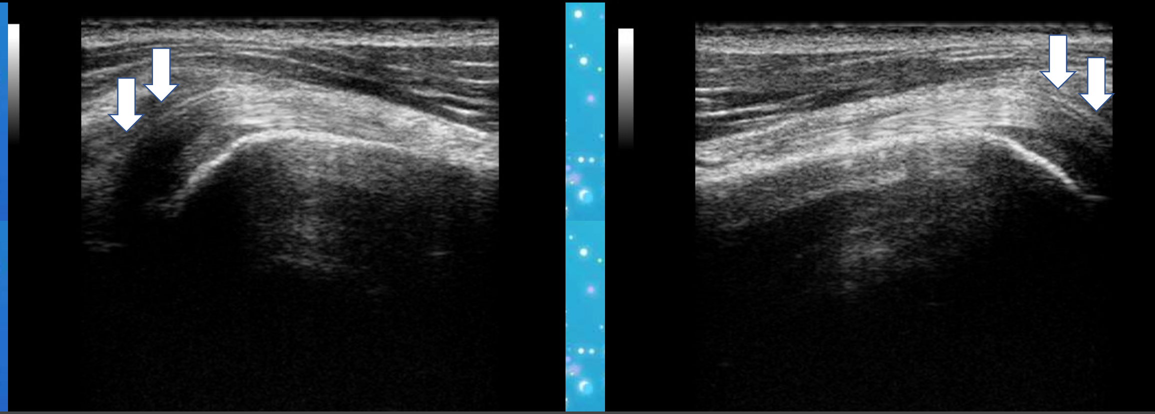
Anisotropy Artifact, cont.



- The decrease in echogenicity occurs as fibrils within muscle, tendon, or ligaments reflect sound away from the transducer.
- This prevents the transducer from receiving the full returning echo, and in turn, the region is demonstrated as hypoechoic.
- A greater returning echo is received by the transducer in regions where fibrils are perpendicular to the incident sound beam.

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Anisotropy Artifact

- Anisotropy must be differentiated from hypoechoic tendinopathy.
- Differentiation is achieved by modifying the transducer's angle of insonation.
- Anisotropy can be useful for confirming tendon position, as it is only producible in the linear tendon, while the surrounding nonlinear echogenic fat is unaffected.
- This creates an increase in contrast between the tendon and surrounding tissues.

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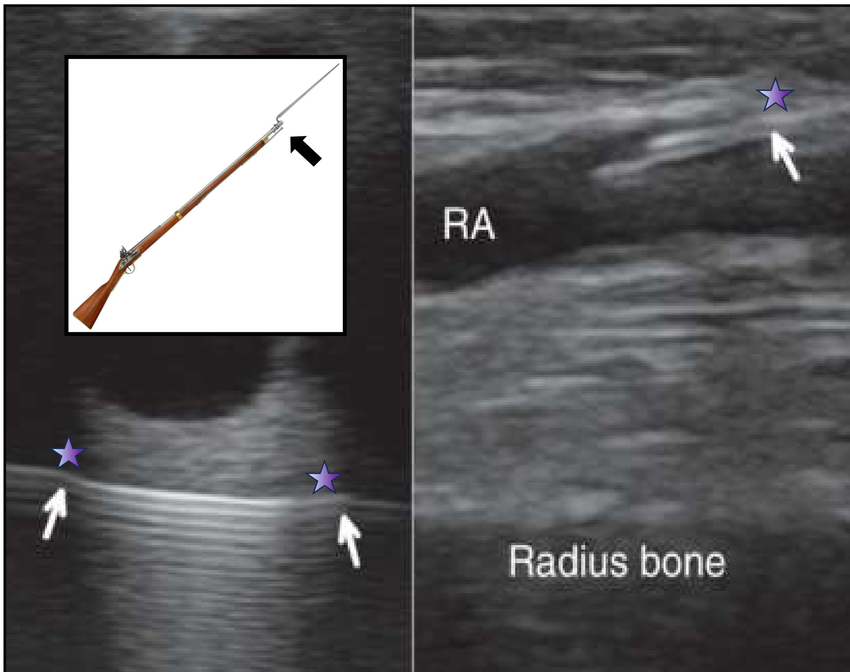

Bayonet Artifact

- Visual **distortion** of interventional tools (e.g., needle, wire).
- Caused by steep insertion angles or probe misalignment.
- **Needle appears bent** due to beam path or velocity mismatch.

Bayonet Artifact (Adapted from Reusz et al., 2014, figure 8)

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Flow Deceptions: Doppler Artifacts

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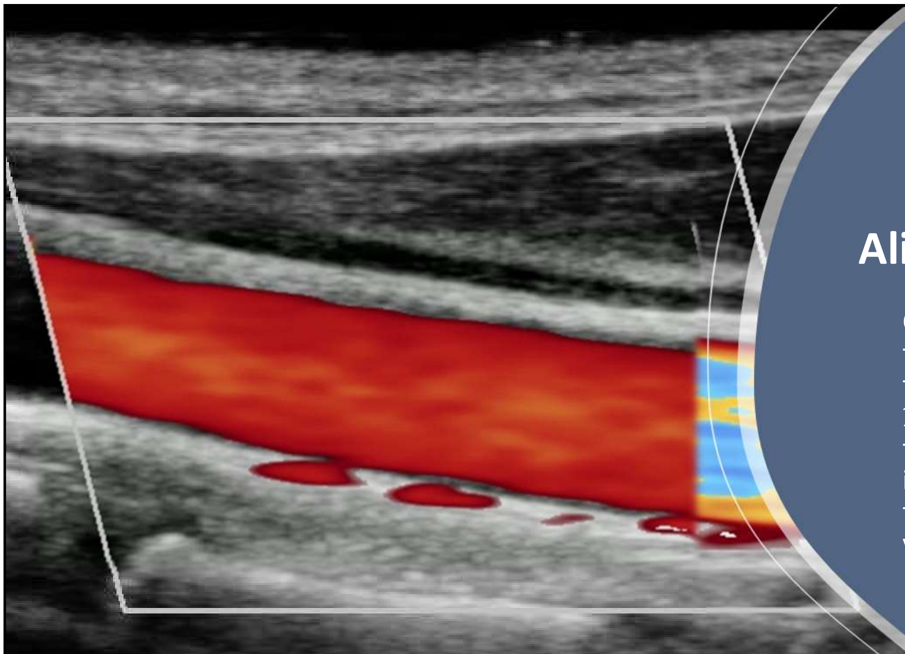

Aliasing Artifact

Occurs when the Doppler frequency shift exceeds the Nyquist limit (which is ½ the pulse repetition frequency [PRF]), resulting in a misrepresentation of flow direction and velocity.

Color Doppler evaluation of the common carotid artery demonstrates aliasing due to an excessively low pulse repetition frequency (PRF). During peak systole, flow velocities exceed the upper limit of the color scale, producing wraparound color display with blue hues. Case courtesy of Bálint Botz, Radiopaedia.org, rID: 64786

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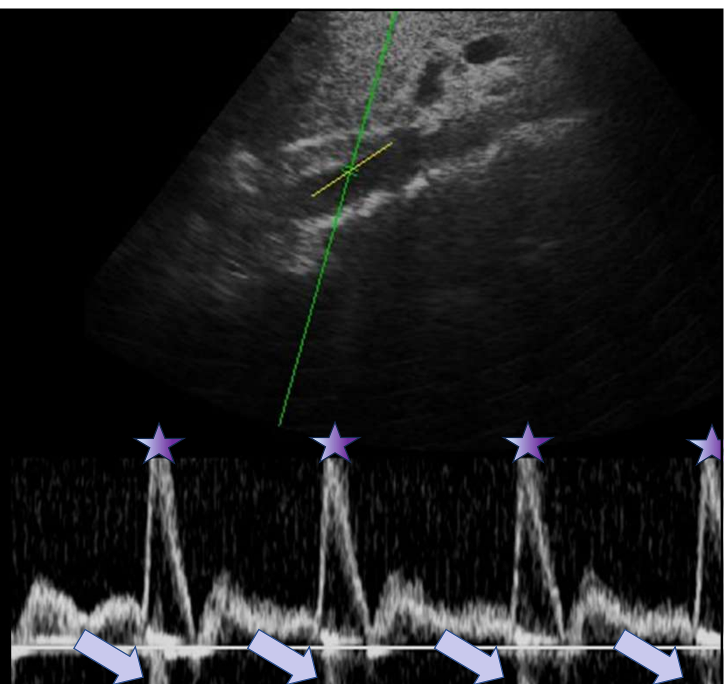
Aliasing Artifact: Pathophysiology & Appearance

- Appears as a *wraparound* of spectral waveforms — where high-velocity flow that should appear above the baseline is erroneously plotted below it (and vice versa).
- In Color Doppler Imaging (CDI), it presents as a color reversal or mosaic pattern.
- Common in high-velocity flow settings (e.g., ICA >70% stenosis).



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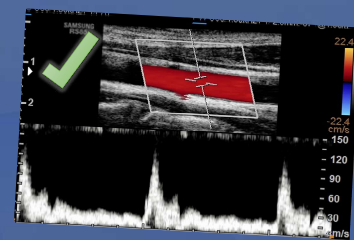
Aliasing Artifact: How To Fix It?



Solutions:

- Increase PRF (though limited by depth).
- Lower the transmitted Doppler frequency.
- Use a shallower sample gate.
- Shift the baseline to display more of the waveform above/below.
- **Switch to Continuous Wave (CW) Doppler**, which can measure any velocity but sacrifices range resolution.

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Range Ambiguity

- Occurs when echoes from multiple depths return at the same time, making it impossible for the system to determine their true origin.
- This is a **temporal artifact**—when the PRF is so high that the system emits a new pulse **before** all echoes from the previous pulse have returned.
- As a result, **deep signals may be incorrectly mapped as coming from shallow depths**.

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Range Ambiguity

- **Appearance:**
  - May look like duplicated or superimposed spectral signals.
  - In spectral Doppler, this mimics **turbulence or abnormal hemodynamics**.
- **Risk Factors**:
  - High PRF to reduce aliasing (ironically trades one artifact for another).
  - Imaging deep structures (e.g., renal arteries, iliac vessels).

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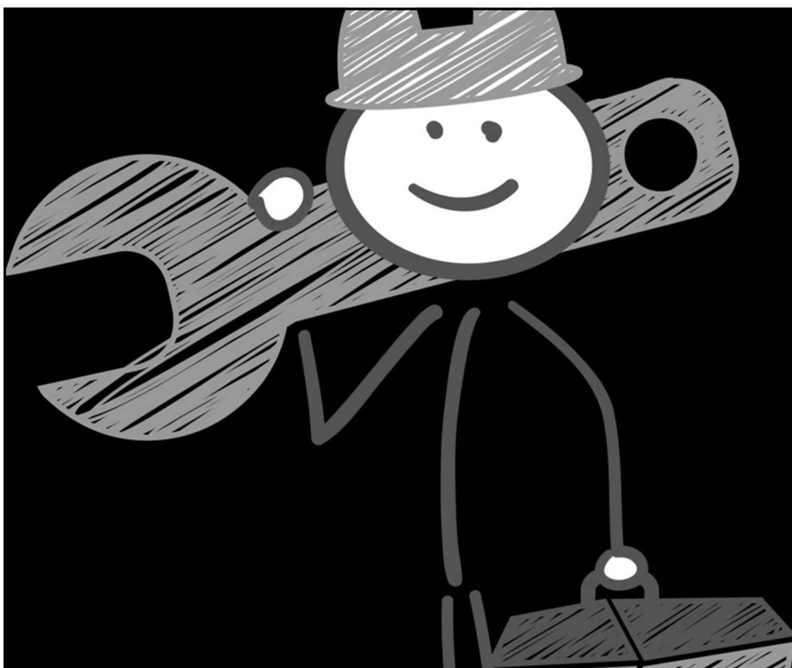

Range Ambiguity: How To Fix It?

Solutions:

- **Lower the PRF** to allow echoes from deeper tissues time to return.
- Use a **shallower sample volume** or reposition the transducer to reduce depth.
- Consider a **different acoustic window**.

Educational Insight:

- This artifact underscores the **tradeoff between depth and resolution**.
- You cannot have infinite depth detection and high frame rates simultaneously—each compromise impacts temporal or spatial accuracy.

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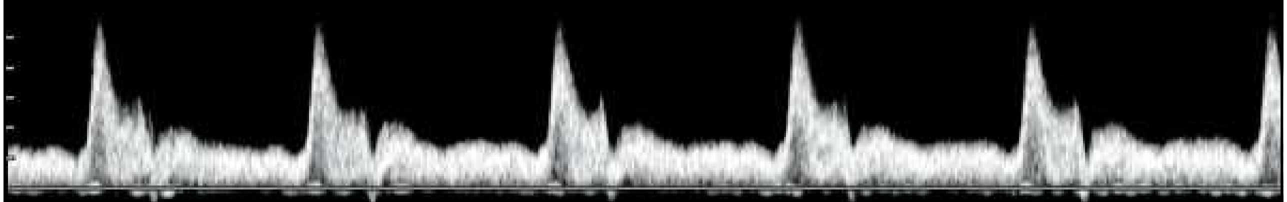
Spectral Broadening

- Spectral broadening refers to the **widening of the Doppler spectral envelope**, indicating a range of velocities within the sample volume.

True Spectral Broadening:

- Represents **turbulent or disturbed flow**, where many velocities exist at once (e.g., post-stenotic turbulence).
- Appears as a “filled-in” spectral window.



Case courtesy of Bálint Botz, Radiopaedia.org, rID: 74129

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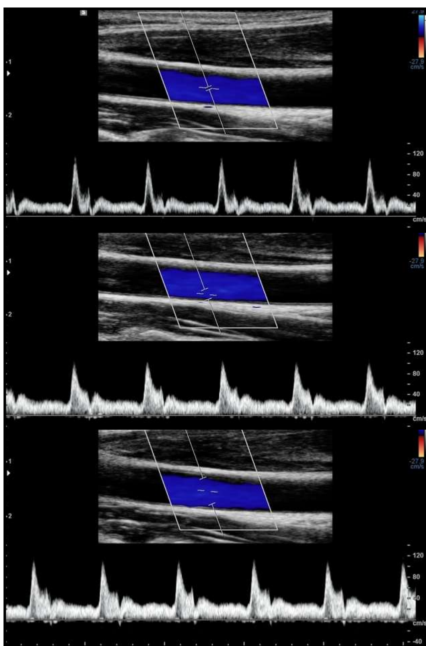

No spectral broadening

Off-center sample gate

Too-broad sample gate

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Spectral Broadening: Close Assessment

Solutions:	Narrow the sample volume.	Adjust the Doppler angle and ensure proper vessel alignment.	Reduce gain and optimize filter settings.
Educational Insight:	While true spectral broadening helps diagnose conditions like **carotid stenosis or AV fistulas**, false broadening is a **common pitfall**.	Always correlate with vessel anatomy and color Doppler to avoid overcalling disease.	**Context and optimization are everything** in Doppler interpretation.

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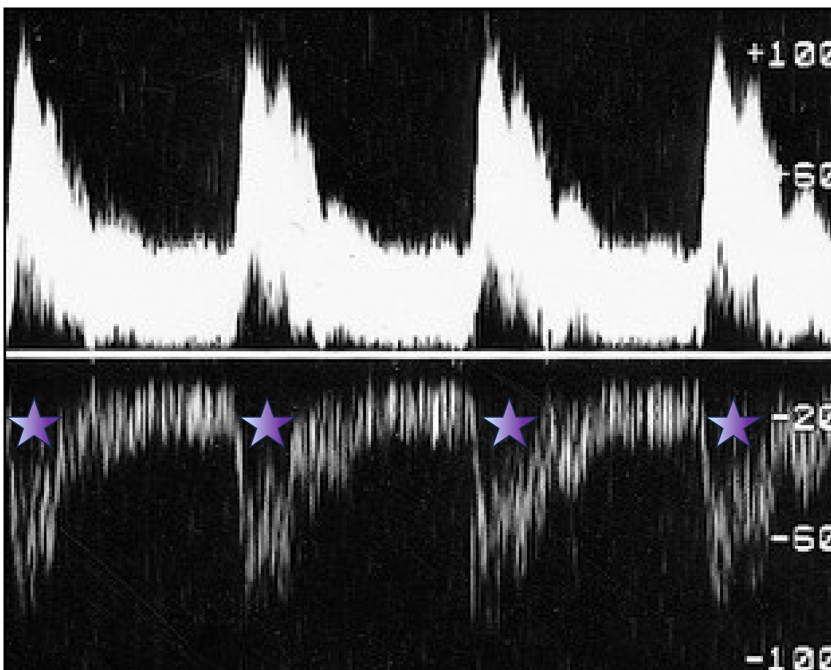

https://radiologykey.com/factors-that-influence-the-doppler-spectrum/

Crosstalk (Spectral Mirroring)

- Crosstalk is a **spectral Doppler artifact** that causes **mirrored waveforms** to appear on both sides of the baseline. It is a **form of spectral duplication**, but unlike true bidirectional flow, it does not represent actual reverse blood flow.

🎯 **Causes:**

  - **Excessive Doppler gain**, causing signal "bleed" across the baseline.
  - **Angle of insonation near 90°**, reducing the ability to detect directionality.
  - **Poor beam focusing** or **overlapping signals** from adjacent reflectors.

- **Not true bidirectional flow**—it's an artifact.

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Crosstalk: How To Fix It?

https://depositphotos.com/vector/female-ultrasound-specialist-97635260.html

🛠 **Correction:**

- Lower the Doppler gain until the true signal remains.
- Optimize beam-to-flow angle (ideally <60°).
- Adjust sample gate and ensure correct vessel alignment.

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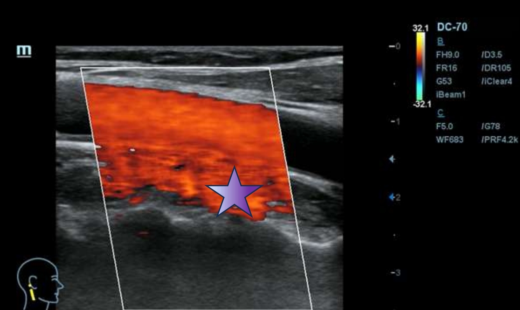
Blooming Artifact: Color Doppler Overgain

🔍 **What It Is:**

Blooming occurs when **color Doppler signals extend beyond the boundaries** of a vessel wall.

🎯 **Causes:**

- **Overgained color Doppler**, resulting in signal spill.
- **Low wall filter settings**, allowing more signal spread.



Case courtesy of Bálint Botz, Radiopaedia.org, rID: 64630

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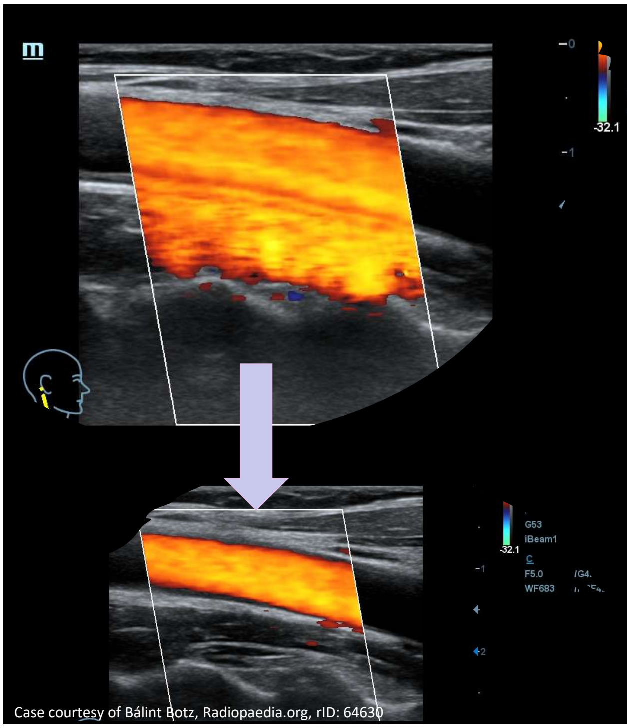

Case courtesy of Bálint Botz, Radiopaedia.org, rID: 64630

Blooming Artifact: How To Fix It?

🛠️ **Correction:**

- **Decrease the color gain** until flow appears confined to the lumen.
- Use a **smaller color box** and **higher frequency** to sharpen edges.
- **Increase wall filter** if needed to suppress low-frequency noise.

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Color Flash Artifact: Motion-Induced Doppler Noise

🔍 **What It Is:**

Color flash is a **transient color Doppler signal** produced by **motion**, rather than blood flow. It often appears as **random flashes of color** in parenchyma or soft tissue, mimicking vascularity.

🎯 **Causes:**

- **Anatomical movement (i.e., heart, diaphragm, fetal)**.
- **Unsteady transducer hand**.
- **Rapid gain adjustments** during scanning.
- Low wall filter setting allowing minor motions to be interpreted as flow.

Philippe Jeanty and www.TheFetus.net; reproduced with permission.

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Color Flash Artifact: Assess and Correct

🛠 **Correction:**

Increase **wall filter** to suppress low-frequency tissue motion.

Minimize transducer motion; use a **light and steady hand**.

Observe for **persistence**—real flow has continuity, while flash is sporadic and motion-related.

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Ghosting/Clutter (Wall Motion Artifact)

- **Ghosting Artifact (Color Doppler):** Low-velocity tissue motion (e.g., vessel wall pulsation, probe movement) appears as false color flow—often symmetrical and peripheral to real flow.
- **Clutter Artifact (Spectral Doppler):** Low-amplitude, non-phasic echoes appear near the baseline, simulating low-velocity blood flow.
- **Common Causes:** Excessive gain, low wall filter settings, patient motion, probe instability.
- **How to Reduce:** Increase wall filter, reduce color or Doppler gain, hold the transducer steady, avoid 90° beam-to-flow angles.

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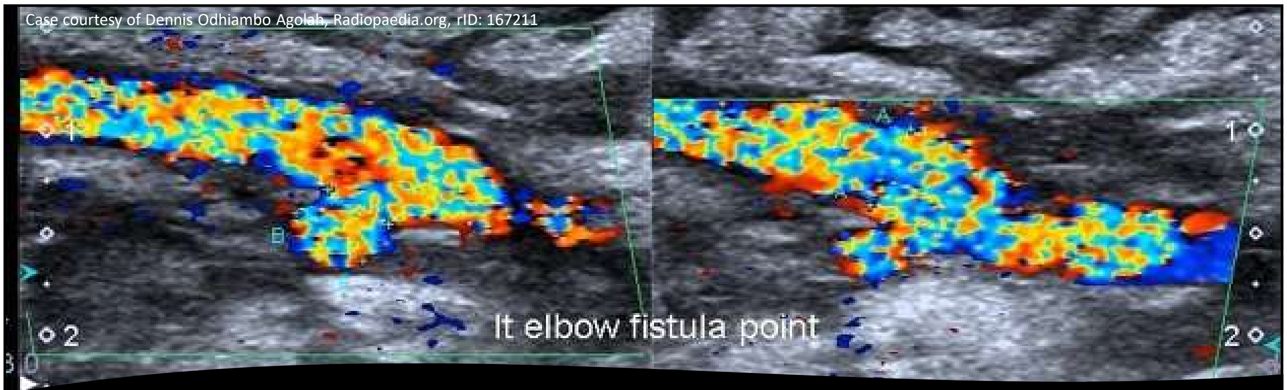

Color Bruit Artifact (Tissue Vibration)

- Color signal radiates into perivascular tissue.
- Associated with stenosis, AV fistula, or shunts.
- Helpful sign for localizing high-velocity jets.

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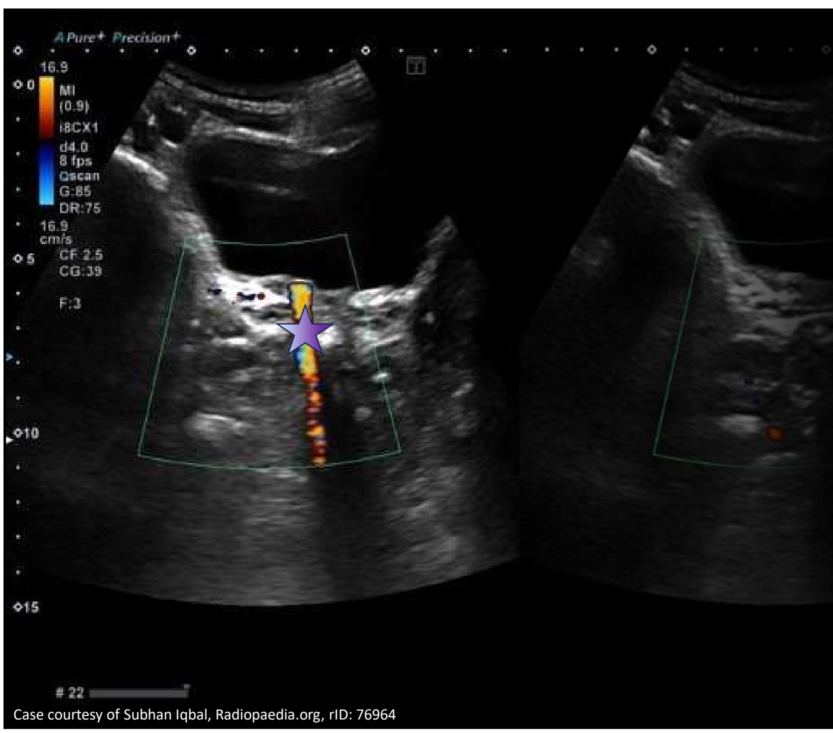

Twinkle Artifact: A Calculus Clue

- Appears as rapid, alternating color Doppler signals behind echogenic reflectors.
- Often seen in association with renal or biliary calculi.
- May be more sensitive than posterior shadowing in detecting small stones.
- Caused by phase jitter: chaotic reflectivity due to irregular surfaces.

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Equipment & Environmental Artifacts

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Electrical Interference Artifact

- Appears as horizontal or vertical banding, flickering lines, or rhythmic striping.
- Caused by nearby electronics—lights, monitors, powered beds, wall current, nearby imaging equipment (recall MRI story).
- Can obscure Doppler or mimic motion; look for recurring patterns across scans.
- Troubleshoot by unplugging nearby devices, relocating the unit, or when all else fails, calling for equipment analysis.

https://www.youtube.com/@akhmadiusg5199

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Hardware-Related & Transducer Artifacts

- **Hardware-related and transducer artifacts** may originate from internal failures such as dead or weak piezoelectric elements, producing dropout lines or complete anechoic bands on the image.
- Present vertically or horizontally depending on array configuration.
- Damaged elements, internal wiring degradation, or acoustic delamination can also lead to production of artifacts.
- **Routine phantom testing**, **QC protocols**, and routine transducer inspection allow for early detection.
- 🎯 When in doubt, **always verify with a second transducer or system** to differentiate between pathologic process or faulty equipment.

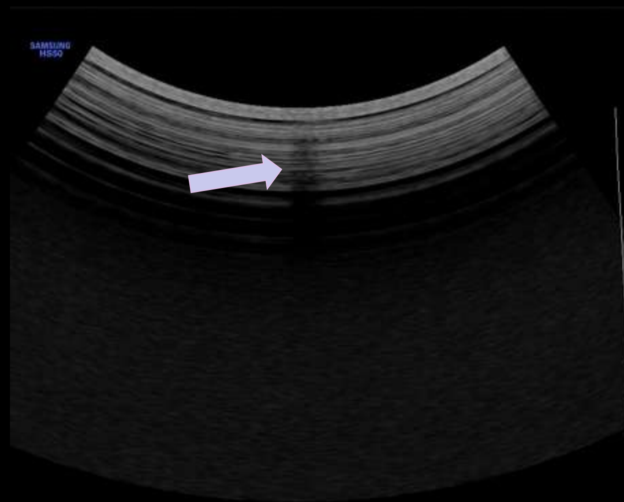

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Image Optimization

What tools are in our toolbox?

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Harmonic Imaging

- **Harmonic imaging leverages non-linear wave propagation**, capturing echoes at higher frequencies generated within tissues.
- It **reduces near-field clutter, side lobe artifacts, and reverberation** to enhance contrast and border definition in technically difficult patients.
- However, harmonics may **suppress low-level echoes** such as sludge, debris, or microbubbles, potentially masking important subtle pathology.
- Sonographers should **toggle harmonic imaging on and off** when evaluating cystic and vascular structures.

Figures 4-1 and 4-2. https://radiologykey.com/tissue-harmonic-imaging-and-doppler-ultrasound-imaging/

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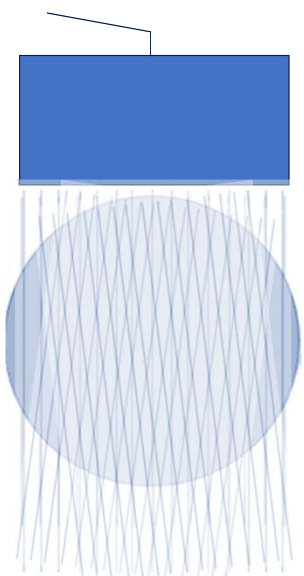

Spatial Compounding

- **Spatial compounding acquires echoes from multiple steering angles**, then integrates them into a single real-time frame.
- This reduces **noise**, **lobe artifacts**, and **posterior acoustic features**, like shadowing (e.g., from stones) or enhancement (e.g., behind cysts).
- **Trade-off:** Spatial compounding degrades temporal resolution.
- **Machine-specific implementations** include GE's *CrossXBeam*, Philips' *SonoCT*, and Canon's *ApliPure+*—often toggled in preset or "advanced imaging" menus.

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Focal Zone and Gain Adjustment

- **Focal zone** should be placed **at or just below** the area of interest.
- Correct placement enhances **lateral resolution**, improving margin and interface clarity.
- **Overall gain** controls global brightness; **TGC** allows depth-specific fine-tuning for uniform brightness.
- **Over-gaining** can obscure pathology, while **under-gaining** may falsely render echo-containing structures as anechoic.

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Doppler Optimization

- **Adjust PRF and wall filter** based on expected flow velocity and vessel type.
- Keep **Doppler angle ≤ 60°** to ensure velocity accuracy and avoid cosine error.
- Use a **small sample gate** placed in the center of the vessel and a **narrow color box** to improve frame rate.
- **Dynamic adjustments** during scanning are needed to accommodate flow variability.

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Clinical Impact of Cosine Error

- At **0°**, the cosine is 1.0, meaning **100% of the Doppler shift is detected**, and calculated velocity is accurate (not always practically achievable)
- At **60°**, the cosine is 0.5 — half of the velocity is reflected in the signal.
- At **75°**, cosine drops to 0.26 — which causes serious **underestimation** of actual flow velocity.

The Doppler equation is:

$$f_D = \frac{2 f_0 v \cos(\theta)}{c}$$

Where:

- f_D is the Doppler shift
- f_0 is the transmitted frequency
- v is the velocity of blood flow
- θ is the Doppler angle
- c is the speed of sound in tissue (~1540 m/s)

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Why 60 Degrees Is Widely Accepted: Cosine

- **60°** is widely accepted in clinical practice as the **maximum recommended Doppler angle** because it represents a **balance between accuracy and practicality**. Here's why:
- Cosine of 60° = 0.5
  - At 60°, the cosine is **0.5**, meaning the Doppler shift (and calculated velocity) is **only half of the actual velocity**.
  - To correct for this, ultrasound systems **use angle correction** and **divide the measured Doppler shift by the cosine of the angle** to estimate the true velocity.

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Why 60 Degrees Is Widely Accepted: Cosine

- At 60°, **cos(60°) = 0.5**
- The system calculates:
  - True velocity = Observed Doppler shift / 0.5
  - 🔁 So — **the system effectively doubles** the measured shift to estimate the true velocity.
- Small **errors in angle correction** (like misaligning 65° instead of 60°) lead to **larger velocity calculation errors**.
  - For example:
    - **cos(60°) = 0.5**
    - **cos(70°) = 0.342**
    - *Just a **10° difference causes a 31% error** in cosine, and therefore velocity!*

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Why 60 Degrees Is Widely Accepted: Practicality

- Angles lower than 60° are more accurate (cosine closer to 1.0), but often **hard to achieve in practice** due to patient anatomy and transducer positioning.
- 60° strikes a **practical compromise**: relatively easy to achieve, and still yields reasonably accurate velocity estimates.

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Why Not Go Beyond 60°?

- ⚠️ As the **Doppler angle approaches 90°**, **cosine approaches 0**, and **errors become extreme**.
- At 80°, for instance, **cos(80°) = 0.17** — any small mistake in angle correction causes massive velocity miscalculations.
- At 90°, **cos(90°) = 0**, meaning **no Doppler shift is recorded at all** — you're insonating perpendicular to flow.

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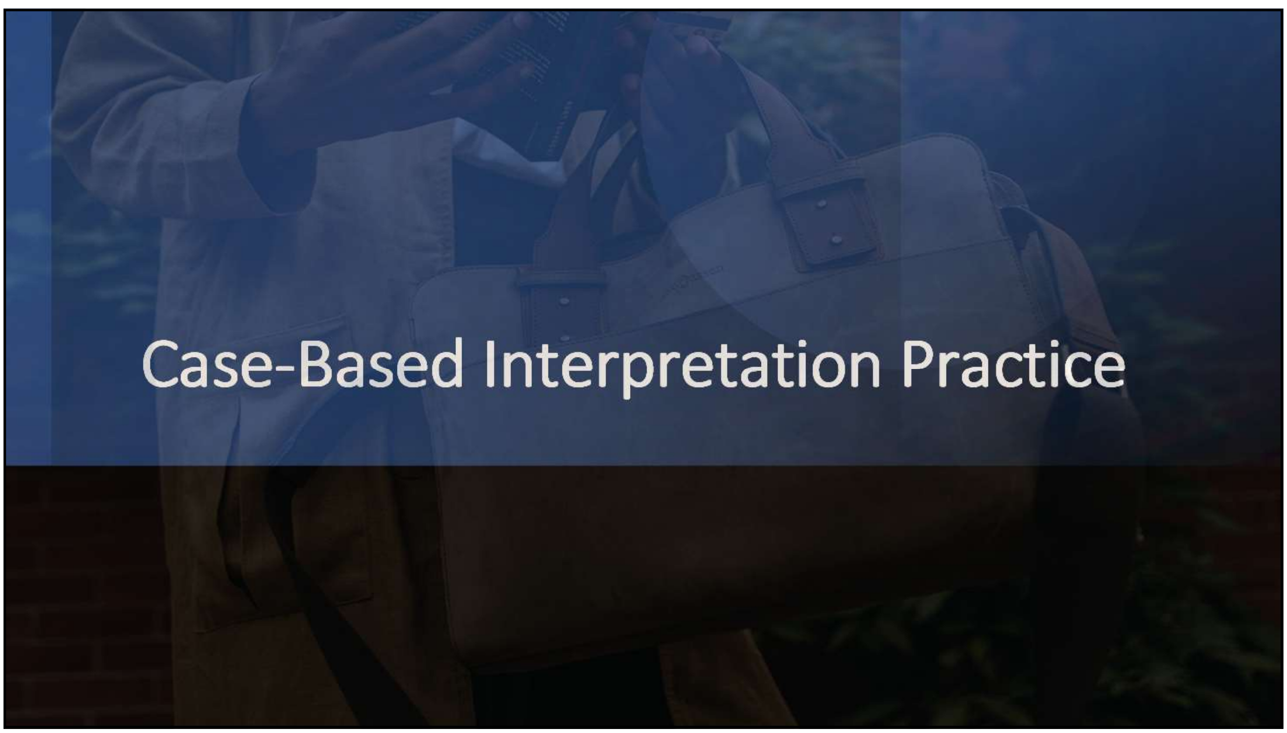

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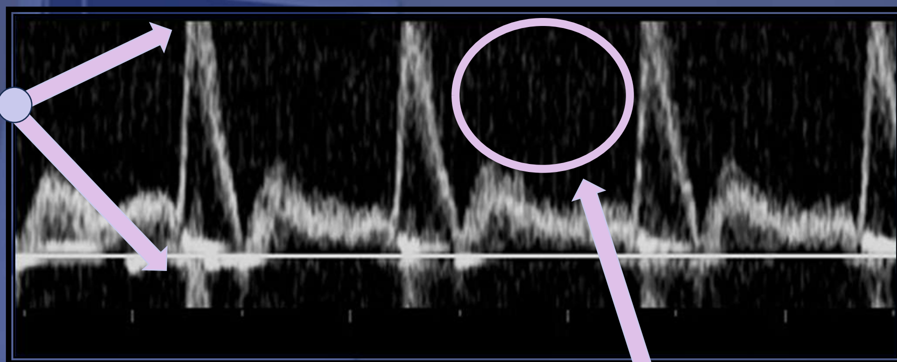
Interactive Case Gallery: What’s Wrong?

Aliasing



Noisy Display Background

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Interactive Case Gallery: How Do We Fix It?

Aliasing Correction with PW-Imaging:

- Increase PRF
- Lower baseline
- Shallower sampling location
- Lower frequency transducer

Noisy Display Background Correction:

- Decrease spectral gain

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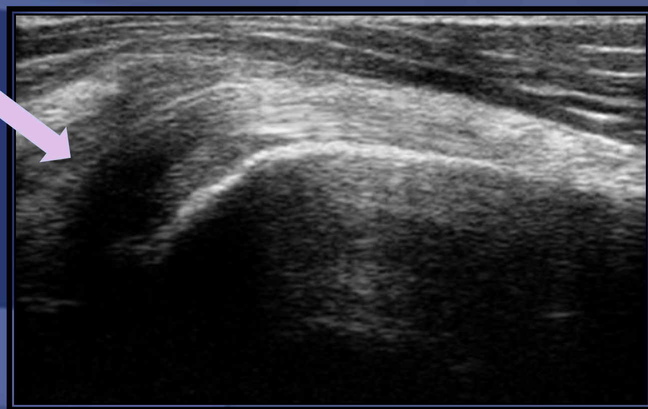
Interactive Case Gallery: What's Wrong?

Anisotropy



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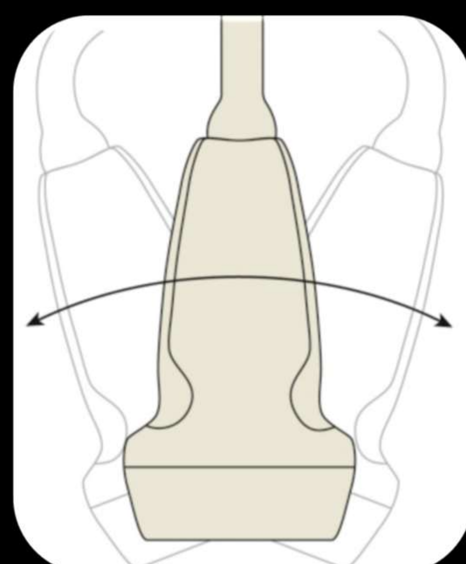
Interactive Case Gallery: How Do We Fix It?

- Ensure the sound beam is perpendicular to the tendon or ligament.
- Rock or heel-toe the probe to **adjust angle of insonation.**
- Use dual-image or cine loop to compare before and after angle correction.
- True pathology confirmed only if hypoechogenicity persists after adjustment.



https://radiologykey.com/introduction-48/

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Clinical Significance & Wrap-Up

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Diagnostic Impact of Misinterpreted Artifacts

- Misread artifacts can lead to **unnecessary imaging, biopsies, or surgery**.
- Missed pathology may delay **life-saving interventions**.
- Overestimation may cause **patient anxiety or overtreatment**.
- Accurate interpretation ensures **appropriate, timely care**.

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Sonographic Reasoning – A Decision Framework

- **Is it reproducible?** Artifacts often change with angle or approach.
- **Does it move with the probe?** Artifacts may shift; pathology typically does not.
- **Does Doppler confirm or refute?** True flow supports real structures.
- **Does image optimization resolve it?** If it disappears, it may not be real.

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Summary & Takeaways

- Artifacts can be both **diagnostic allies and confounding traps**.
- Recognize **patterns** and use the tools in your toolbox to assess.
- Confident scanning = **reliable interpretation + better patient care**.
- Let's wrap up with a Q&A session to test your knowledge!

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Q&A

Which grayscale ultrasound artifact produces a symmetrical duplication of an anatomical structure across a highly reflective interface, with the duplicate image appearing deeper than the true anatomical structure?

A. Refraction
B. Reverberation
C. Mirror Image Artifact
D. Crosstalk

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Q&A

Mirror Image Artifact

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Q&A

Which grayscale ultrasound artifact appears as vertical echogenic bands extending posteriorly from **gas** collections or bubbles?

A. Comet tail
B. Ring down
C. Reverberation
D. Refraction

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Q&A

Ring Down Artifact

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Q&A

While performing spectral Doppler analysis, you notice that the waveform is symmetrically mirrored across the baseline. The insonation angle is near 90°, and the Doppler gain appears elevated. Which artifact is most likely present?

A. Aliasing
B. Mirror image artifact
C. Spectral broadening
D. Crosstalk

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Q&A

Crosstalk

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Thank You

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