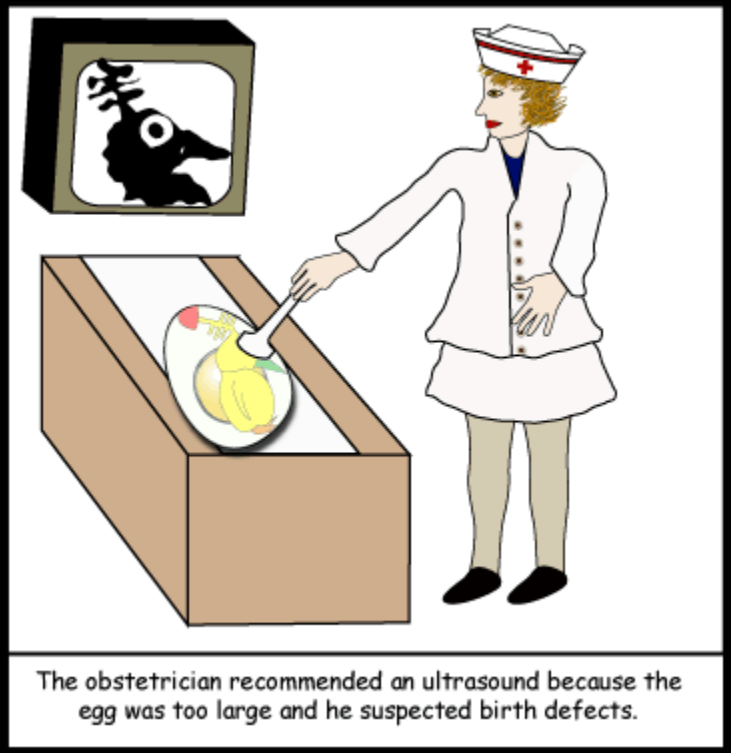
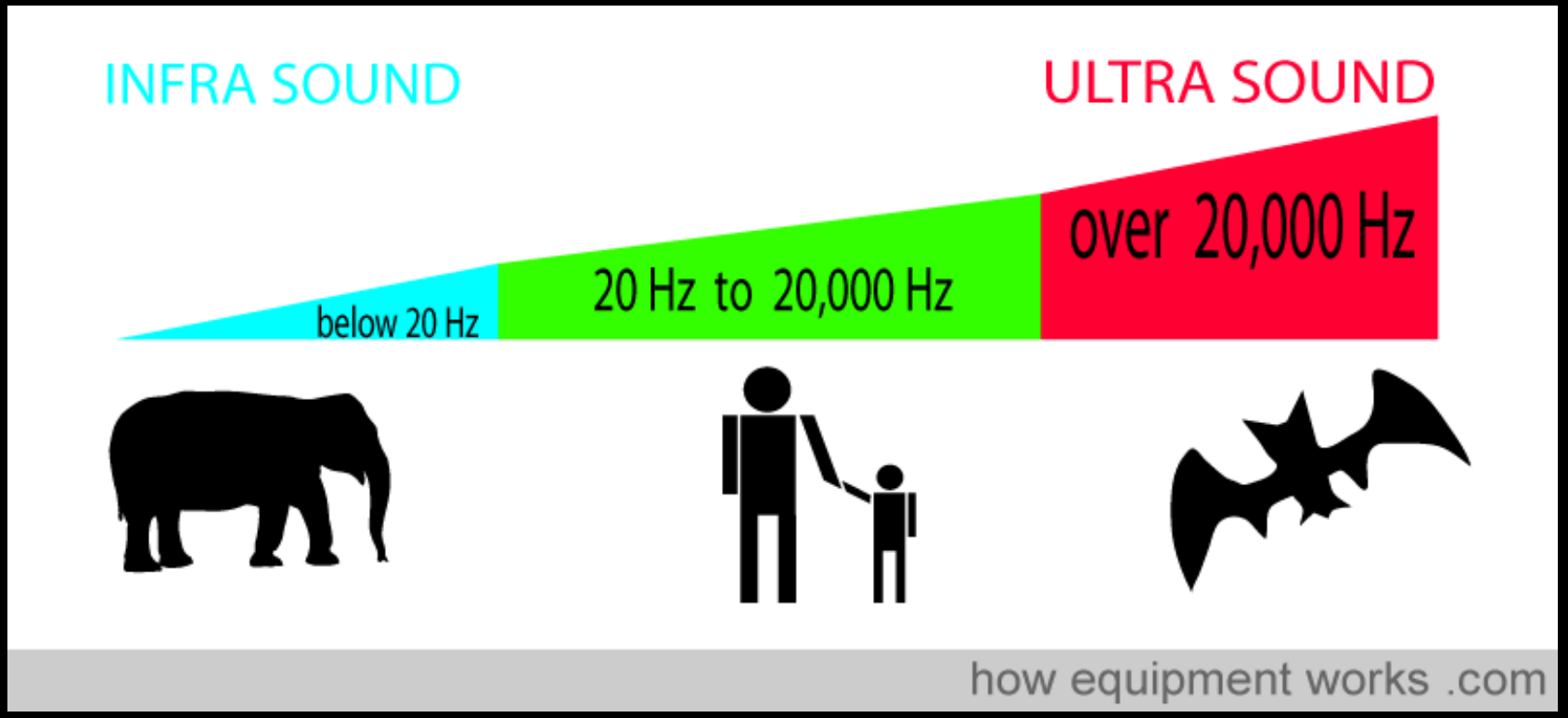
ULTRASON İNCELEMESİNİN ABC'Sİ



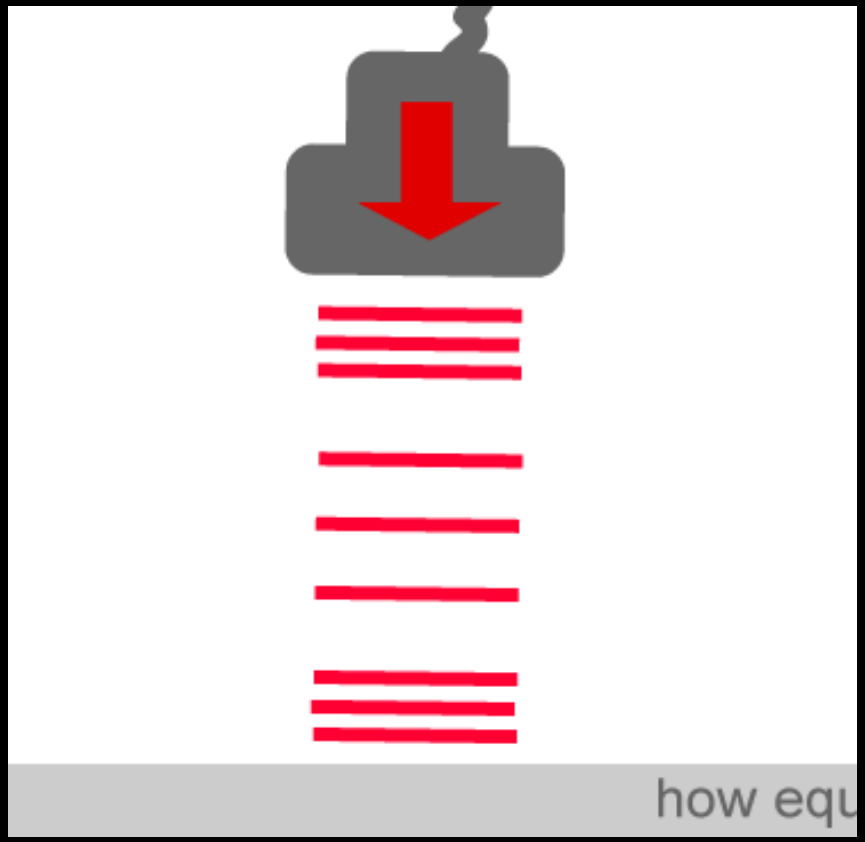
- Dr. Semih AYTAÇLAR

SES

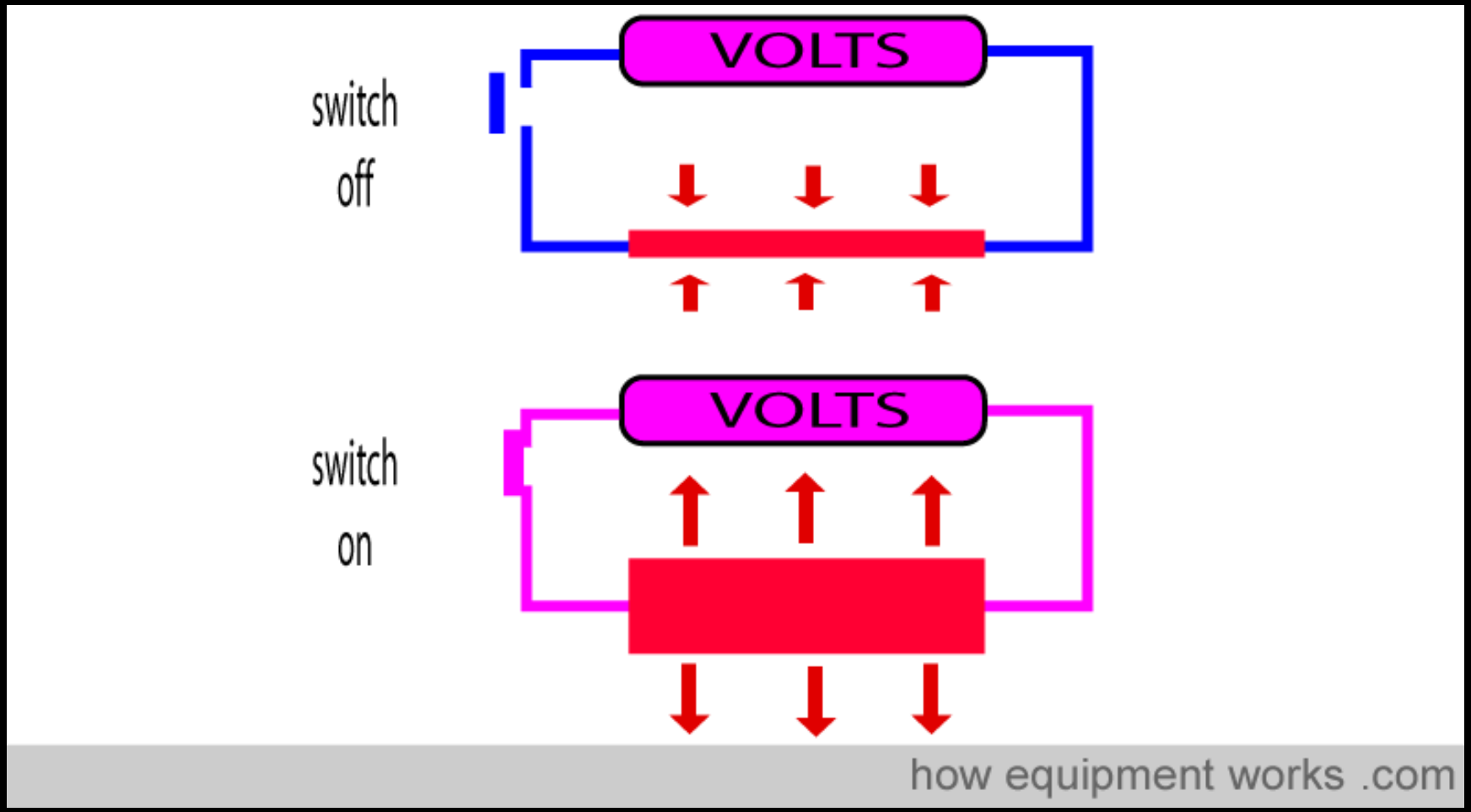
US 2-20 MHz


INFRA SOUND
ULTRA SOUND
below 20 Hz
20 Hz to 20,000 Hz
over 20,000 Hz
how equipment works .com

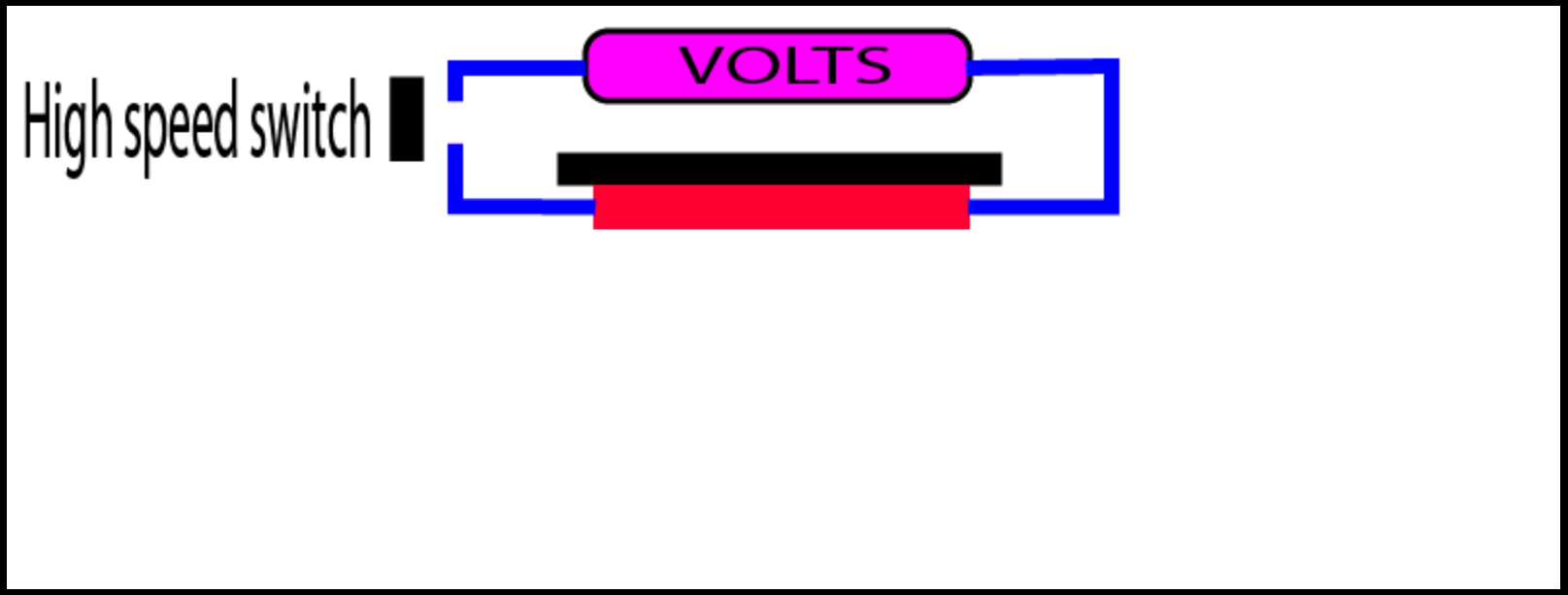
DOĞA - TEKNİK



Piezoelekrik kristal



Piezoelektrik Kristal

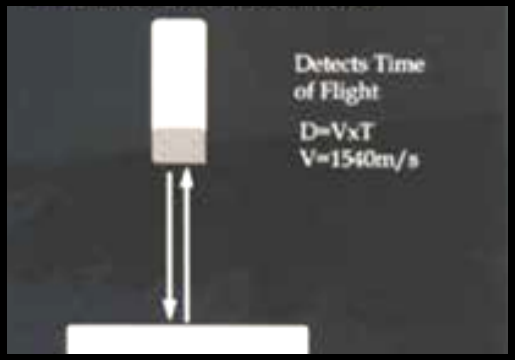


SESİN YAYILIMI

- Ses enerjisi ortamda hareket eden küçük vurularla oluşturulur
- Enerji probun yönüne paralel longitudinal dalgalar biçiminde yayılır

VURU - YANKI

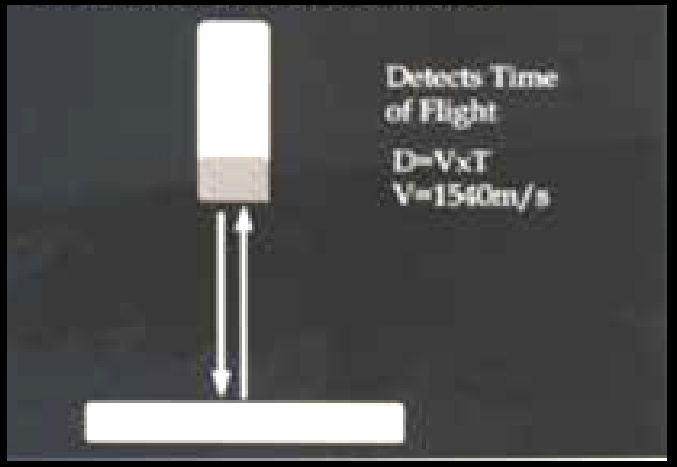
- Ultrasonda vuru-yankı formatı geçerlidir.
- Kısa aralıklarla yollanan ses dalgaları doku arayüzeylerinde yansıyarak cihaza döner

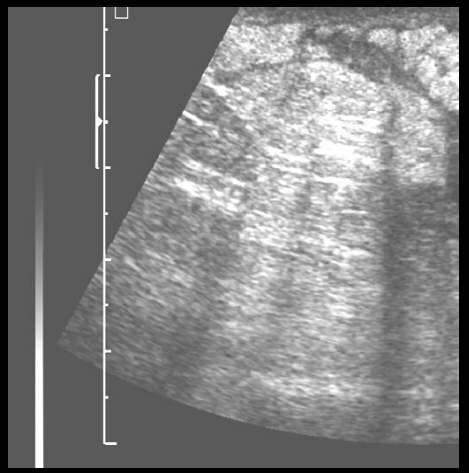


ULTRASONİK GÖRÜNTÜ
PRF

DERİNLİK - UZAKLIK

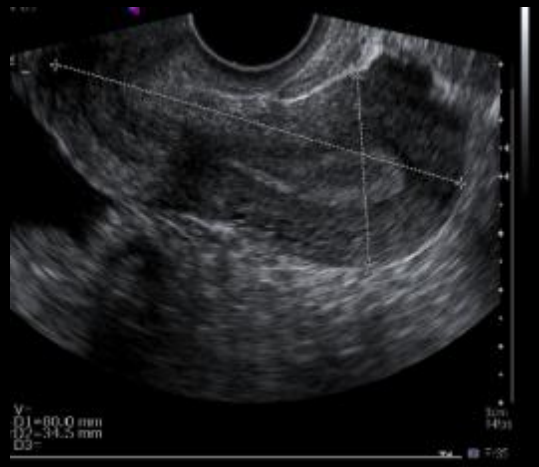
- Ultrason dalgasını yansıtan dokunun derinliği yollanan dalga ile geri gelen dalga arasındaki zamana göre belirlenir ve dönen dalganın şiddetine göre gri rengin tonları ile kodlanır.

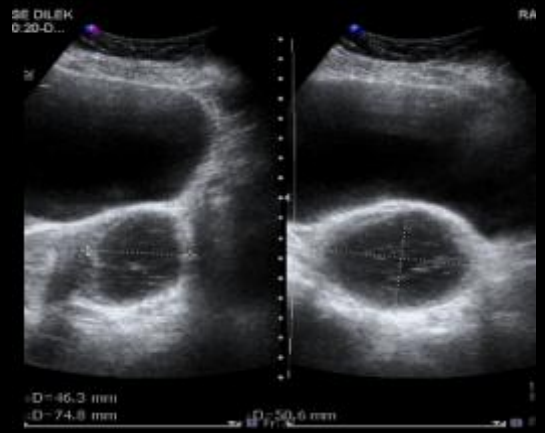




İŞLEM

- Ultrason iki boyutlu görüntüye ek olarak
  - anatomik uzaklık,
  - volümetrik ölçümler,
  - harekete dayanan çalışmalar,
  - kan hız ölçümleri ve
  - 3 boyutlu görüntülemeye de olanak tanır.

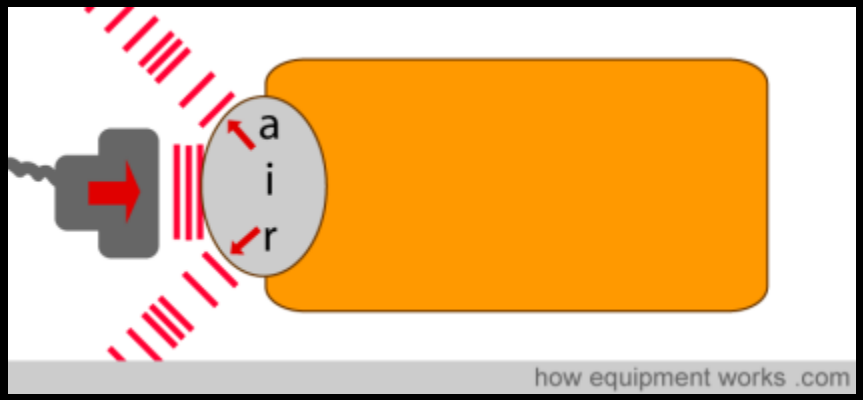


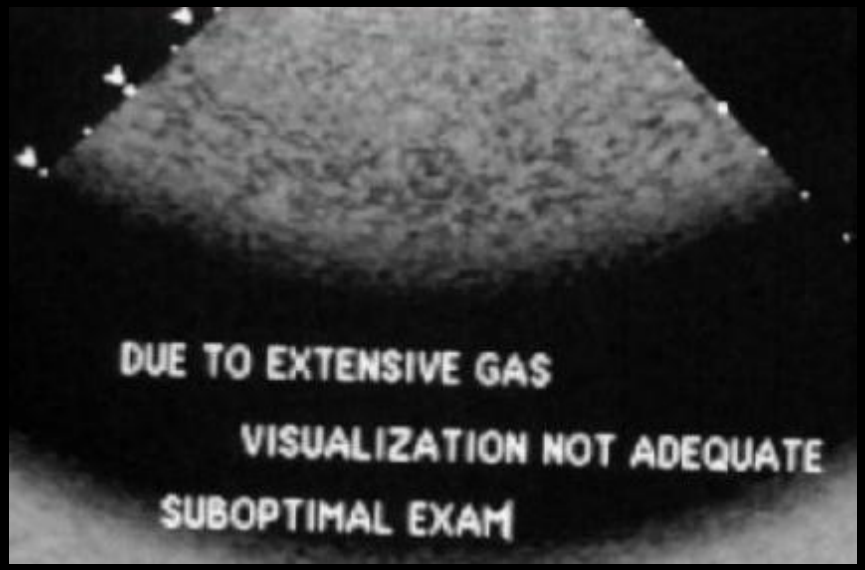


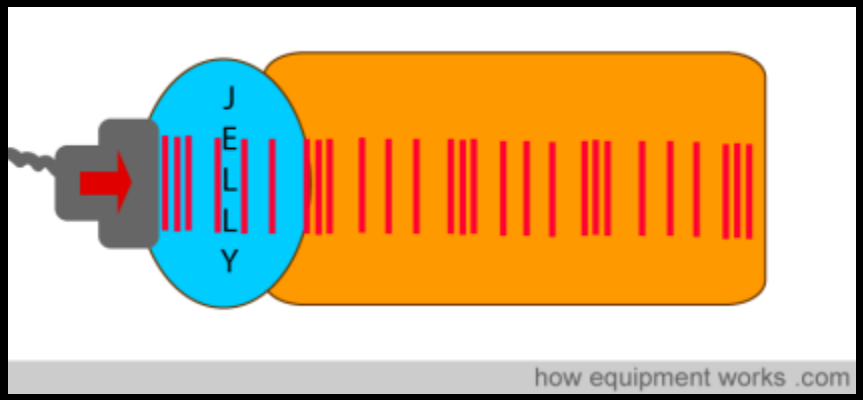
SES - DOKU İLİŞKİSİ

	Density kgm^{-3}	*Velocity* ms^{-1}	*Impedance* 10^{-6} kg/m^2s	α *dB/cm*
Air	1.20	344	0.00043	11.9
Lung	400	650	0.26	
Fat	920	1467	1.33	0.60
Water	1000	1520	1.48	2.2×10^{-4}
Brain	1030	1504-1612	1.55-1.66	0.85
Kidney	1040	1558	1.62	0.78
Liver	1566	1566	1.66	0.96
Myocardium	1070	1561-1626	1.67-1.74	1.3-3.2
Skull bone	1380-1810	2717-4077	3.75-7.38	11.3-20

Hava = Ultrasonun düşmanı






J
E
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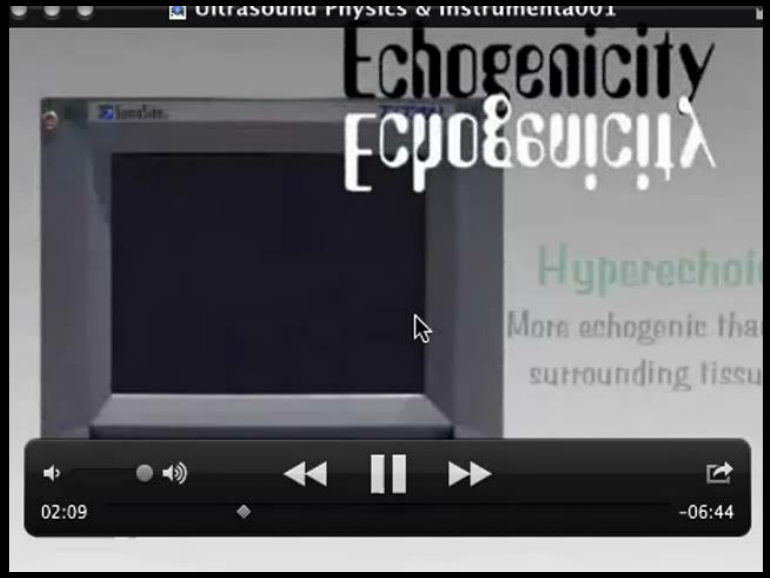
Y
how equipment works .com

SES – DOKU İLİŞKİSİ
ATENÜASYON

EKOJENİTE –DÖNEN SESİN GÜCÜ

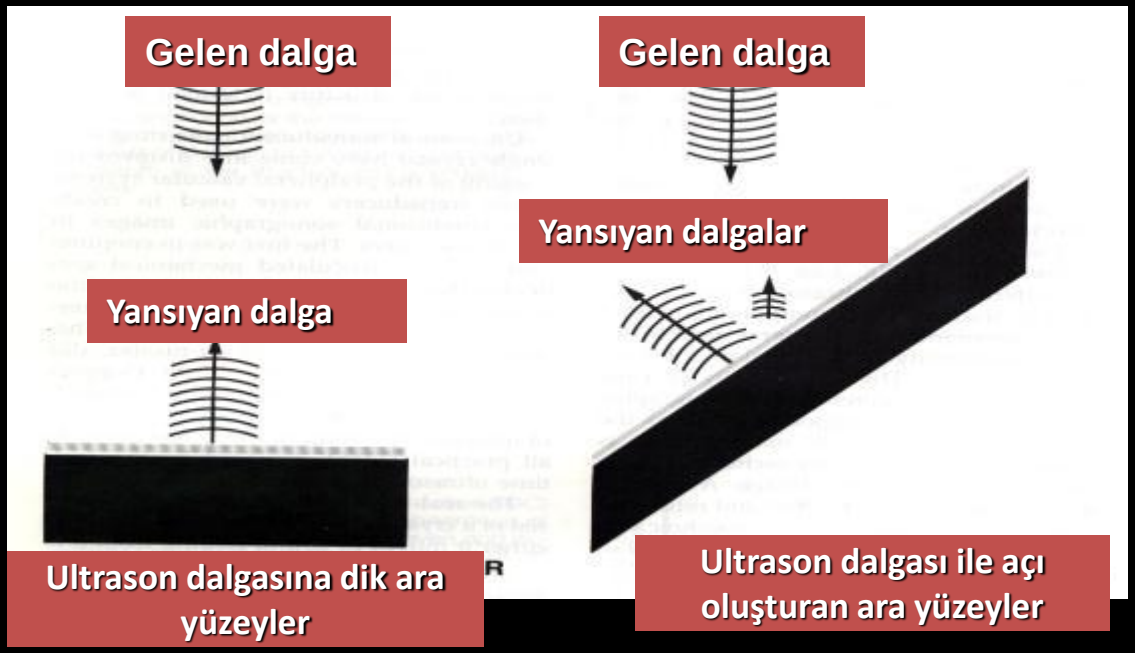


- DÖNEN SESİN GRİ SKALASI
  - EKOJEN (GÜÇLÜ SES - BEYAZ TONLAR)
  - GRİ TON (DEĞİŞİK GÜÇLERDE SES – ZAYIF SES DAHA AZ EKOJEN – GÜCE GÖRE GRİ TONLAR)
  - ANEKOJEN (SES DÖNÜŞÜ YOK – SİYAH)

EJOJENİTE – GRİNİN TONLARI

- SIVI DOKU
  - ELOLUSEN (SİYAH)
  - İÇİNDEN GEÇİRİR. YANSIMA YOK YA DA MİNİMAL
- SIVIDAN YOKSUN DOKU
  - EKOJEN (BEYAZ)
  - HAVA VE KEMİK GİBİ
  - ARKA PLAN GÖRÜNTÜLENEMEZ
- SIVI MİKTARI DEĞİŞKEN DOKU
  - DOKUNUN SIVI MİKTARI VE YANSITICI ARAYÜZLERE BAĞLI GRİNİİN ARA TONLARINDA

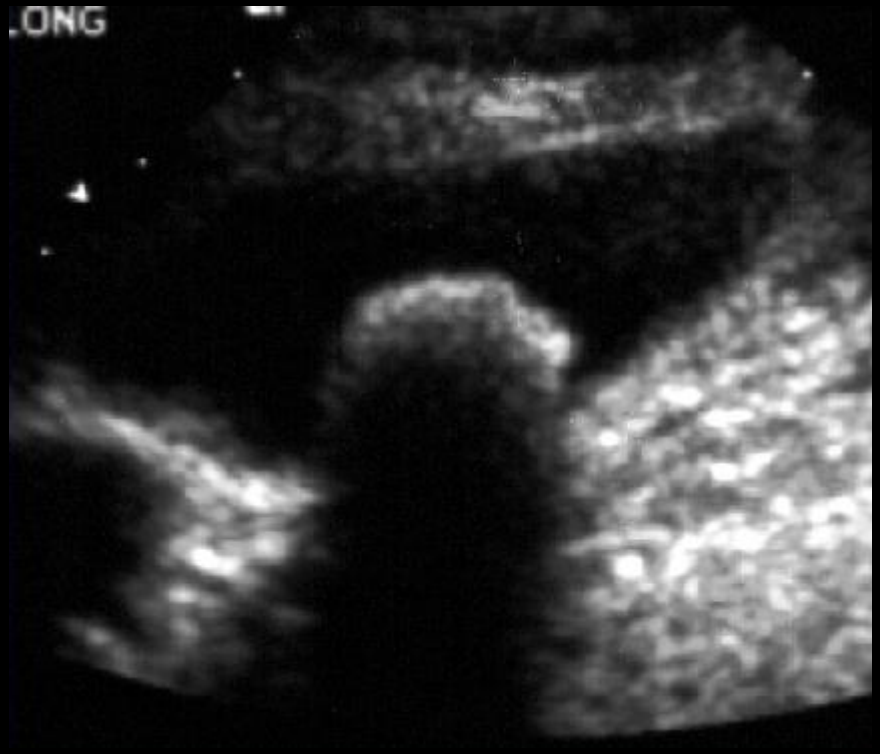
SES DALGASI VE ORTAM ETKİLEŞİMİ

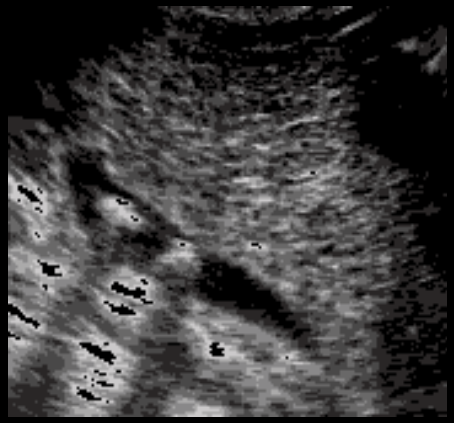


- Ultrason dalgasının bir bölümü ara yüzeylerde yansımaya uğrar
  - Geriye, proba doğru yansıyan ses = yankı
  - Yankı ultrason görüntüsünü oluşturur
  - Yansıyan sesin miktarı yansıdığı ara yüzey ile arasındaki açıya bağlı
  - Açı artarsa yansıyan ses azalır ve proba daha az miktarı döner

SES DALGASI VE ORTAM ETKİLEŞİMİ
DOKUDA YANSIMA

- Kemik-doku arayüzeyleri de güçlü yansıtıcı
- Hava ya da kemikte görüntüleme bu nedenle zor
- Bu tür arayüzeylerde ses geçişinin olmaması gölgelenme denen yankı kaybına neden olur.



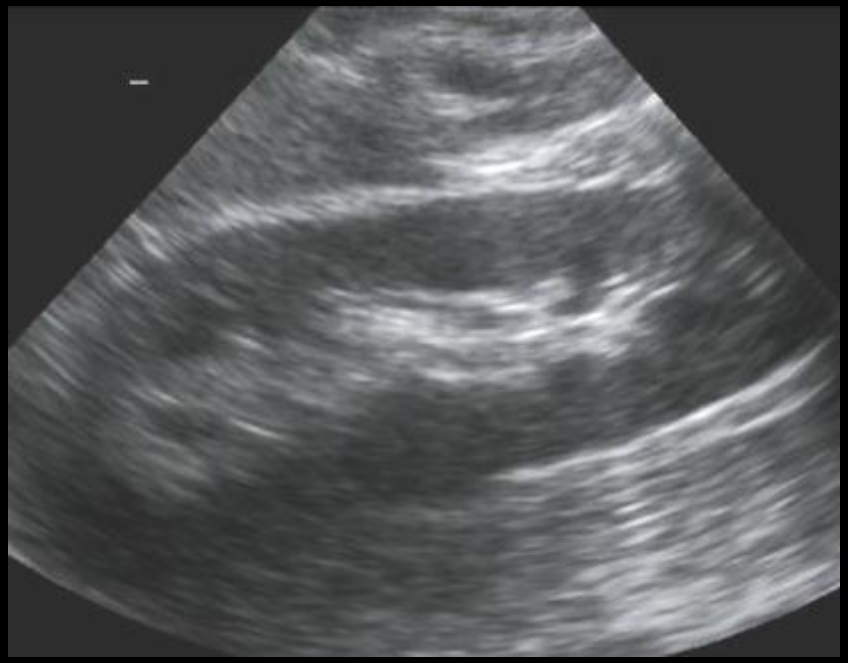


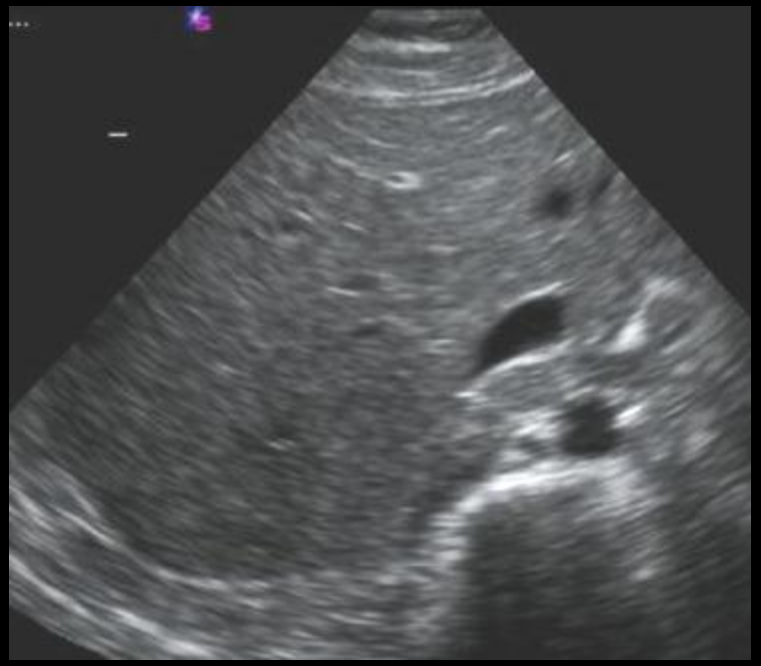
SES DALGASI VE ORTAM ETKİLEŞİMİ
DOKUDA YANSIMA

- Abdominal incelemede en güçlü yankılar barsaklardaki gazlardan gelir.

SES DALGASI VE ORTAM ETKİLEŞİMİ
DOKUDA YANSIMA

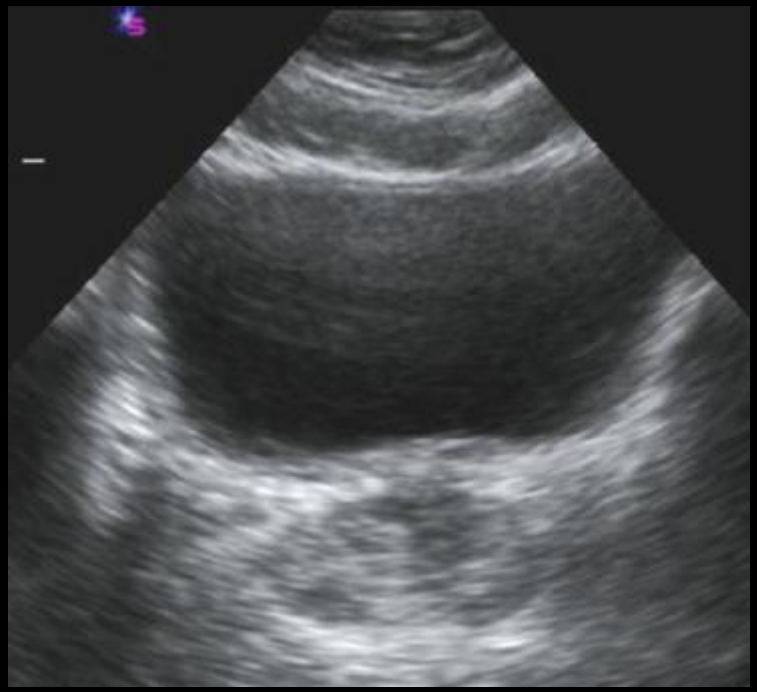
- Böbrek, pankreas dalak, karaciğer gibi organlarda arayüzeyler küçük olup yansımadan çok saçılma önemlidir ve benekli yapı oluşur.

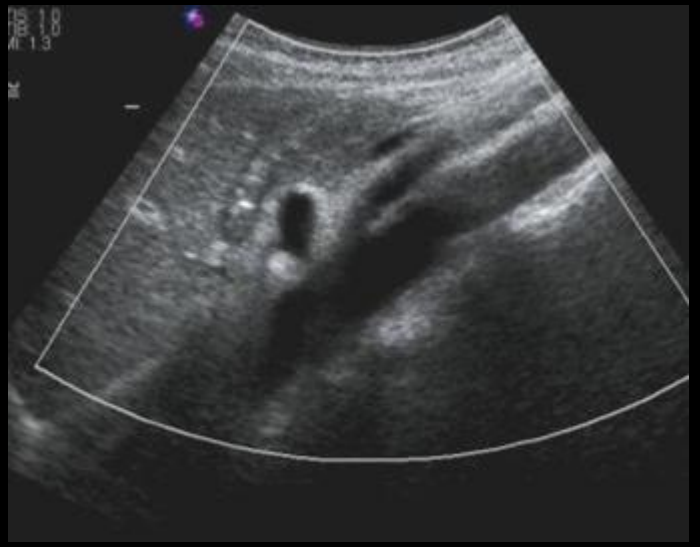




SES DALGASI VE ORTAM ETKİLEŞİMİ
DOKUDA YANSIMA

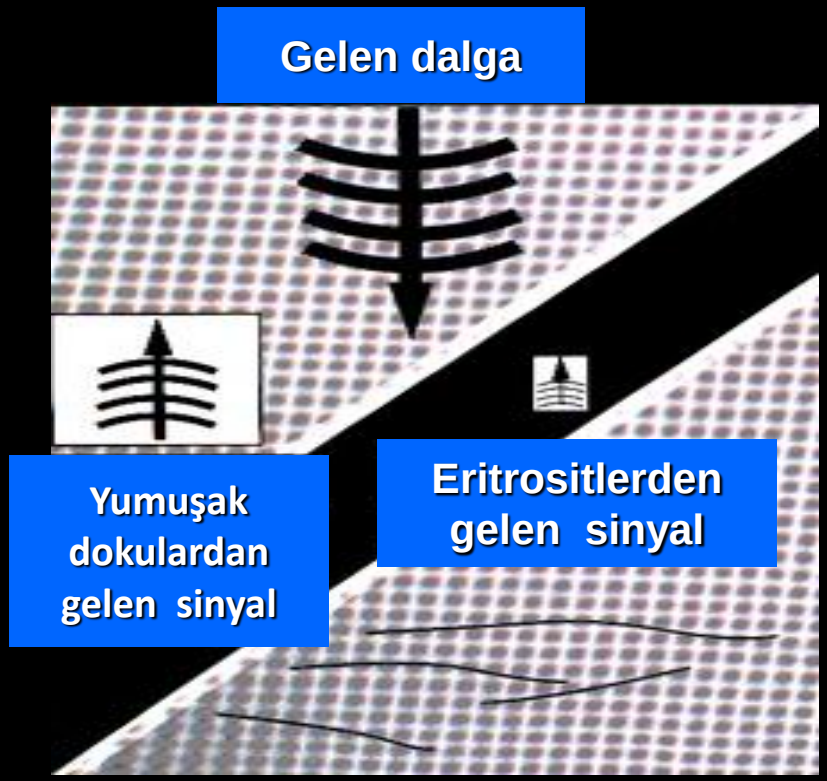
- Mesane, kist, kan damarlarında hemen hemen eko yoktur ve siyah görünür.

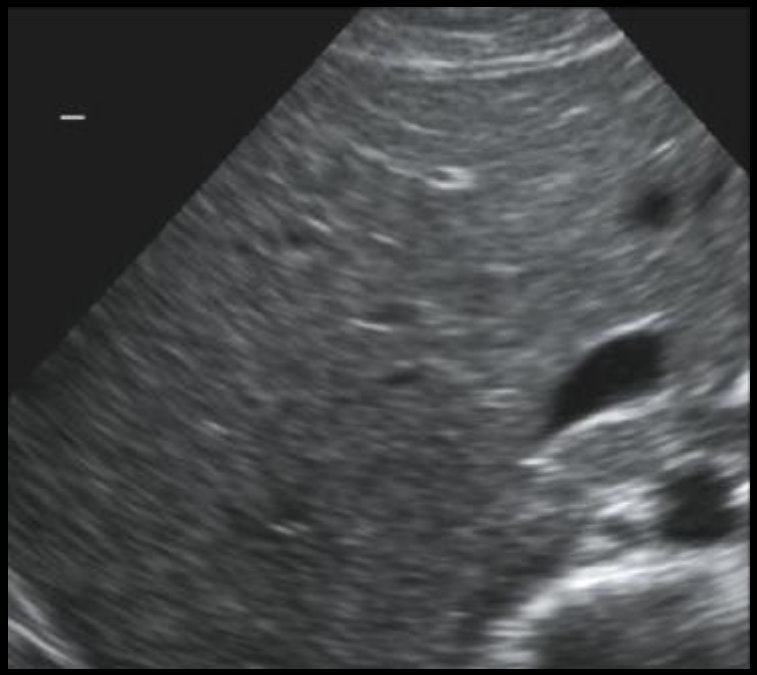




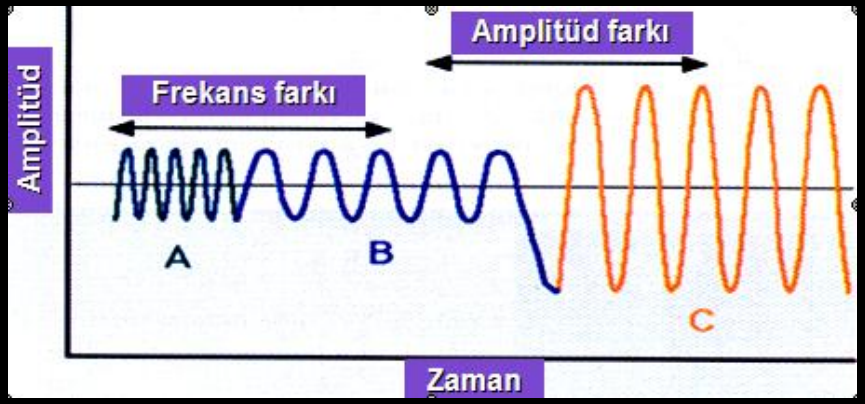
SES DALGASI VE ORTAM ETKİLEŞİMİ
SAÇILMA

- Doku içindeki yansıtıcı yüzeylerin boyutu ultrasonik dalga boyuna eşit ta da küçükse saçılma oluşur.
- Bu yüzeyler kaba ve hafif bir yansıtıcı gibiş davranır.



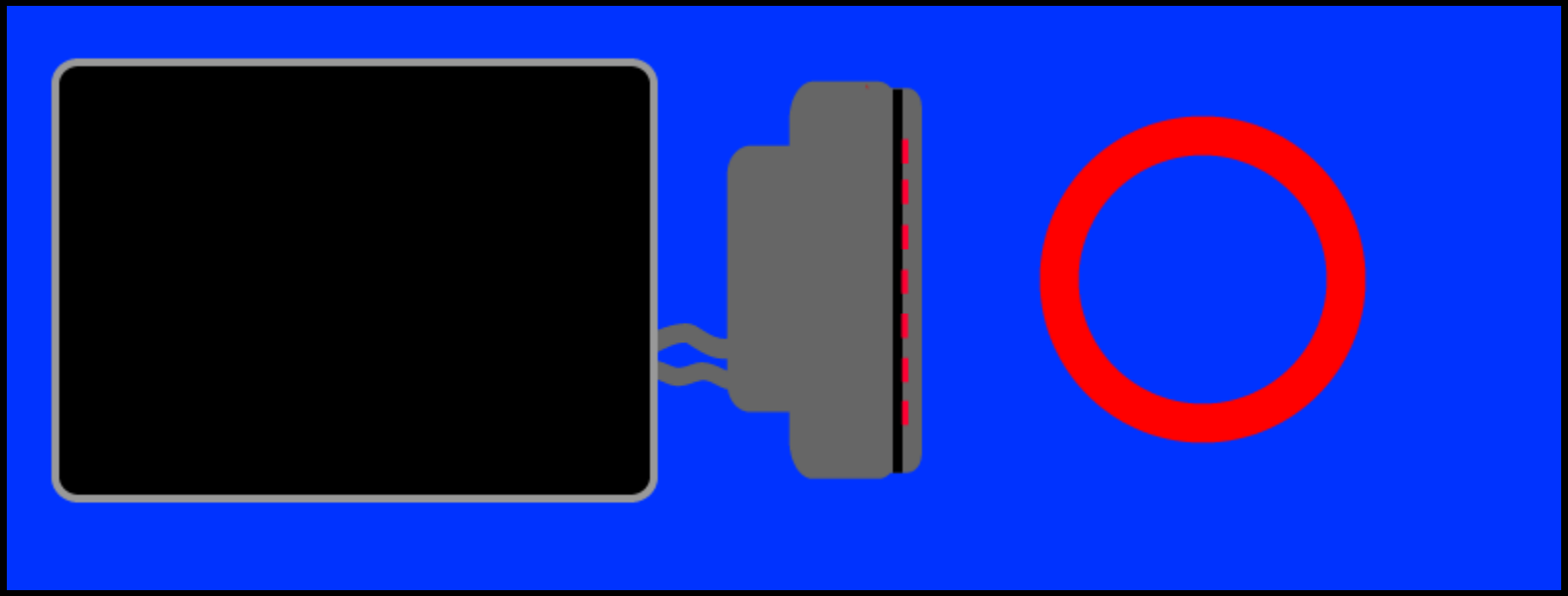


AMPLİTÜD (GENLİK) - FREKANS

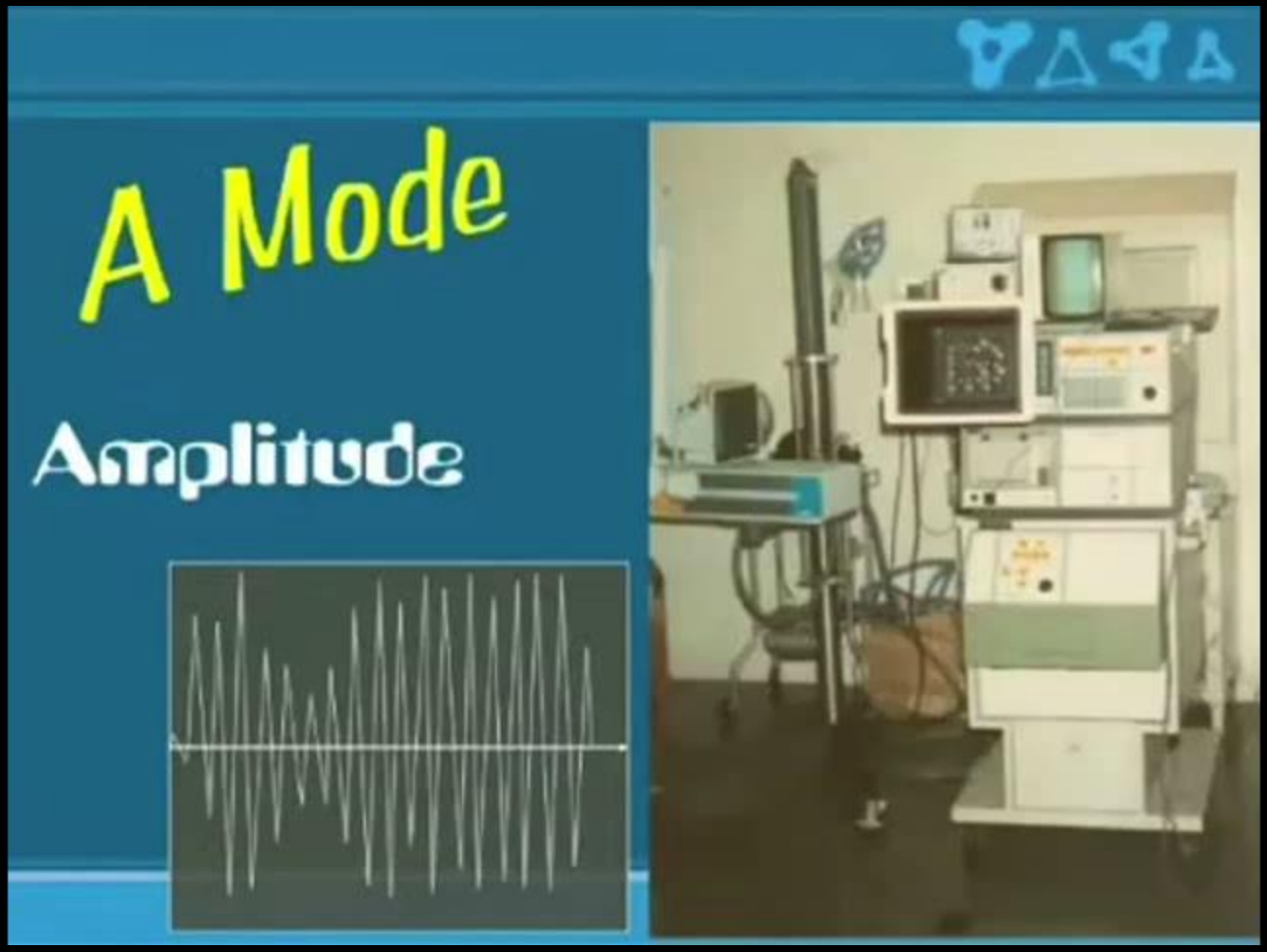


- Dokulardan yansıyarak cihaza dönen ses genlik değişimleri ile sonografik, frekans değişimleri ile Doppler görüntülerini oluşturur.

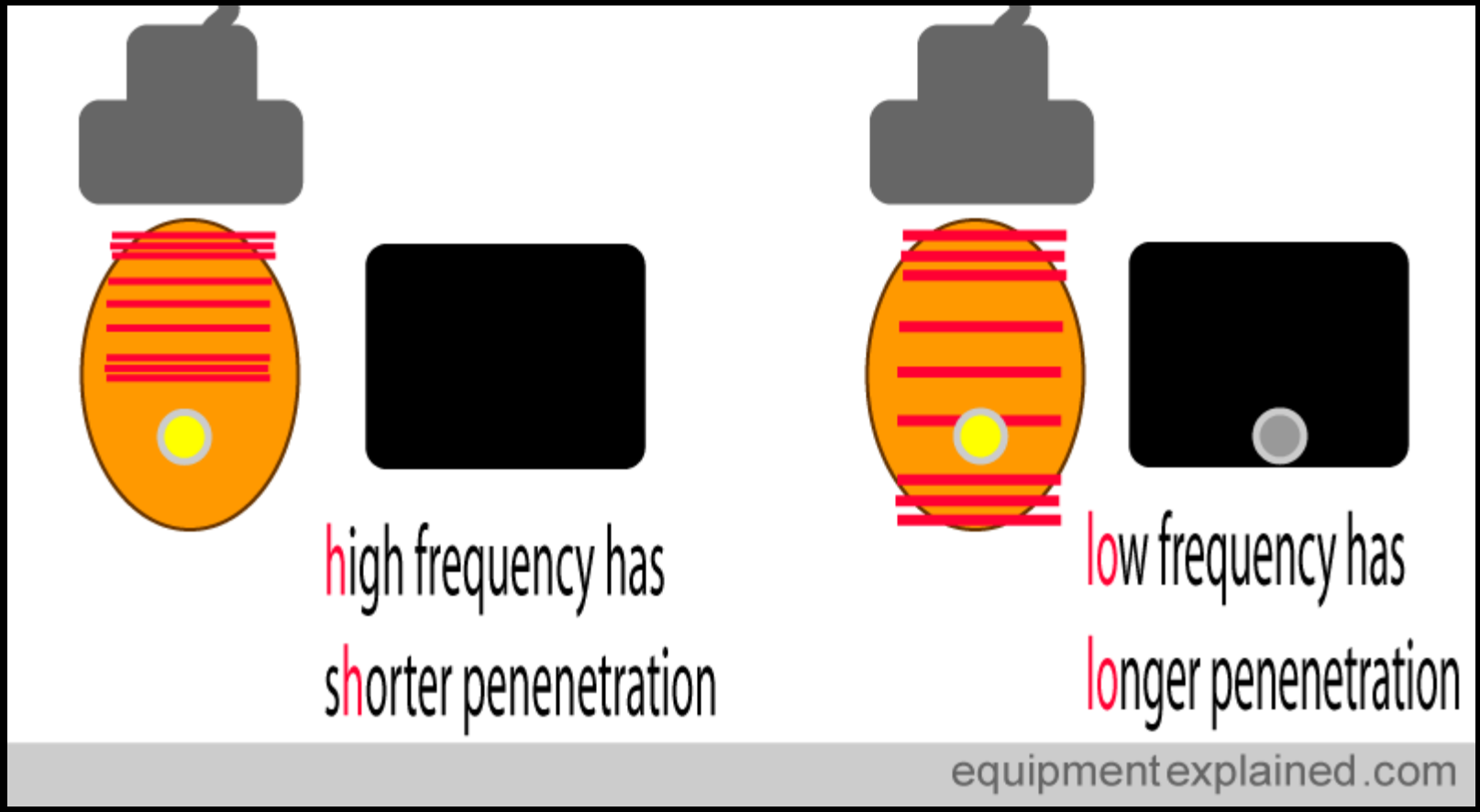
B MOD GÖRÜNTÜ



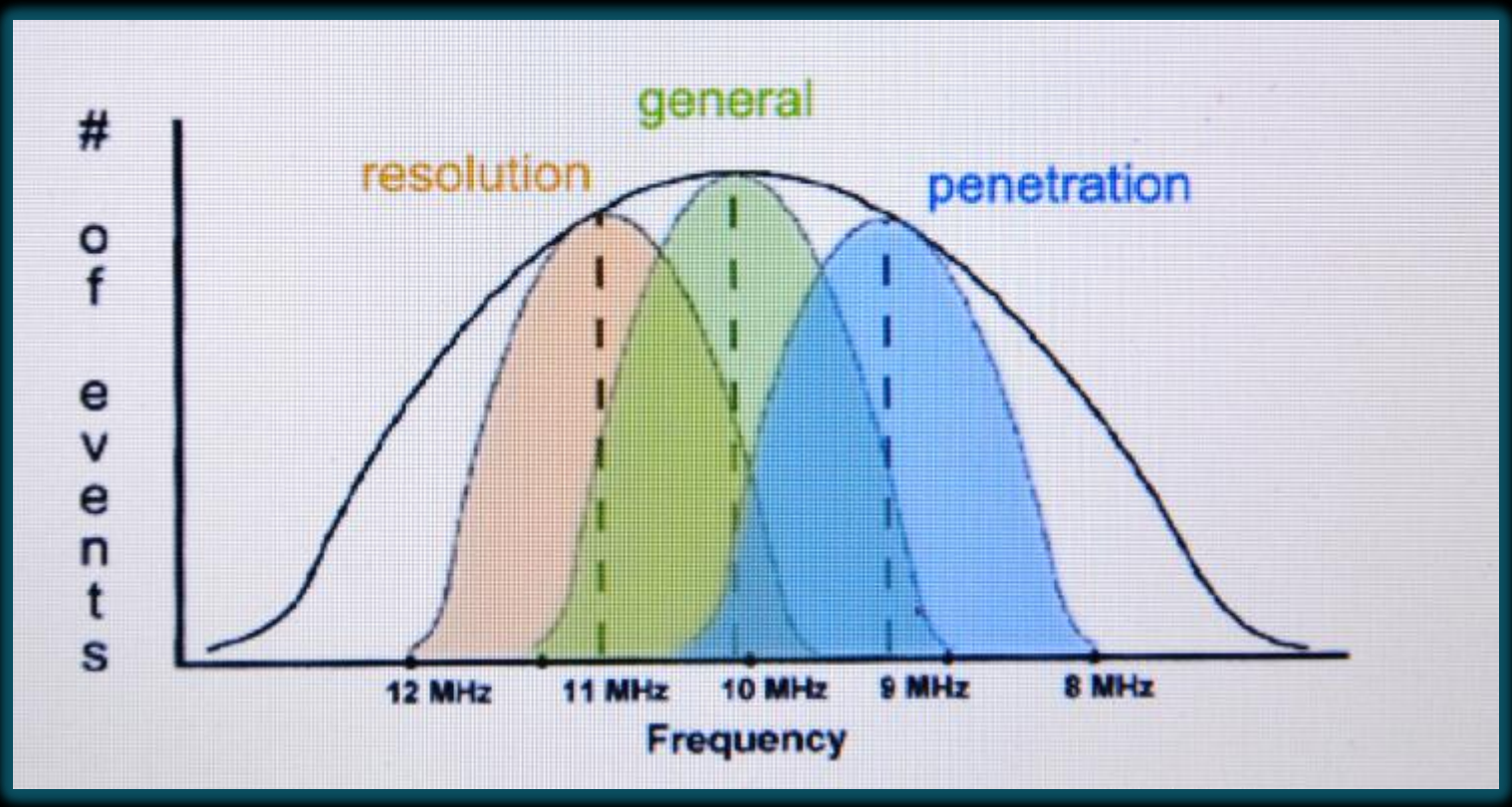
ULTRASON GÖRÜNTÜ MOD'LARI



FREKANS


high frequency has
shorter penenetration
low frequency has
longer penenetration
equipmentexplained.com

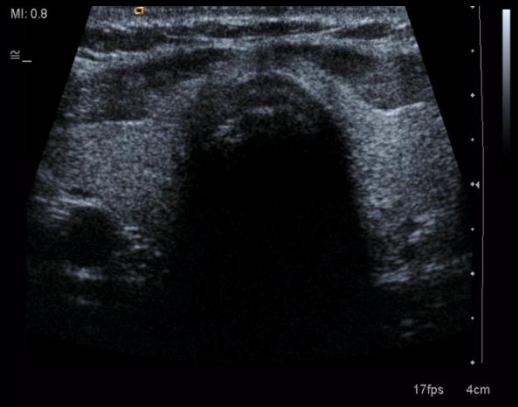
FREKANS

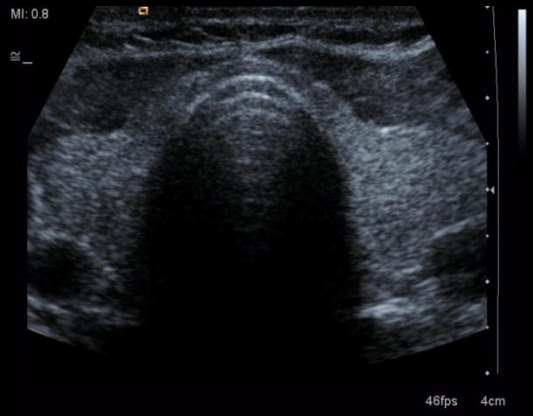

general
resolution
penetration
# of events
12 MHz
11 MHz
10 MHz
9 MHz
8 MHz
Frequency

FREKENS VE PROBLAR

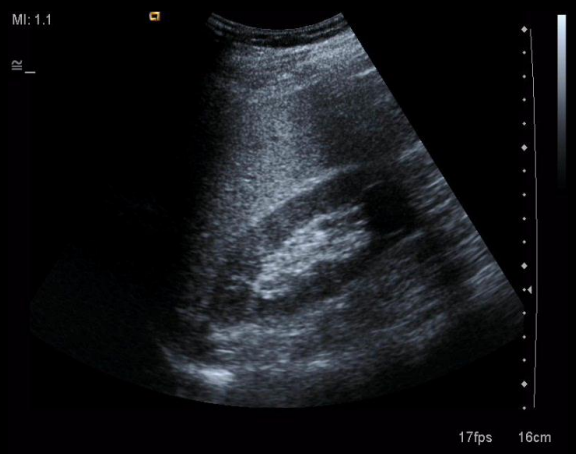
TRANSDUCER - PROB

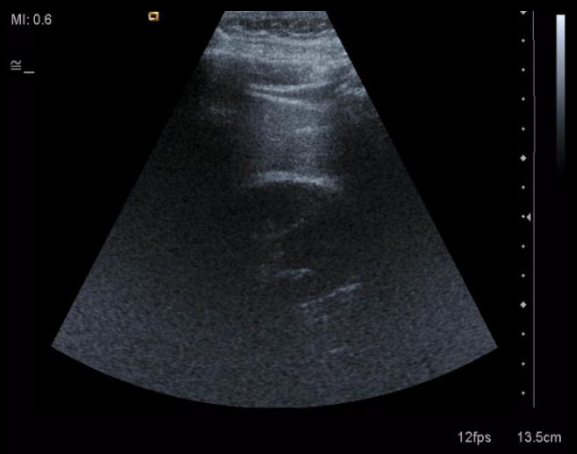
FREKANS

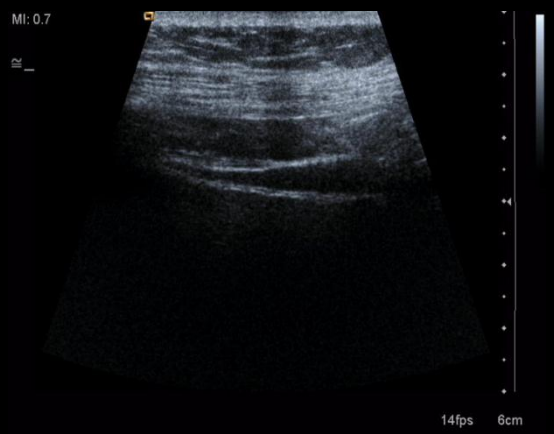




FREKANS

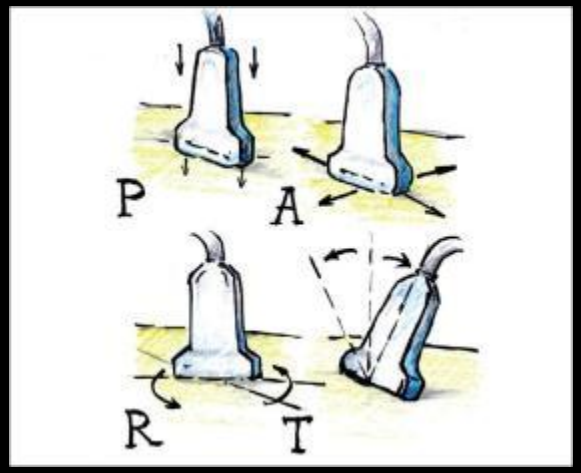




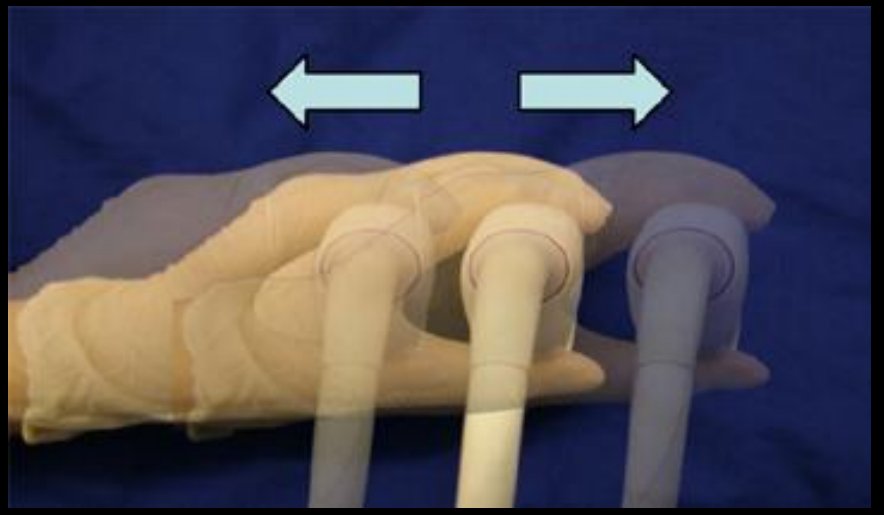


PROB HAREKETLERİ

- Pressure (Bası)
- Alignment (Hizalama)
- Tilt (Eğim)
- Rotation (Döndürme)

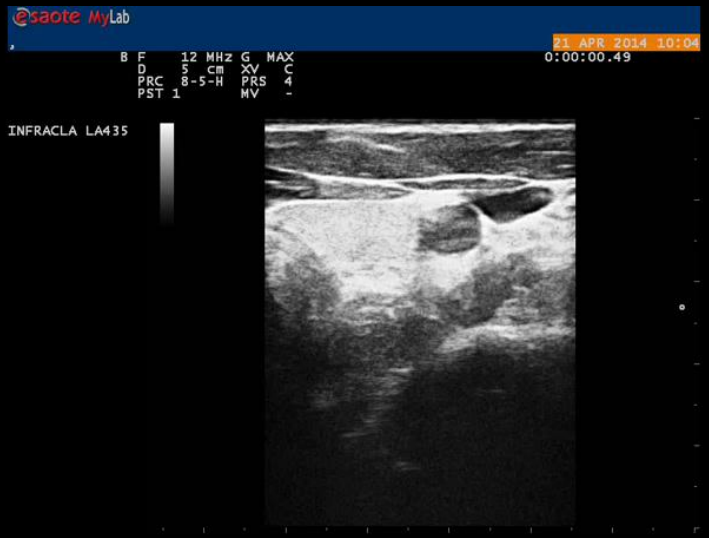


PROB HAREKETLERİ HİZALAMA



PROB HAREKETLERİ - DÖNDÜRME

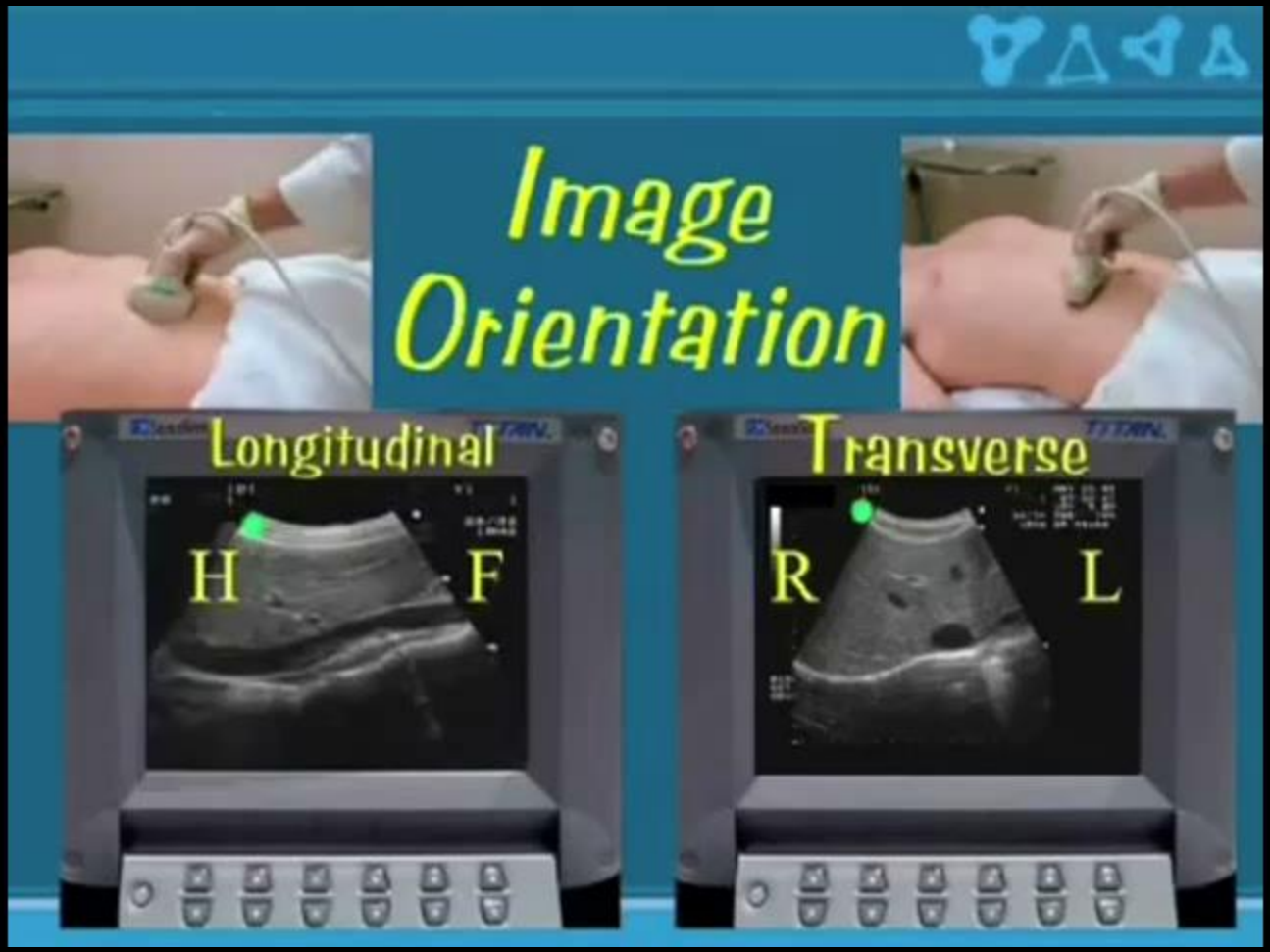
PROB HAREKETLERİ – AÇILAMA – EĞİM VERME



PROB HAREKETLERİ - BASINÇ

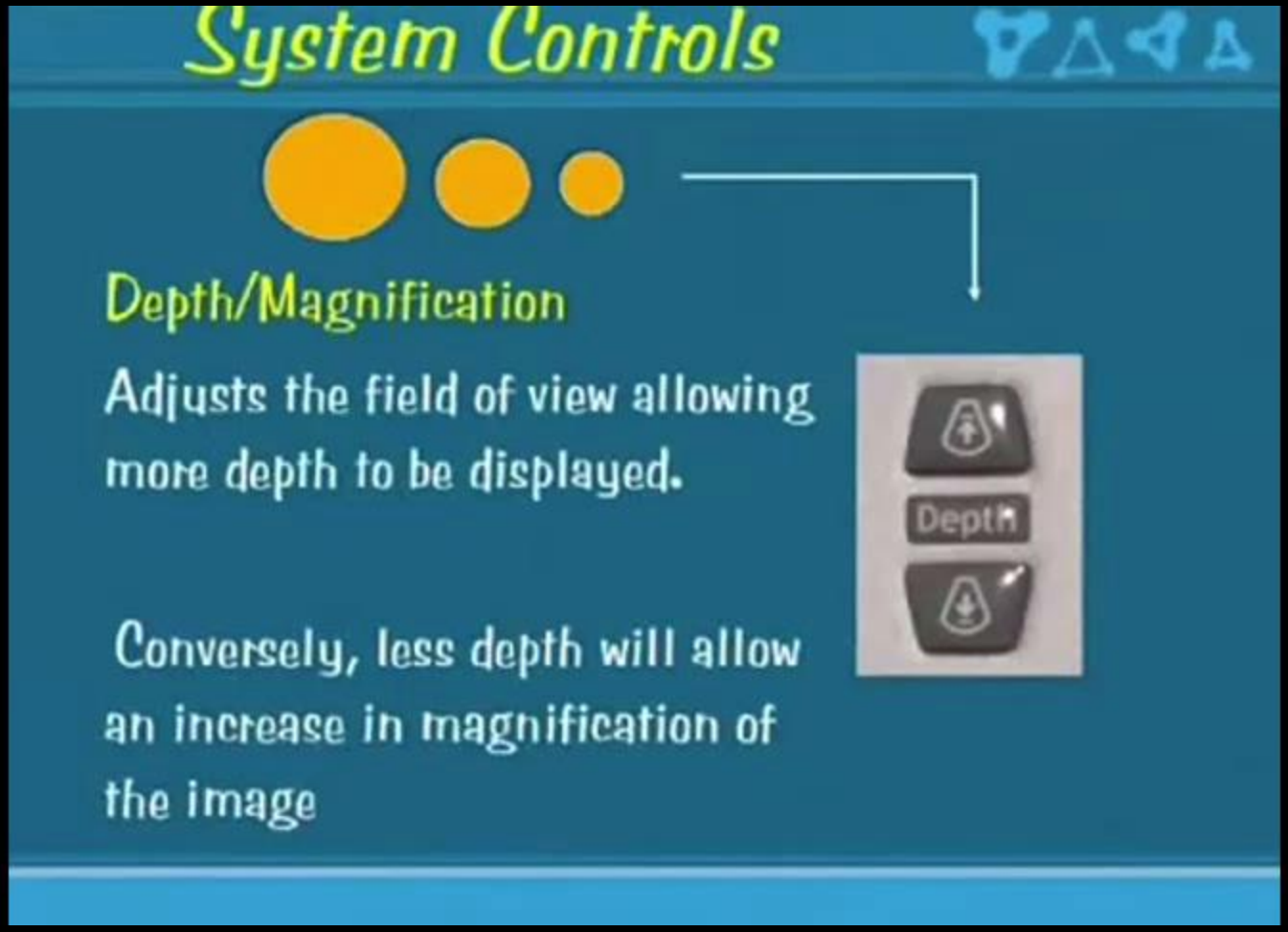
PROB HAREKETLERİ - TEKNİK

ORYANTASYON

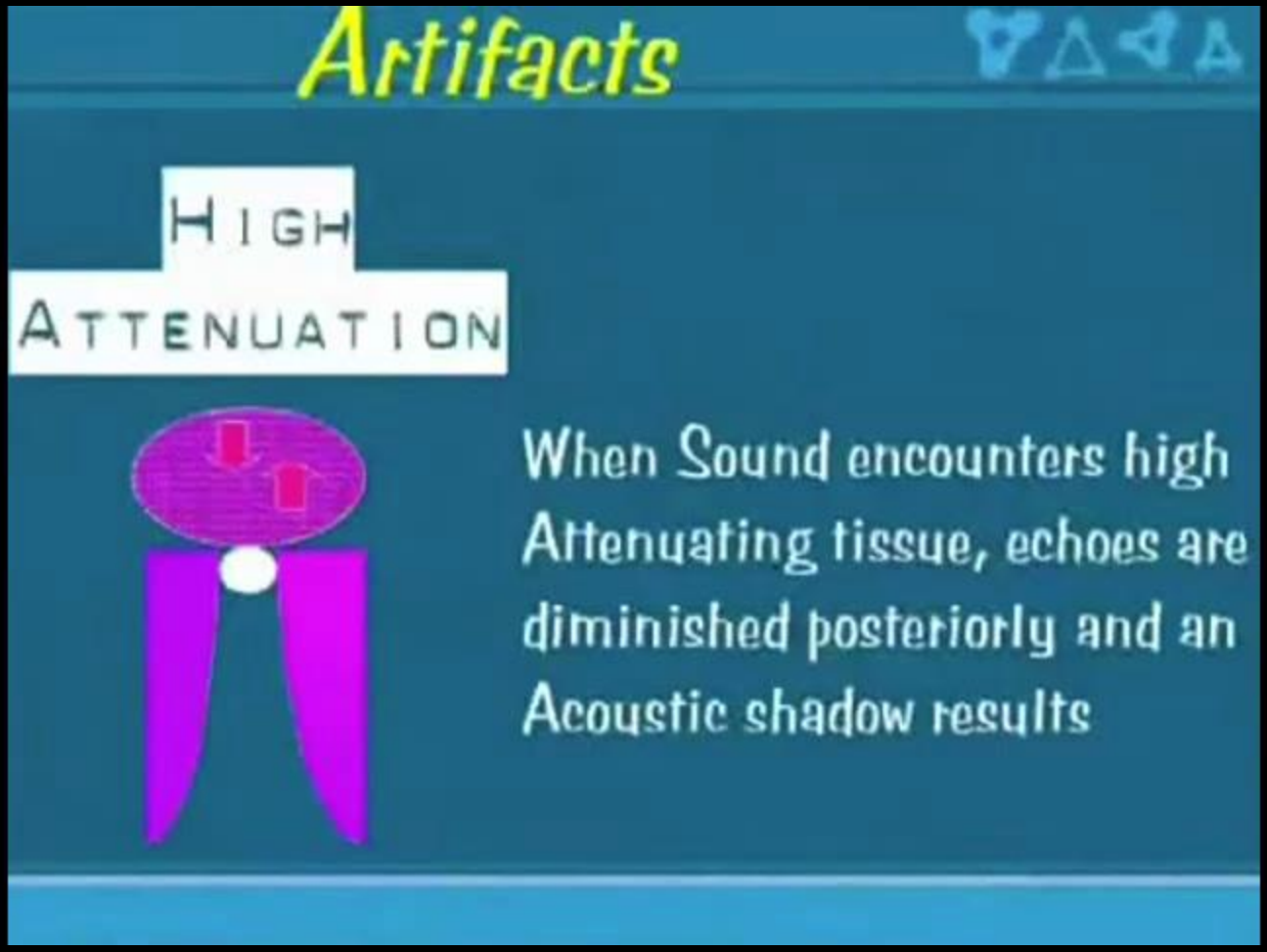


TARAMA PLANLARI

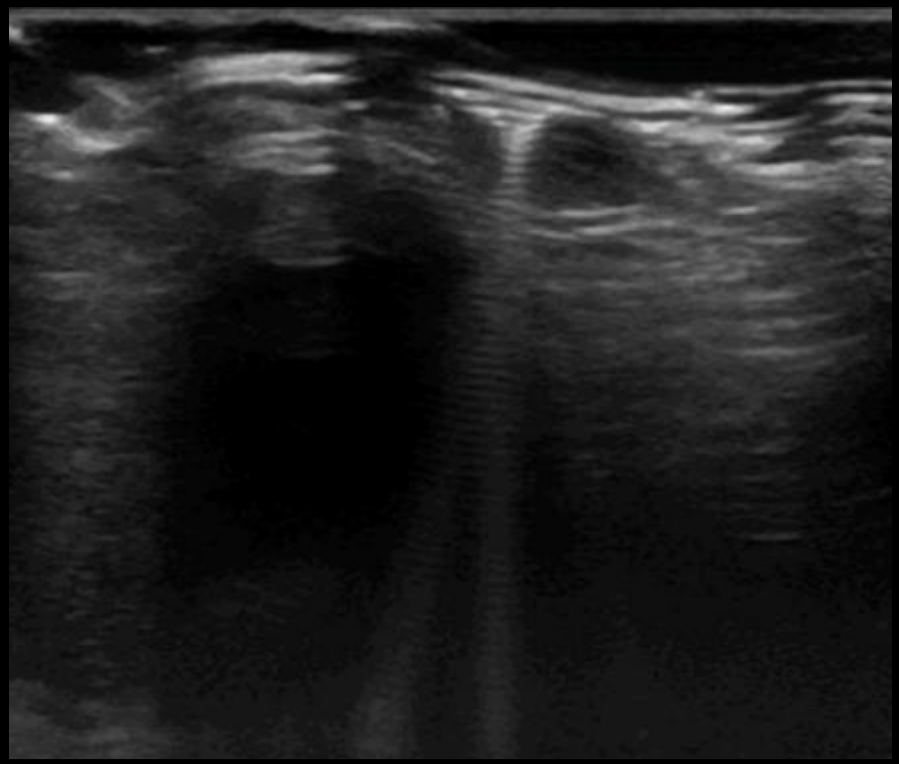
KNOBOLOGY – SİSTEM KONTROL

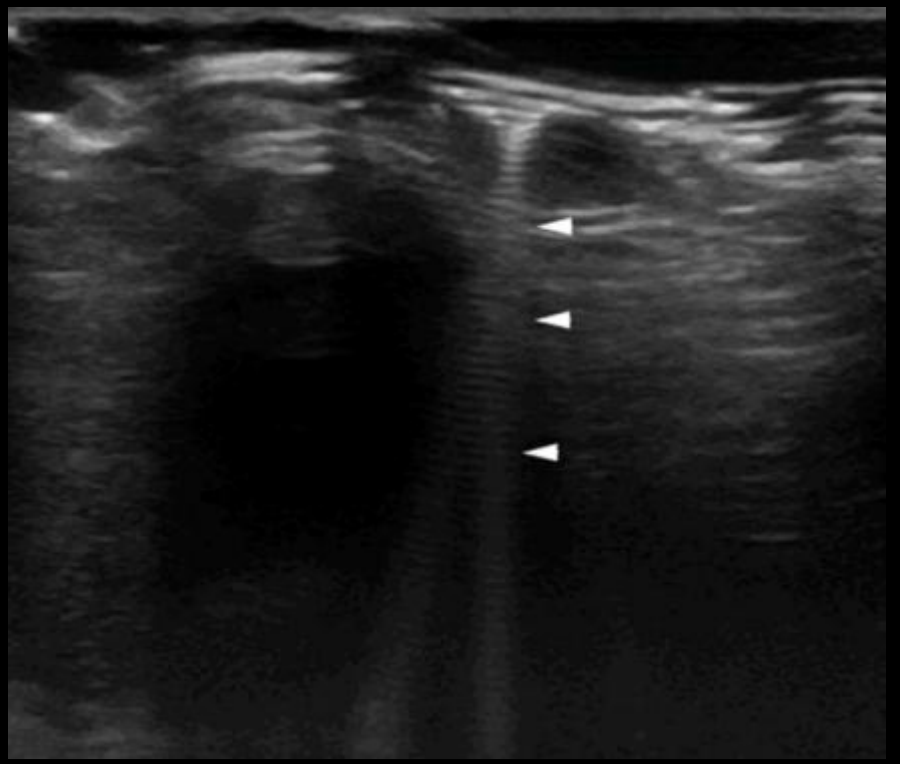


ARTİFAKTLAR

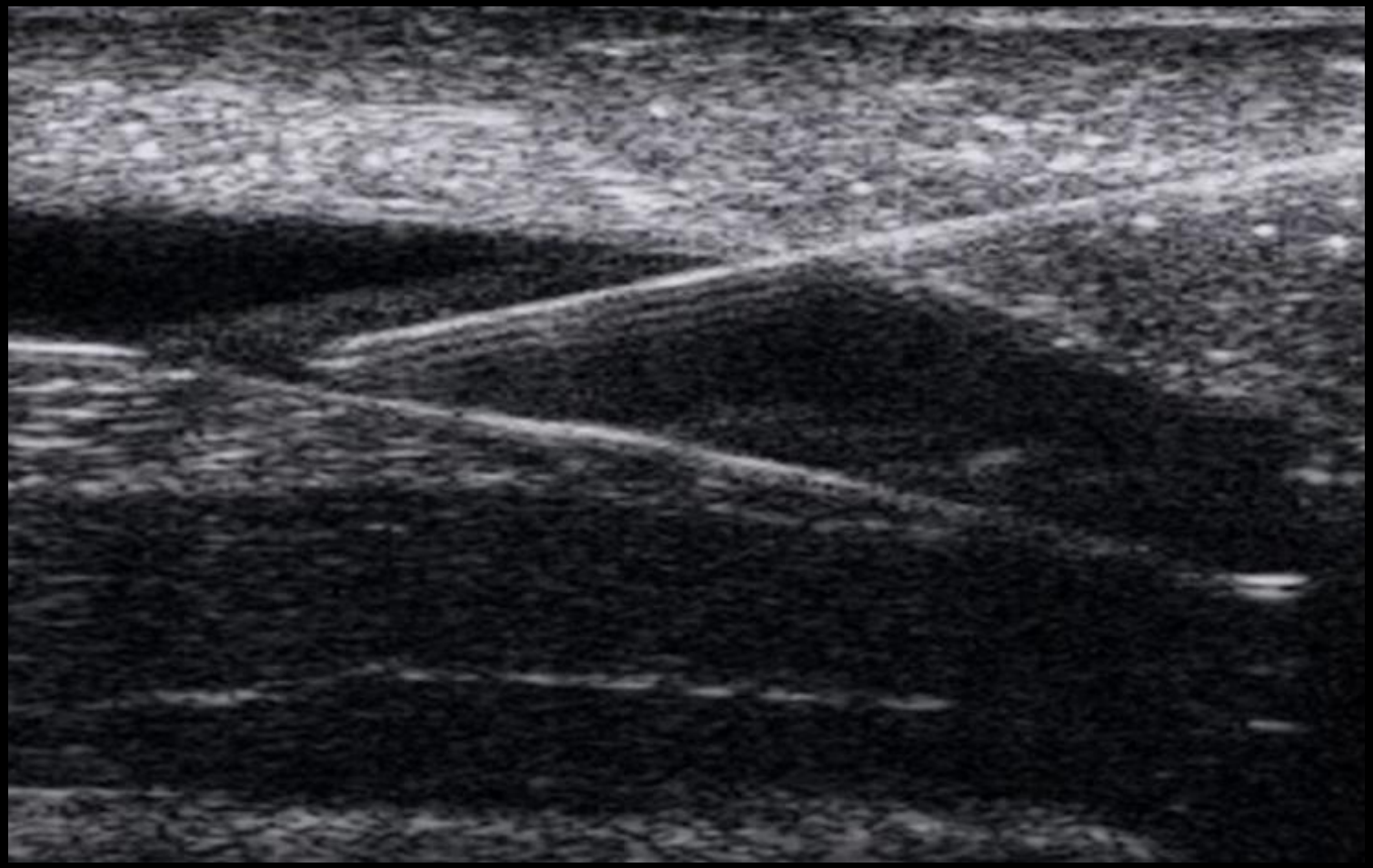


REVERBERASYON

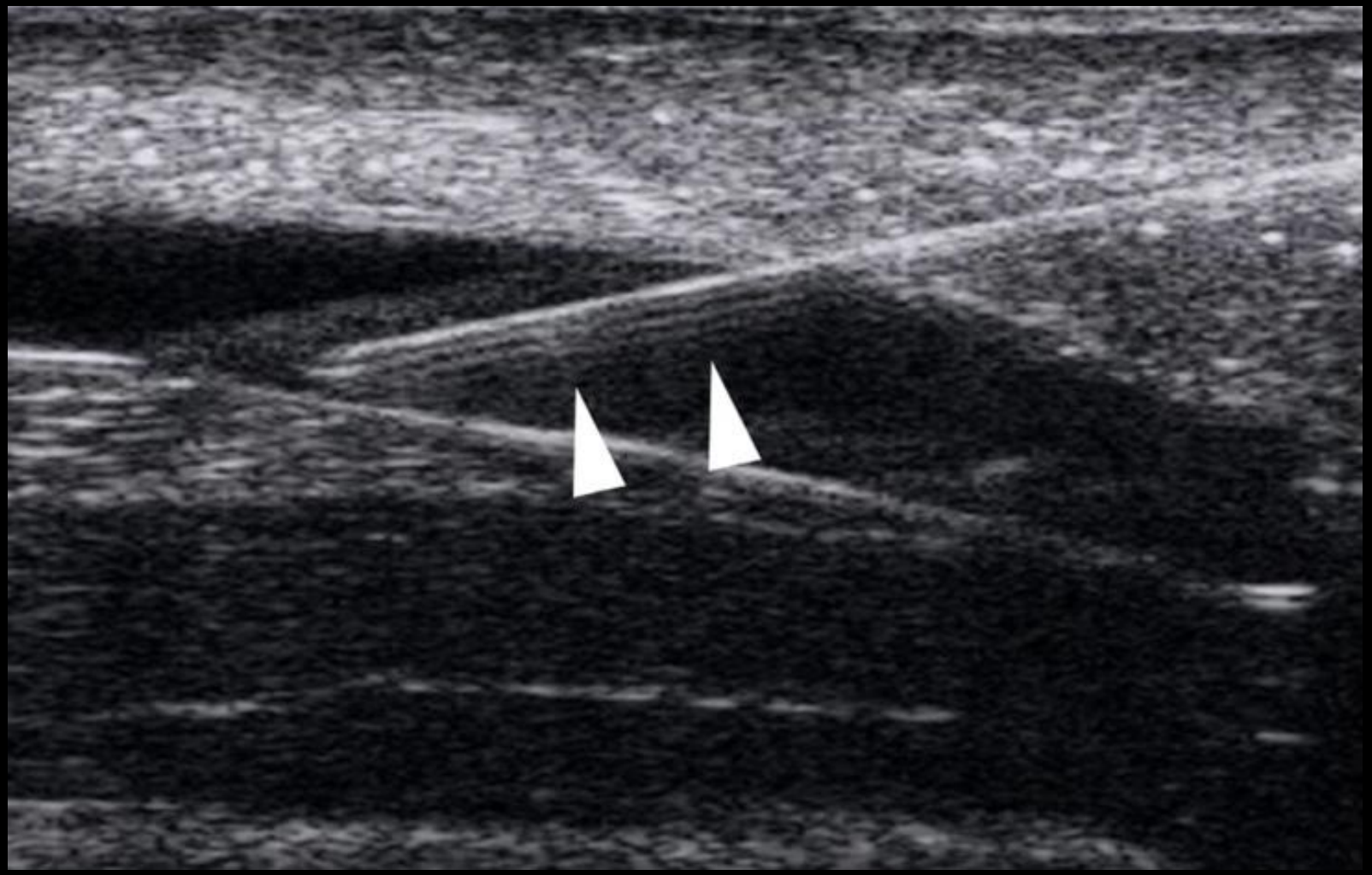




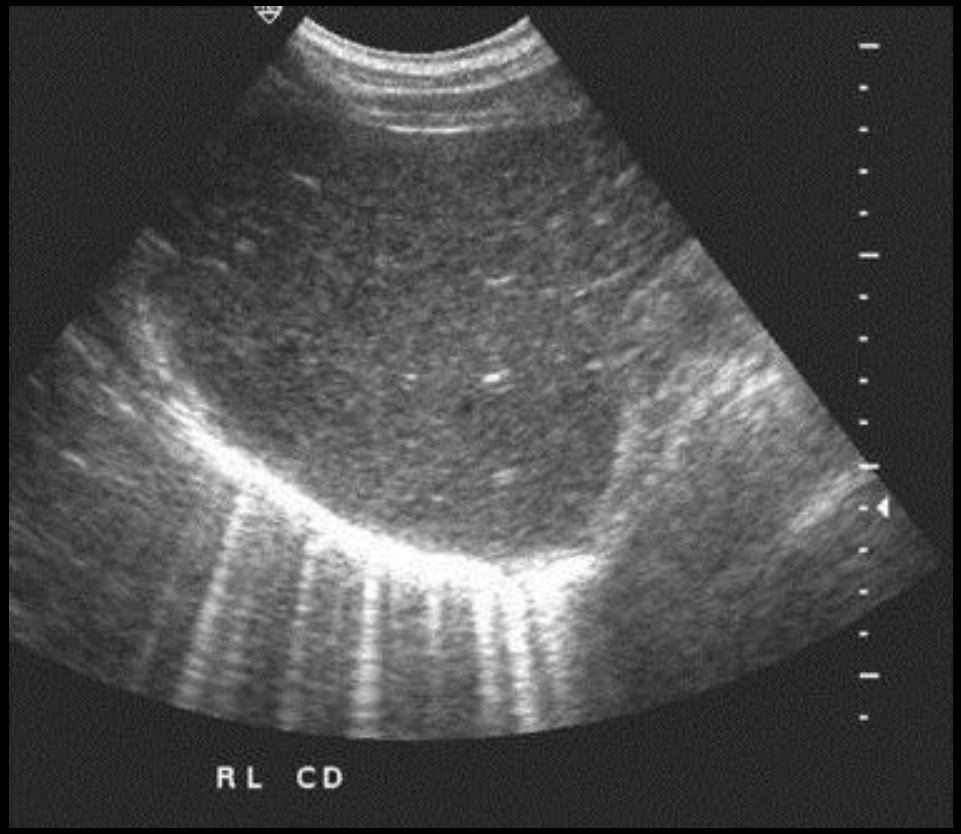
REVERBERASYON



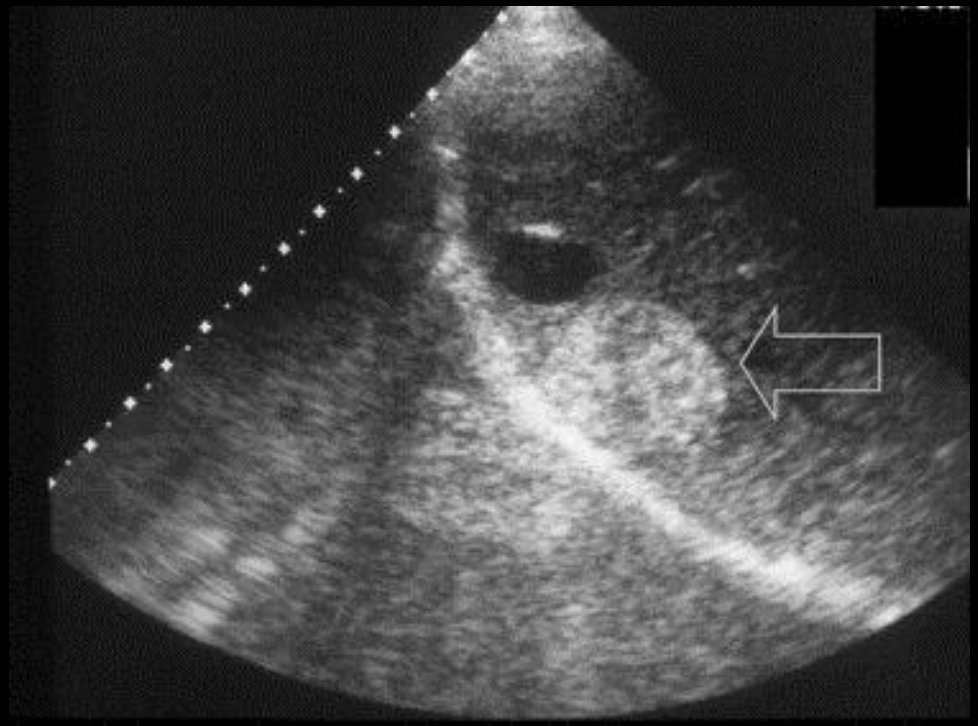
REVERBERASYON

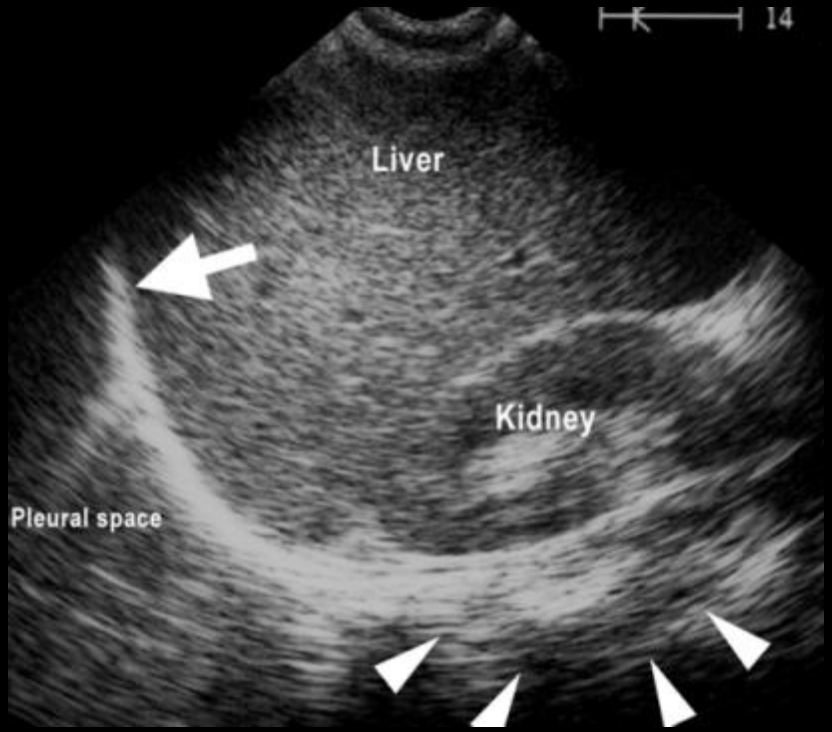


RING DOWN

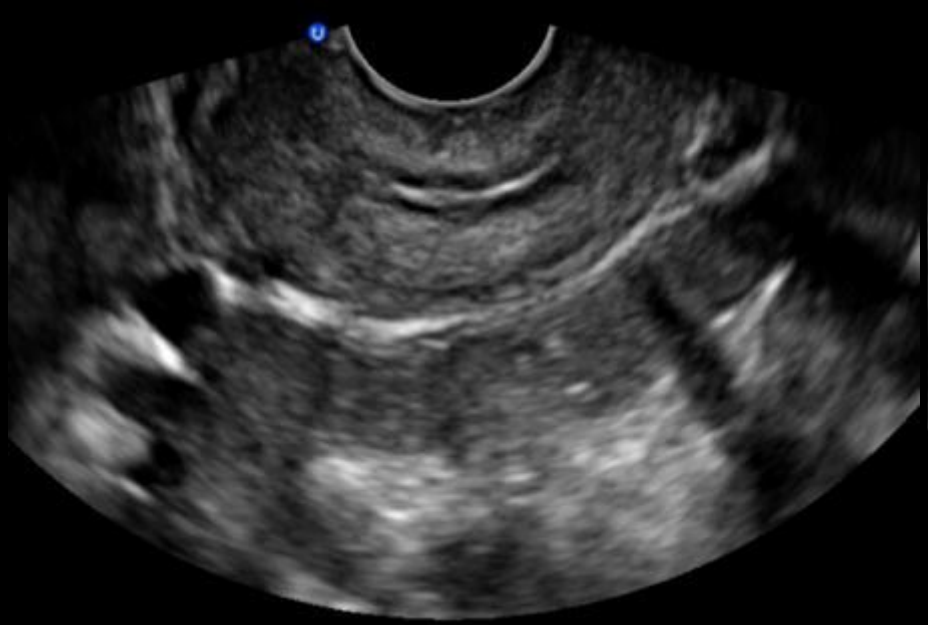


AYNA





AYNA



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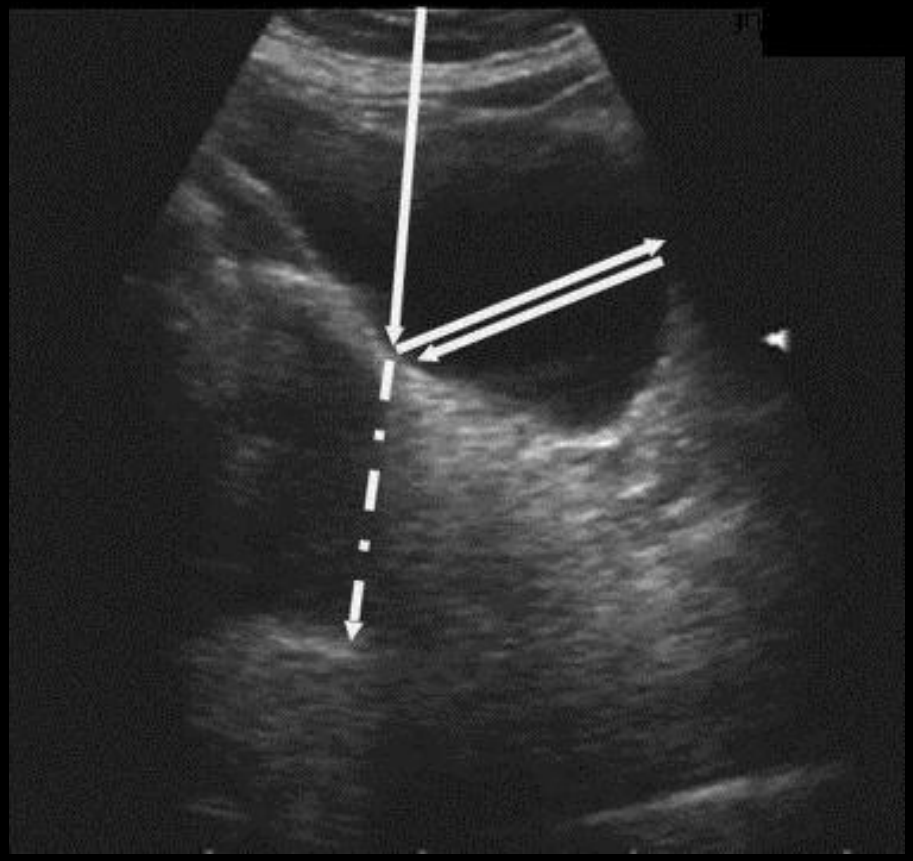

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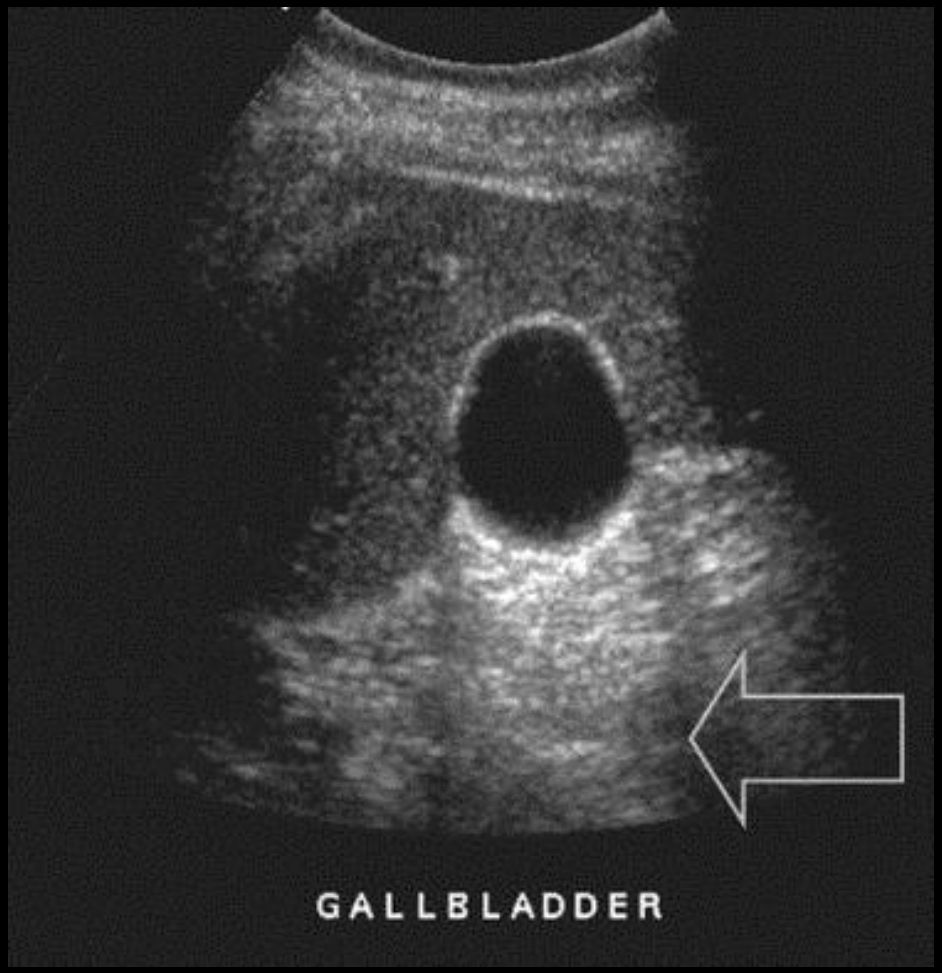

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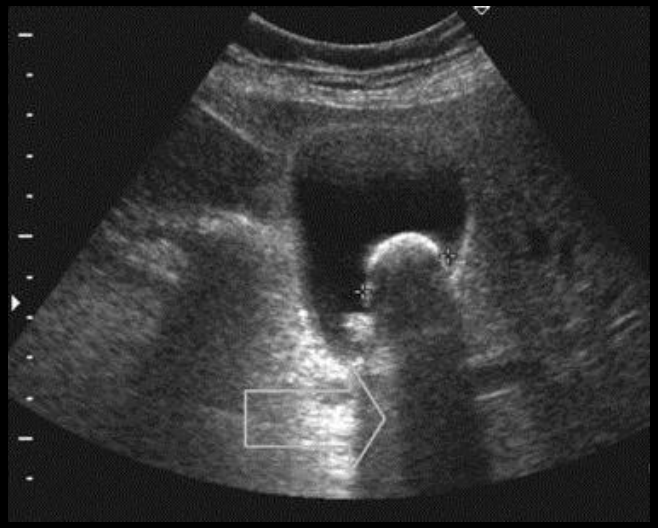

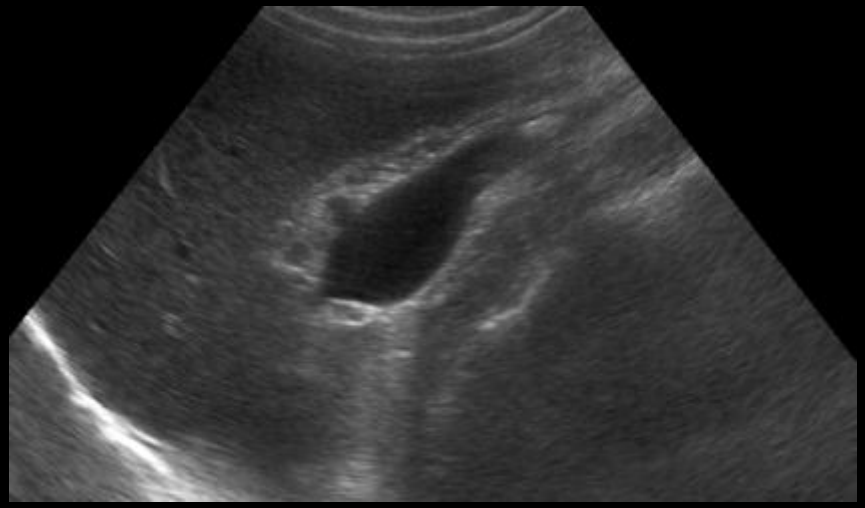

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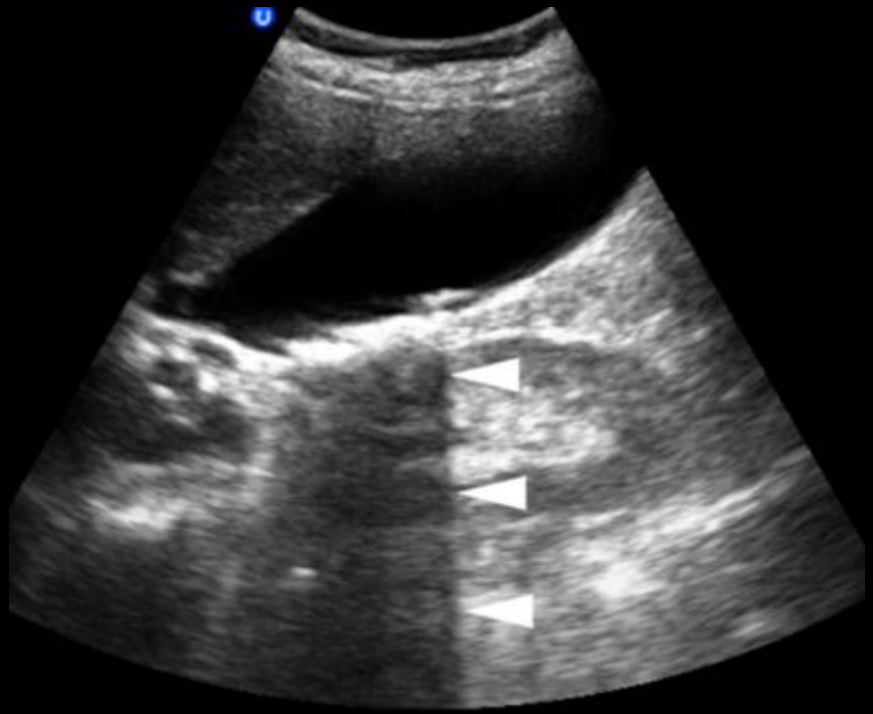

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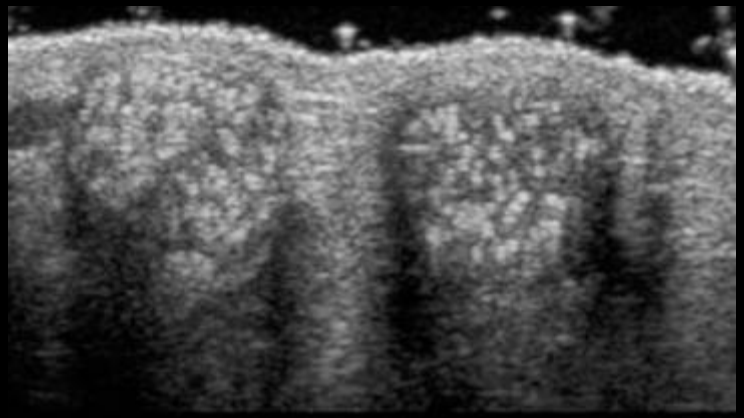

TRANS |

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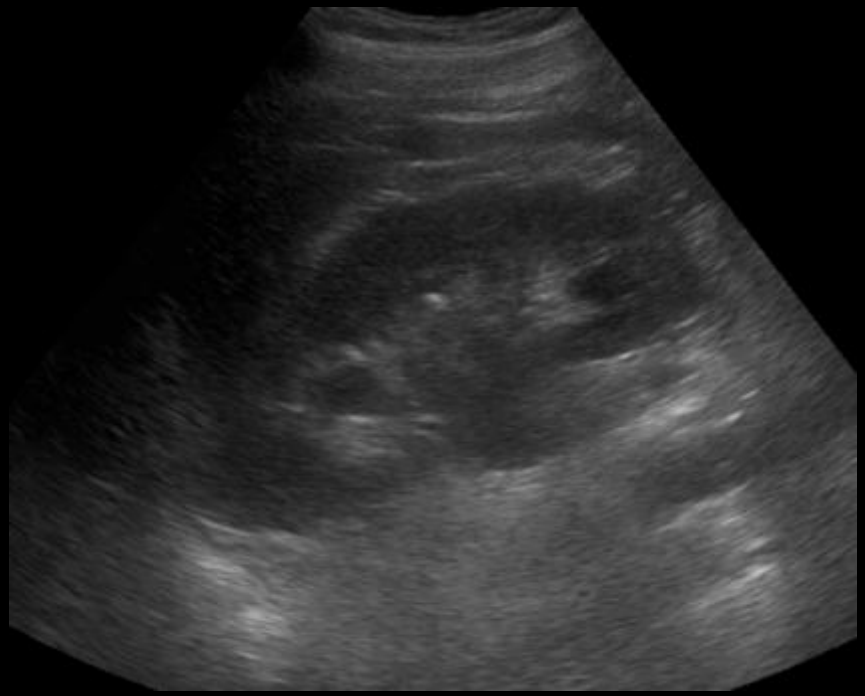

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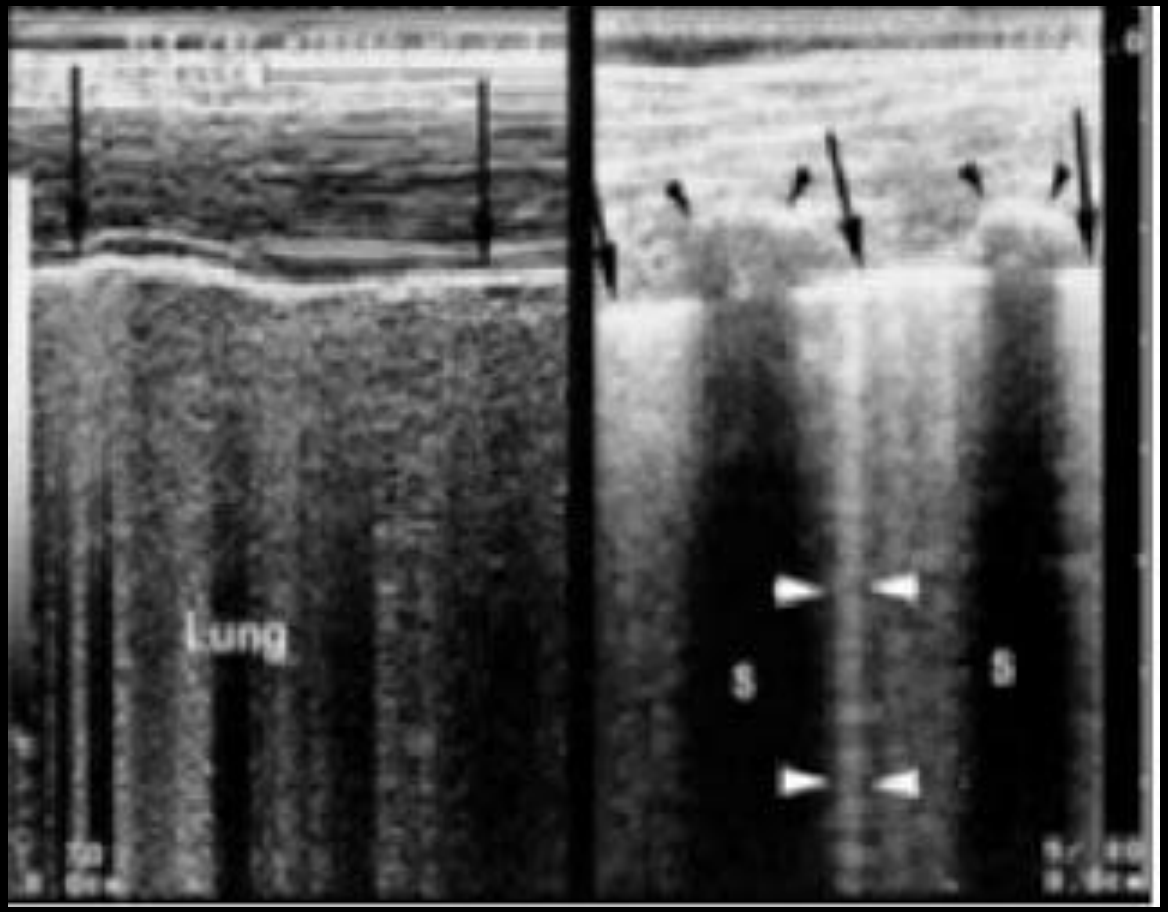

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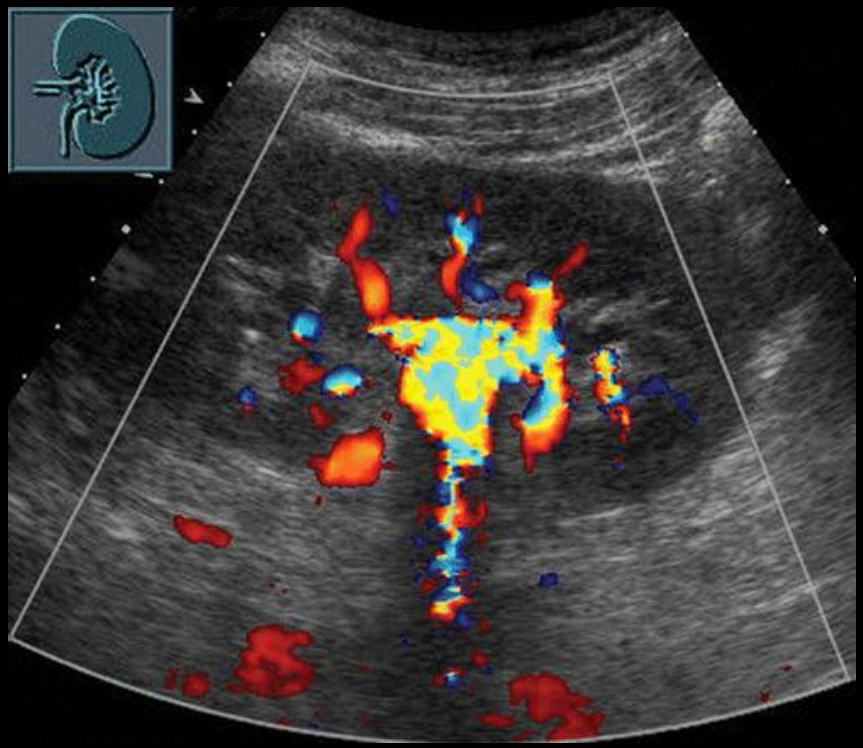

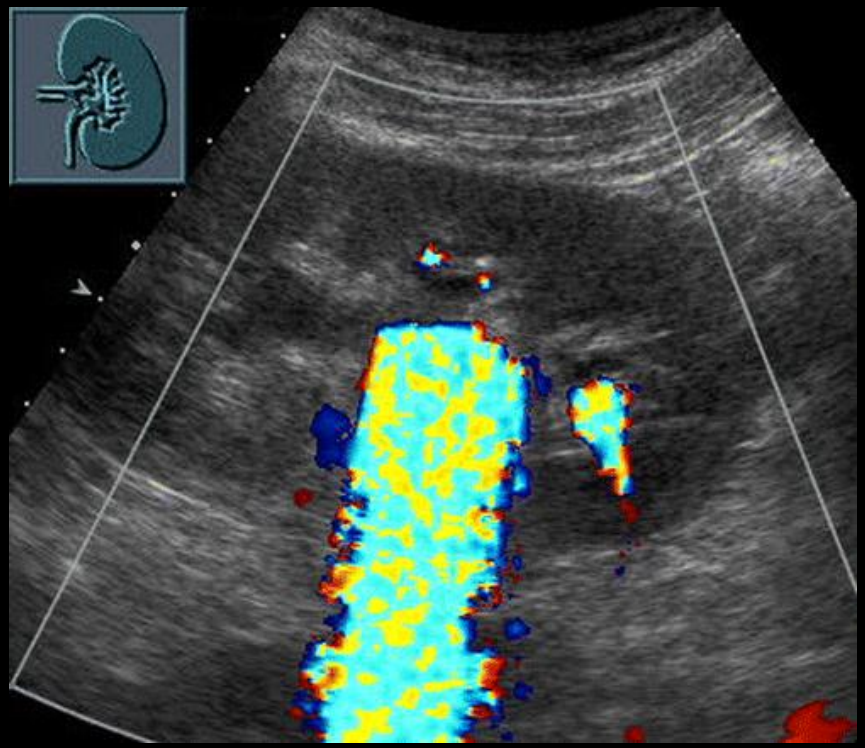

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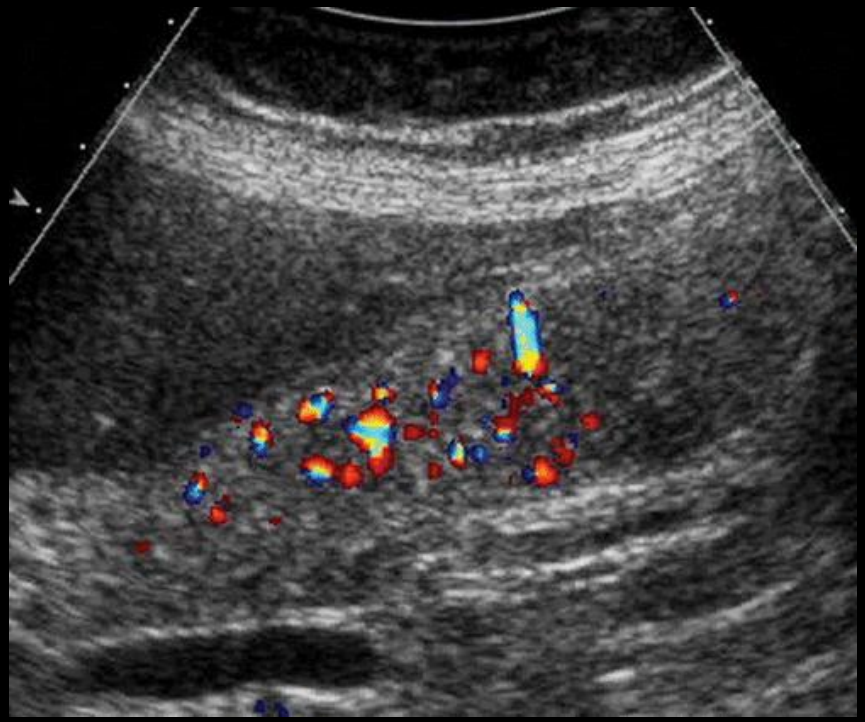

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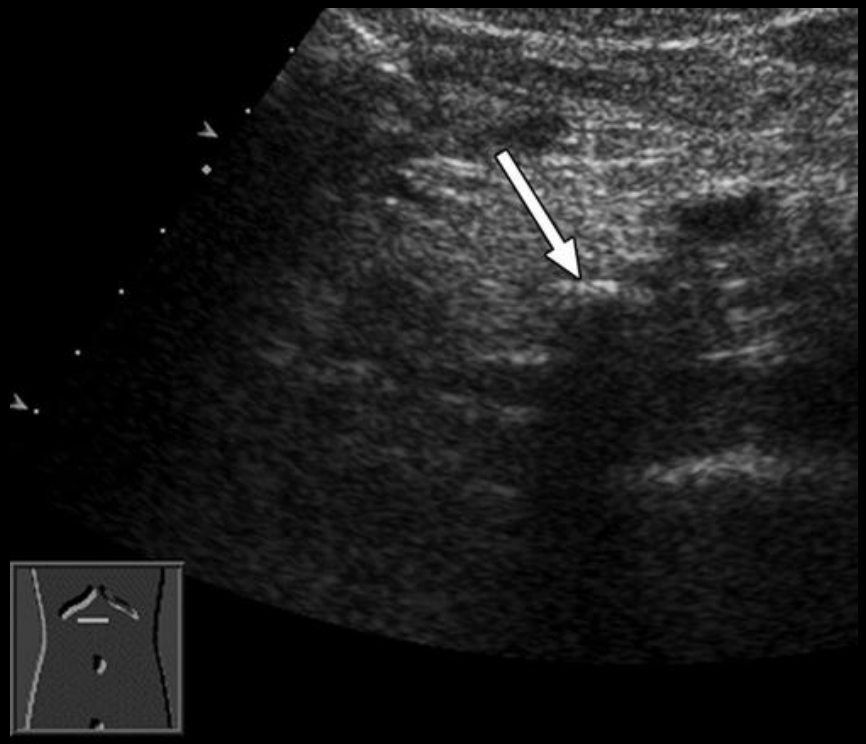

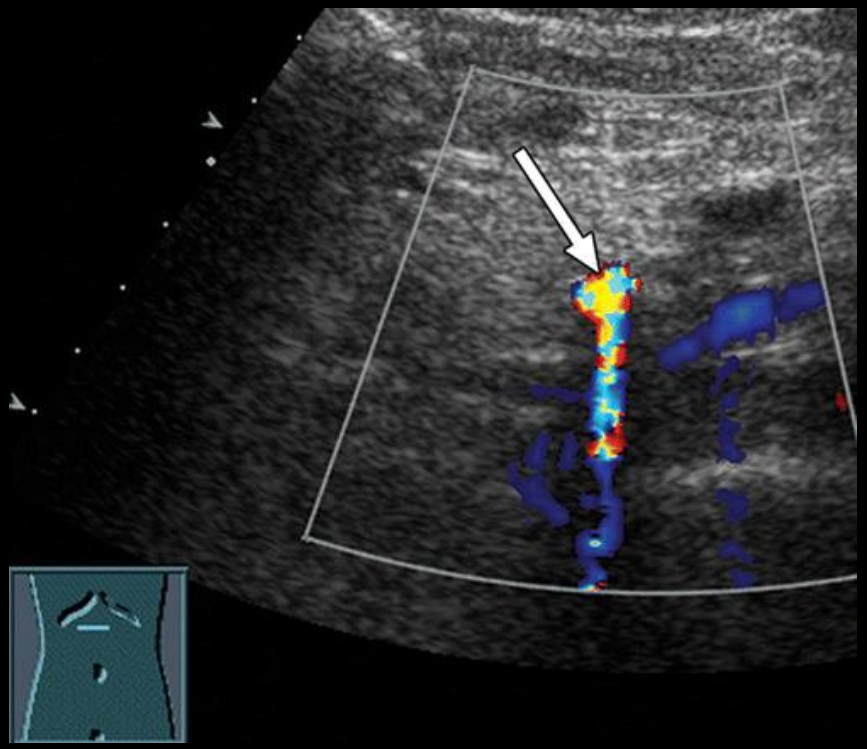

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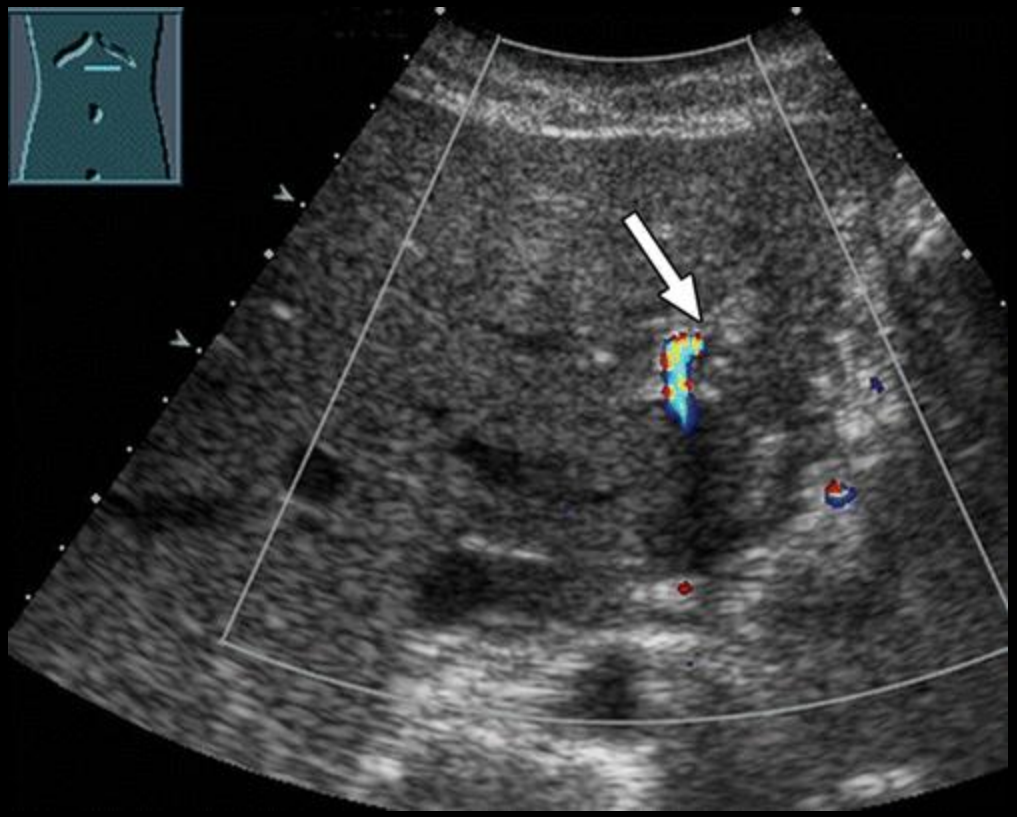

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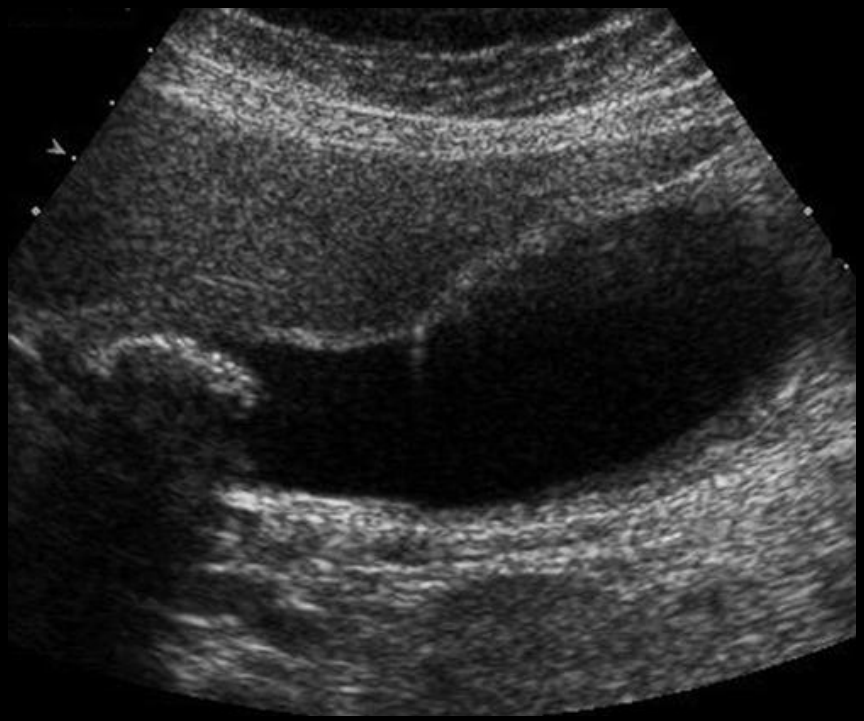

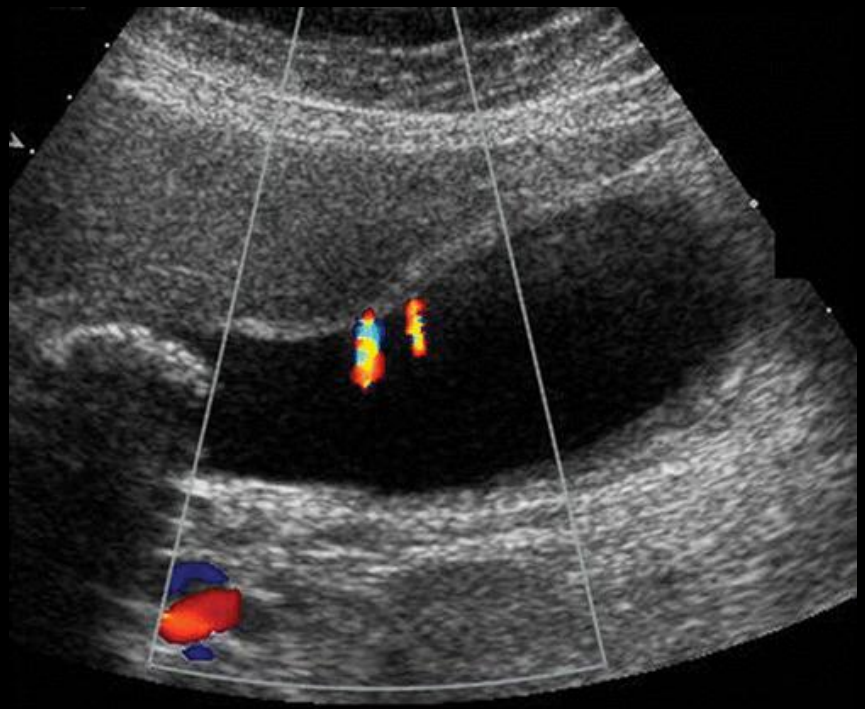

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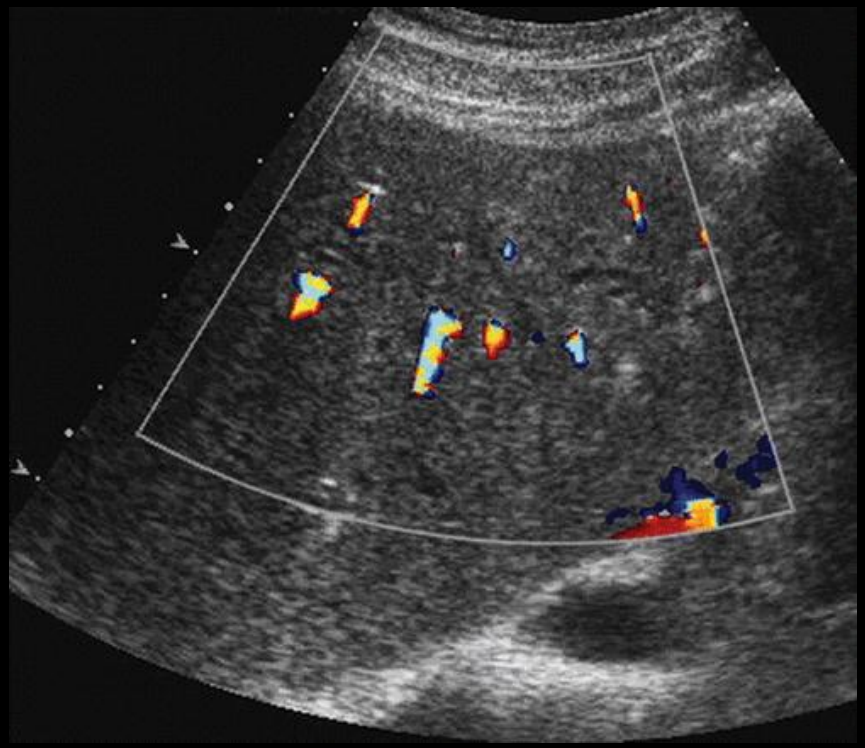

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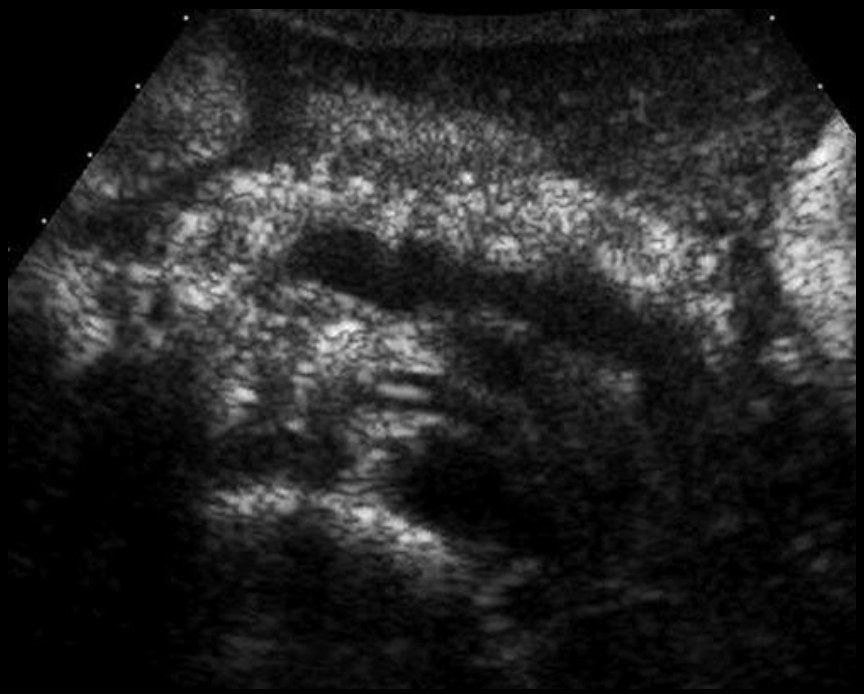

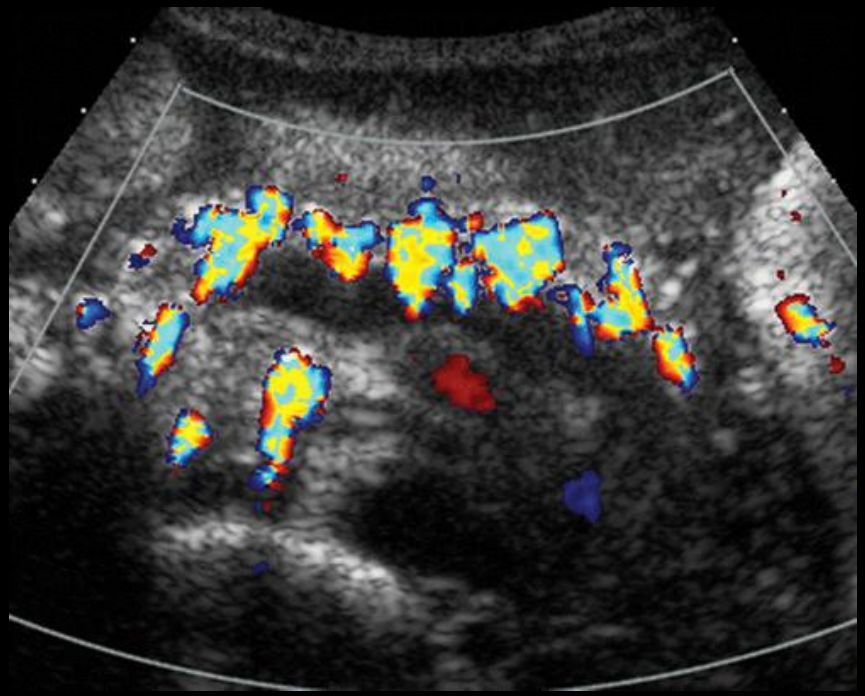

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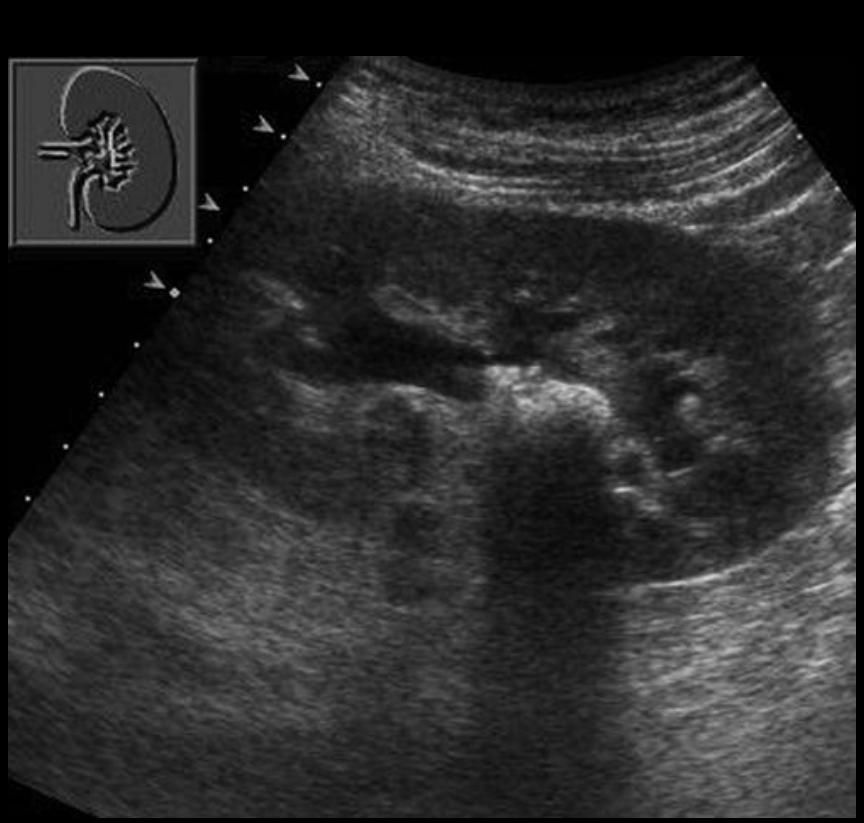

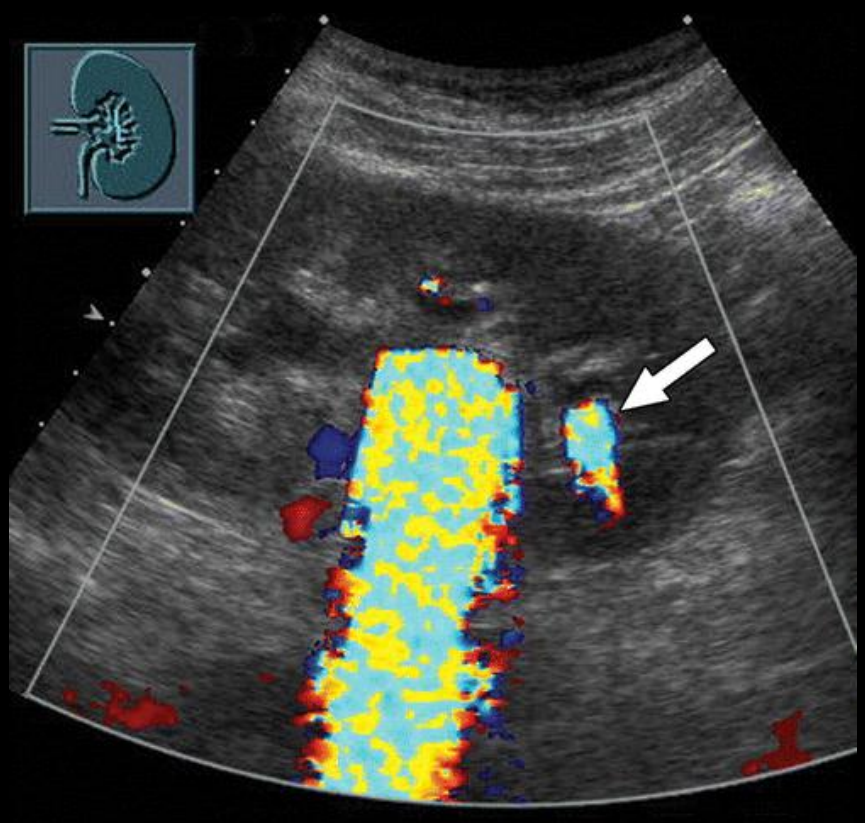

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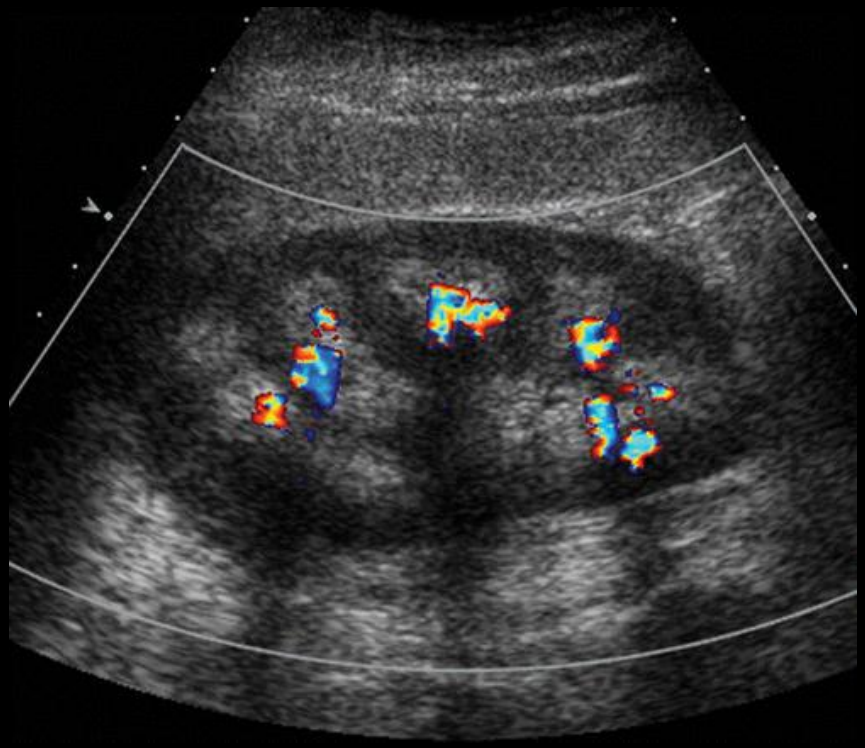

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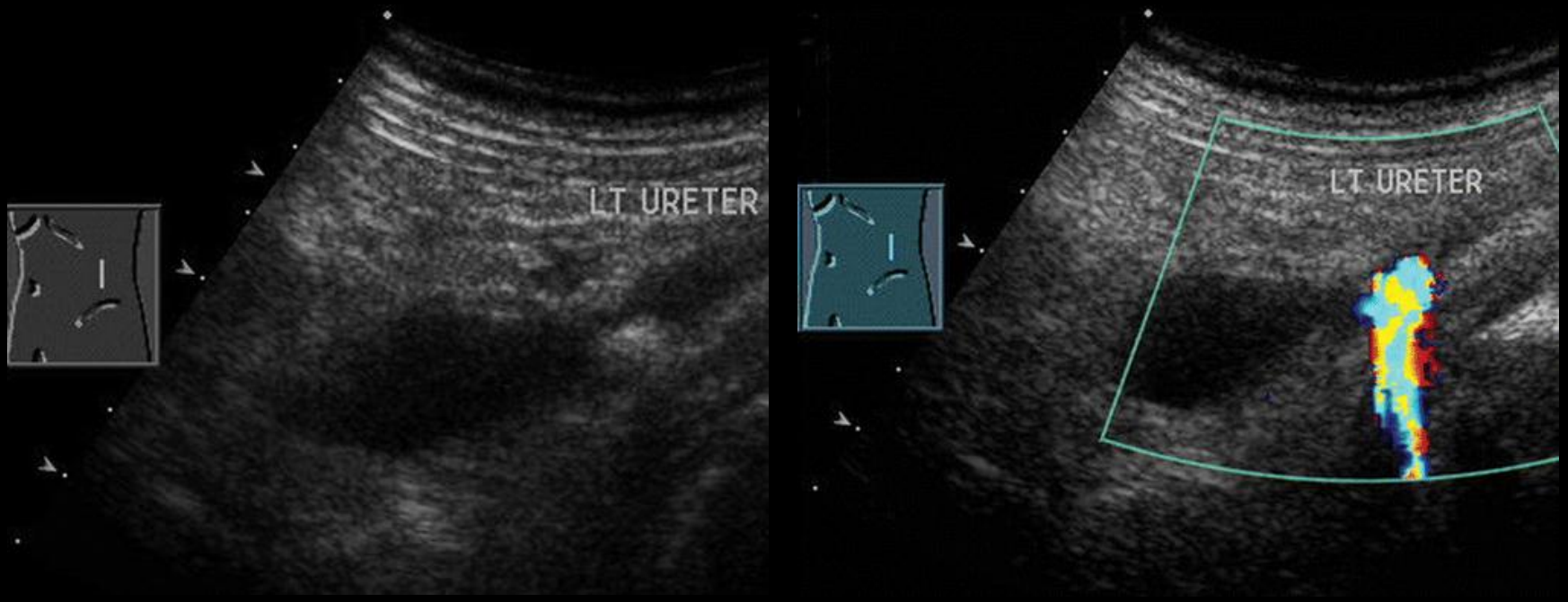

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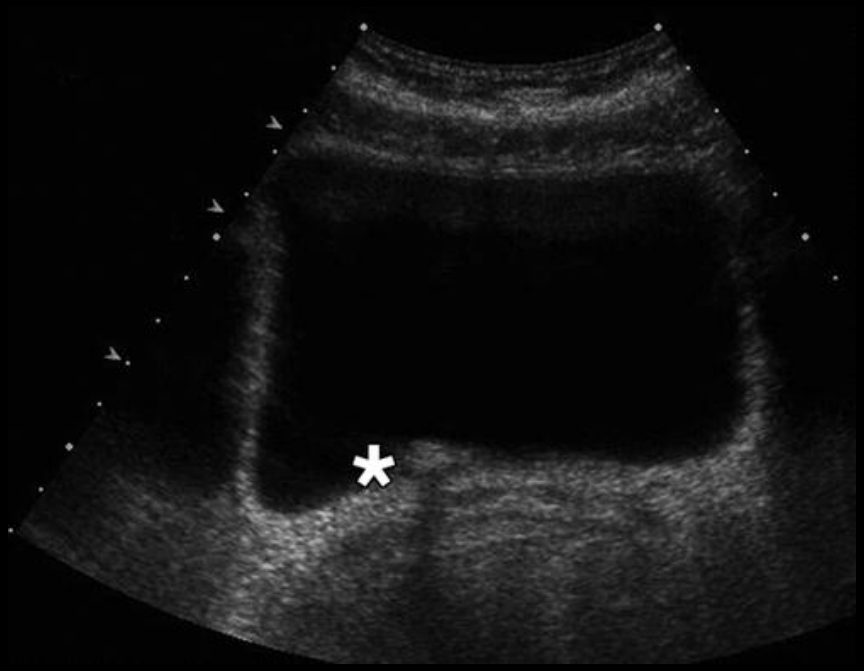

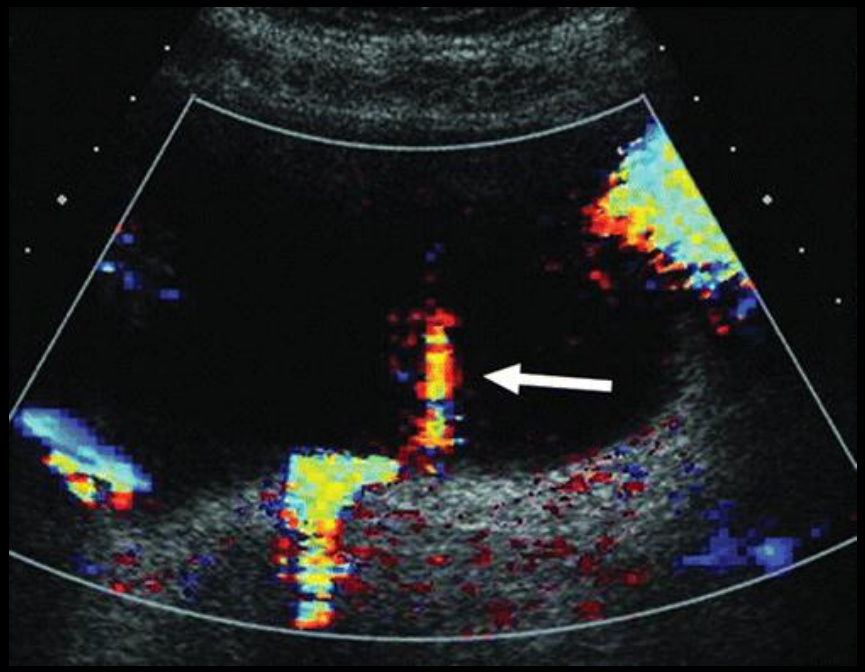

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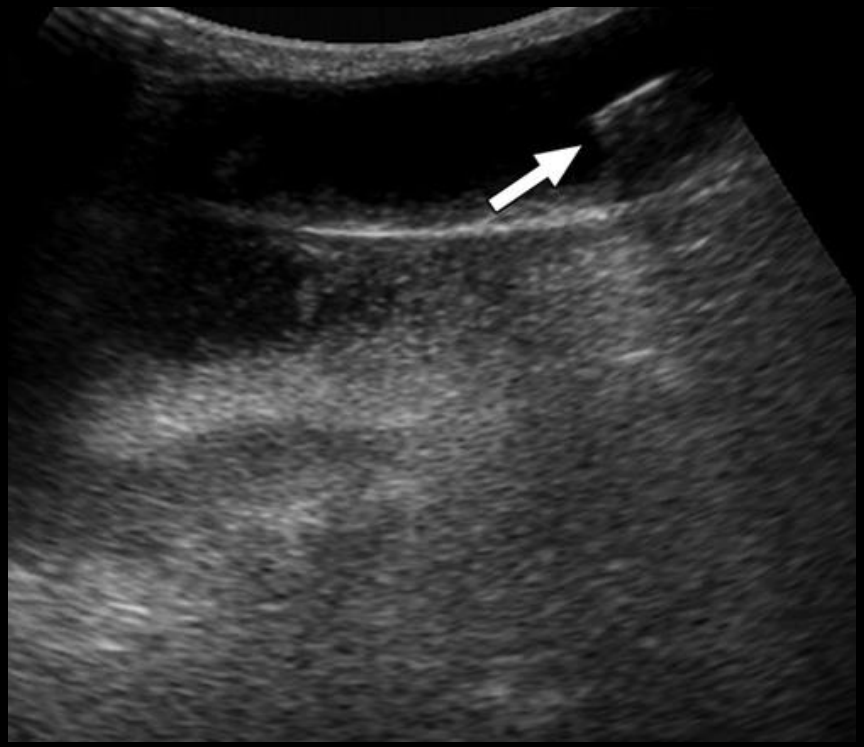
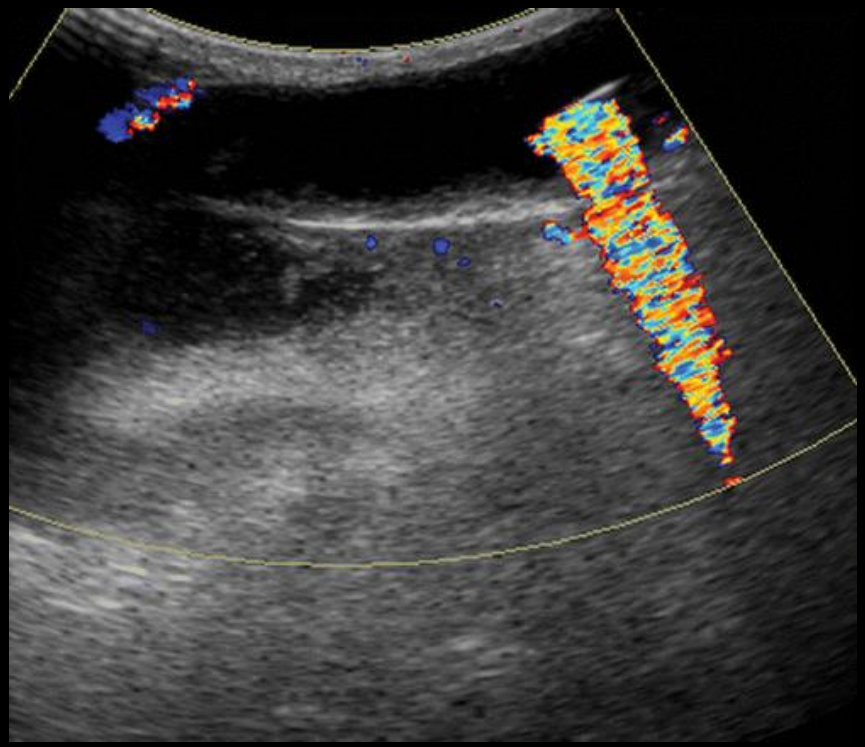
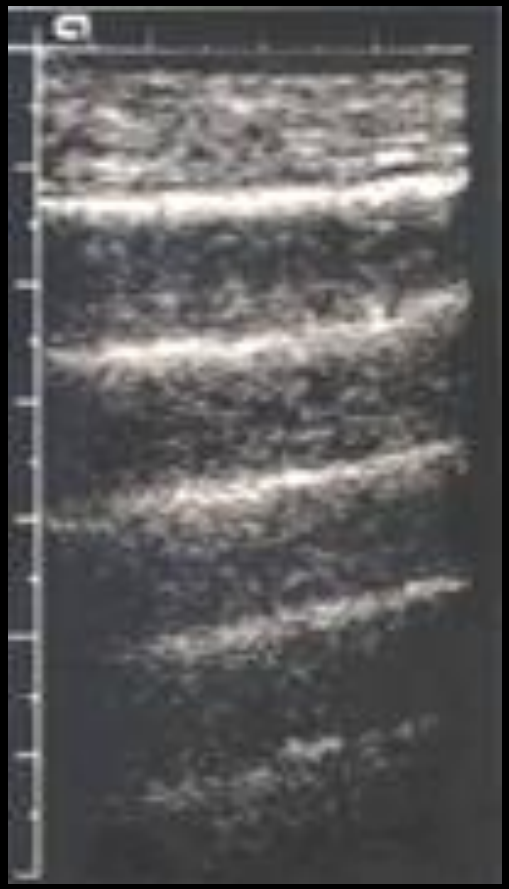
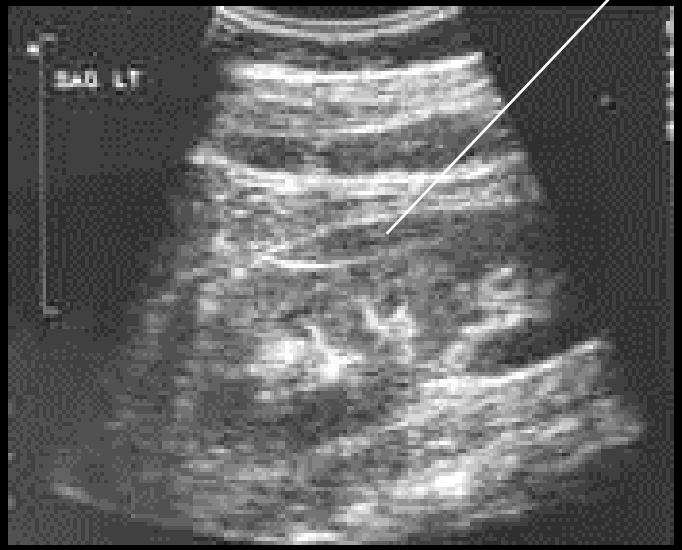




ULTRASON ARTEFAKTLARI





ULTRASON ARTEFAKTLARI

- Hız yerdeğiştirme artefaktları farklı dokularda ses hızındaki değişikliklere bağlıdır.
- Örneğin yağ dokusunda ses hızının daha yavaş olmasına bağlı distal anatomik alanlardan dönen sesler % 6'lık bir gecikme ile kitle içinen geçerek görüntüde yerdeğişikliğine neden olurlar