ECHOCOLOR DOPPLER LESSONS

ULTRASOUND IN ABDOMINAL AORTA AND ILIAC ARTERIES Atherosclerotic Disease

Franco Accorsi
Ultrasound in abdominal aorta and iliac arteries atherosclerotic disease

INTRODUCTION

The echocolor Doppler examination of the abdominal aorta must inform on its profile, its wall and on the possible presence of atherosclerotic pathologies. The ultrasound investigation is the best way to diagnose an abdominal aortic aneurysm with an accuracy of almost 100%: sonographically the most common appearance of an abdominal aorta aneurysm is a dilated vessel with associated atherosclerotic changes. The ultrasound evaluation of the axial aneurysm diameters and the exact relationship of the aneurysm with the origin of the renal arteries and the bifurcation are required. Dilatation or stenosis of the common iliac arteries should also be documented. The ultrasound evaluation of the iliac arteries provides the description of the artery wall and requires the documentation of possible associated pathologies. In this lesson the sonographic characteristics of the atherosclerotic diseases (thrombosis, aneurysms and dissections) of the abdominal aorta and of the iliac arteries are presented.
INDICATIONS FOR US OF THE ABDOMINAL AORTA:

A. Screening Evaluation for an Abdominal Aortic Aneurysm
1. men 65 years or older/women 65 years or older with CV risk factors
3. pts 50 years or older with a family history of aortic and/or peripheral vascular aneurysmal disease
4. pts with a personal history of peripheral vascular aneurysmal disease
   
   Groups with additional risk: diabetes, smoking, hypertension, connective tissue diseases

B. Diagnostic Evaluation for an Abdominal Aortic Aneurysm
1. palpable or pulsatile abdominal mass
2. unexplained lower back pain or abdominal pain
3. follow-up of a previously demonstrated abdominal aortic aneurysm/pts with an abdominal aortic and/or iliac endoluminal stent graft
<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Men</strong> age 65-74</td>
<td>1A</td>
</tr>
<tr>
<td>2</td>
<td><strong>Women</strong> age 65 who have cardiovascular disease and positive family history of AAA</td>
<td>3C</td>
</tr>
<tr>
<td>3</td>
<td><strong>Men</strong> aged 50 and above with positive family history</td>
<td>3C</td>
</tr>
</tbody>
</table>
US IN AORTIC PATHOLOGY: PROTOCOL

1. description of the profile and aortic wall
2. presence of atherosclerosis/plaque/thrombus/dissection
3. presence of aneurysm
aorta and iliac arteries disease

aortic pathology

US IN AORTIC PATHOLOGY: PROTOCOL

1. description of the profile and aortic wall
2. presence of atherosclerosis/plaque/thrombus/dissection
3. presence of aneurysm
a) longitudinal image of atherosclerotic abdominal aorta with small plaque and regular diameter (= 1,54 cm.)

b) the waveform shape is normal: high resistance, normal laminar flow (a narrow band of blood flow velocities with a “window” beneath the spectral trace in systole)
aorta and iliac arteries disease

aortic pathology

US IN AORTIC PATHOLOGY: PROTOCOL

1. description of the profile and aortic wall
2. presence of atherosclerosis/plaque/thrombus/dissection
3. presence of aneurysm
FLOATING THROMBUS IN ABDOMINAL AORTA:
PERIPHERAL EMBOLIZATION

a) longitudinal scan of abdominal aorta: floating thrombus
b) longitudinal scan (embolization in the post. tibial artery, occluded) and transverse scan (you can see veins but not post. tibial artery)
ACUTE THROMBOSIS OF THE ABDOMINAL AORTA:
- longitudinal scan: hypoechoic occluding thrombus within the aortic lumen
abdominal aortic thrombus

ACUTE THROMBOSIS OF THE ABDOMINAL AORTA:
- longitudinal scan: anechoic occluding thrombus within the aortic lumen
abdominal aortic dissection

AORTIC DISSECTION

a) longitudinal scans: aortic double lumen (color Doppler and B-mode images)
b) transverse scan: aortic double lumen (B-mode images)
abdominal aortic dissection

**AORTIC DISSECTION**

a) longitudinal scan: aortic double lumen (color Doppler image)
b) longitudinal scan: aortic double lumen (B-mode image)
abdominal aortic dissection

**US**

**CHRONIC DISSECTION OF THE DESCENDING AORTA**
- longitudinal (a) and transverse (b) scans: abdominal aorta (true and false lumen)
aorta and iliac arteries disease

**aortic pathology**

**US IN AORTIC PATHOLOGY: PROTOCOL**

1. description of the profile and aortic wall
2. presence of atherosclerosis/plaque/thrombus/dissection
3. presence of aneurysm
<table>
<thead>
<tr>
<th>AAA (cm.)</th>
<th>Diameter rupture risk (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>0</td>
</tr>
<tr>
<td>40-49</td>
<td>1</td>
</tr>
<tr>
<td>50-59</td>
<td>1.0-11</td>
</tr>
<tr>
<td>60-69</td>
<td>10-22</td>
</tr>
<tr>
<td>&gt;70</td>
<td>30-33</td>
</tr>
</tbody>
</table>

*Management of Abdominal Aortic Aneurysms Clinical Practice Guidelines of the European Society for Vascular Surgery*
<table>
<thead>
<tr>
<th>AAA Size</th>
<th>Follow-up Recommendation</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 cm.</td>
<td>Repeat ultrasound follow up in 3-5 years</td>
<td>1A</td>
</tr>
<tr>
<td>3,1-3,4 cm</td>
<td>Repeat ultrasound in 3 years</td>
<td>1A</td>
</tr>
<tr>
<td>3,5-3,9 cm</td>
<td>Repeat ultrasound in 2 years</td>
<td>1A</td>
</tr>
<tr>
<td>4-4,5 cm</td>
<td>Repeat ultrasound in 1 year</td>
<td>1A</td>
</tr>
<tr>
<td>4,5 cm or &gt;</td>
<td>Referral to vascular surgeon and repeat ultrasound every 6 months</td>
<td>1A</td>
</tr>
<tr>
<td>If &gt; 1 cm growth in a year</td>
<td>Referral to vascular surgeon for consideration of repair</td>
<td>1A</td>
</tr>
</tbody>
</table>
AORTIC ANEURYSM

criteria for diagnosing

- an aneurysm is a permanent focal dilatation of an artery to 1.5 times its normal diameter
- the normal infrarenal aortic diameters in patients older than 50 years are 1.5 cm in women and 1.7 cm in men
- by convention, an infrarenal aorta 3 cm in diameter or larger is considered aneurysmal
### Classification of abdominal aortic aneurysms

<table>
<thead>
<tr>
<th>Classification</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>By location</td>
<td>Suprarenal: Above origin of renal arteries (very rare)</td>
</tr>
<tr>
<td></td>
<td>Juxtarenal: Where renal arteries originate</td>
</tr>
<tr>
<td></td>
<td>Infrarenal: Below origin of RA (most common)</td>
</tr>
<tr>
<td>By morphology</td>
<td>Fusiform (most common)</td>
</tr>
<tr>
<td></td>
<td>Hourglass</td>
</tr>
<tr>
<td></td>
<td>Saccular</td>
</tr>
<tr>
<td>By etiology</td>
<td>Atherosclerotic (most common)</td>
</tr>
<tr>
<td></td>
<td>Inflammatory (5% – 10%)</td>
</tr>
<tr>
<td></td>
<td>Mycotic (1%): saccular, salmonella &amp; SA, high mortality</td>
</tr>
</tbody>
</table>

Abdominal aortic aneurysm

US EVALUATION OF AAA

- The US examination of the abdomen is the best way to diagnose an abdominal aortic aneurysm in the majority of patients.
- Is required dimensional evaluation of AP-LL axial aneurysm diameters on two-dimensional US axial sections.
- High US feasibility and a low rate of inadequate examinations.
Abdominal aortic aneurysm

US Evaluation of AAA

In the case of aneurysm it is necessary to describe:

- the maximum diameter of the aorta and its branches
- the diameter at the renal level (above and below)
- the possible presence of thickening of the walls (aortitis? inflammatory aneurysm?)
- the possible presence of intraluminal thrombus
abdominal aortic aneurysm

1. AP-LL AXIAL ANEURYSM
   - 45.7 mm (2D)
   - 49.3 mm (2D)

2. PROXIMAL NECK
   - 25.9 mm (2D)

3. INTRALUMINAL THROMBUS
   - 35.3 mm (2D)
   - 28.3 mm (2D)

4. ANEURYSM LENGTH ?
abdominal aortic aneurysm

US EVALUATION OF AAA

- color Doppler evaluation follows the gray scale examination of the aorta.
- sudden change in the aortic lumen diameter causes turbulent flow within the aneurysmal sac (the “pseudo yin-yang” sign).
abdominal aortic aneurysm

**US**

**ABDOMINAL AORTIC ANEURYSM: US EVALUATION**

a) transverse image: B-mode anterior-posterior and transverse diameter

b) longitudinal image: color Doppler demonstrates the typical turbulent flow in the aneurysm sac ("pseudo yin-yang" sign).
**ABDOMINAL AORTIC ANEURYSM: US EVALUATION**

a) transverse image: diameter and typical swirling flow in the aneurysm sac. Thin eccentric thrombus

b) longitudinal image: diameters of the aneurysm and of the distal neck
ABDOMINAL AORTIC ANEURYSM: US EVALUATION

a) transverse image: diameter (= 3.17 cm.) and typical swirling flow in the aneurysm sac.
b) longitudinal image (b-mode and color): diameters of the aneurysm (= 3.11 cm.) and of the proximal neck (= 1.92 cm.)
abdominal aortic aneurysm

ABDOMINAL AORTIC ANEURYSM REPAIR: US EVALUATION

a) transverse image (b-mode and color): aneurysm diameter (= 6.28x 4.55 cm.) and aorto-iliac endoprosthesis in the aneurysmal sac.
b) longitudinal scans: regular flows in the iliac arteries; c) angioCT
abdominal aortic aneurysm

US AAA: WHAT TO EVALUATE

- location
- measurements
- morphologic evaluation
- presence of complications
- the possible involvement of the iliac arteries
US AAA: WHAT TO EVALUATE

LOCATION

1. **suprarenal**: above the origin of the renal arteries (very rare)

2. **juxtarenal**: involving the part of the abdominal aorta in which the renal arteries originate (often involves the renal arteries)

3. **infrarenal**: below the renal arteries (most common location)
abdominal aortic aneurysm

US

US AAA: WHAT TO EVALUATE

- location
- measurements
- morphologic evaluation
- presence of complications
- the possible involvement of the iliac arteries
US EVALUATION OF AAA

- Diameter measurements are made on a cross sectional image of the vessel (scan plane orthogonal to the vessel axis).
- The lateral diameter (left-right) measurements tend to be less accurate than the antero-posterior diameter owing to the lower lateral resolution of B-mode US compared with its depth resolution (this results in better visualization of the aortic wall in the AP direction).
- To avoid confusion about aneurysm size, aneurysm length measurements should be generally not reported.
**ABDOMINAL AORTIC ANEURYSM**

- US B-mode of abdominal aortic aneurysm documenting aortic anterior-posterior (A-P) and transverse (right-left) diameter
- the lateral resolution of US is less that the depth resolution making accurate A-P diameter measurements easier to obtain
abdominal aortic aneurysm

US

**US AAA: WHAT TO EVALUATE**

- location
- measurements
- morphologic evaluation
- presence of complications
- the possible involvement of the iliac arteries
US AAA: WHAT TO EVALUATE

MORPHOLOGIC EVALUATION

A description of aneurysm morphology should be included

a) **fusiform**: appears as a symmetric enlargement. The most frequent

b) **saccular**: localized dilatation (round)

c) **hourglass**: two noncontiguous areas of focal dilatation separated by normal caliber aorta (double aneurysm)
abdominal aortic aneurysm

**US**

AAA: US MORPHOLOGIC EVALUATION

**a. fusiform aneurysm** (tube-shaped): symmetric enlargement of the AA

**b. saccular aneurysm** (round): a distended sac affecting only part of the arterial circumference

**c. hourglass:** two focal dilatations separated by normal caliber aorta
abdominal aortic aneurysm US

US AAA: WHAT TO EVALUATE

- location
- measurements
- morphologic evaluation
- presence of complications
  (such as rupture, thrombosis and embolization)
- the possible involvement of the iliac arteries
abdominal aortic aneurysm

RUPTURE OF A AAA ultrasound findings

1. aneurysm with hypoechoic/anechoic areas
2. focal parietal interruption: a small hypoechoic area of discontinuity in the wall
3. thrombus within the aortic lumen
abdominal aortic aneurysm

RUPTURE OF A AAA transverse image

AAA (diam. = 124 x 128 mm.) with hypoechoic/anechoic areas within the floating thrombus
abdominal aortic thrombus

AAA FUSIFORM COMPLETELY THROMBOSED

a) upstream to the occlusion: high-resistance waveforms
b) longitudinal and transverse scan: thrombus completely occluding the abdominal aorta
abdominal aortic aneurysm

US

ABDOMINAL AORTIC ANEURYSMS WITH THROMBI

- aortic aneurysms with extensive mural thrombi
- thrombus appears as heterogeneous image that partially fills the aneurysm and partially surrounds the hypoechoic flow lumen

a) aneurysm = 49.8 mm., residual lumen = 31.9 mm.
b) aneurysm = 52.6 mm., residual lumen = 18.8 mm.
ABDOMINAL AORTIC ANEURYSM WITH EXTENSIVE MURAL THROMBUS

- aortic aneurysms: thrombus appears as heterogeneous image that partially fills the aneurysm
  a) transverse scan: aneurysm 53 x 57 mm., residual lumen = 20 x 24 mm.;
  b) longitudinal scan: aneurysm = 52 mm., residual lumen = 18 mm.)
abdominal aortic aneurysm

ABDOMINAL AORTIC ANEURYSMS WITH THROMBI

- aortic aneurysms with extensive mural thrombi
- thrombus appears as heterogeneous image that partially fills the aneurysm
abdominal aortic aneurysm

US

US AAA: WHAT TO EVALUATE

- location
- measurements
- morphologic evaluation
- presence of complications
- the possible involvement of the iliac arteries
  (stenosis/ aneurysm)
abdominal aortic aneurysm

AAA NOT EXTENDED TO THE ILIAC ARTERIES

a) longitudinal image: color Doppler demonstrates the typical swirling flow within the aneurysm
b) transverse image of the iliac arteries: normal diameters
abdominal aortic aneurysm US

AAA NOT EXTENDED TO THE ILIAC ARTERY

a) longitudinal image: color Doppler demonstrates the aortic aneurysm and the normal diameter of the iliac artery
b) iliac artery: typical normal high resistance waveform
AA ANEURYSMS EXTENDED TO THE IliAC ARTERIES
colorDoppler: AAA and aneurysm of the left iliac artery
a) transverse images (aorta diameter = 4.9 x 5.3 cm.; iliac rt diameter = 1.79 cm.; lt diam. = 5.24 cm.)
b), c) longitudinal images (iliac rt diameter = 1.74 cm.; lt diam. = 5.09 cm.)
AAA EXTENDED TO THE ILIAC ARTERIES

color Doppler images: AAA and aneurysm of the Lt iliac artery

a) transverse images (aorta diameter = 3,7 cm.; iliac rt diameter = 1,1 cm.; Lt diam. = 1,8 cm.)
b) longitudinal images (iliac rt diameter = 1,0 cm.; Lt diam. = 1,6 cm.)
US IN ILIAC ARTERIES PATHOLOGY: PROTOCOL

Description of the:

- profile and the wall of the iliac arteries
- presence of stenosis/occlusion
- presence of aneurysms: maximum diameter
aorta and iliac arteries disease

iliac arteries pathology

US IN ILIAC ARTERIES PATHOLOGY: PROTOCOL

Description of the:

- profile and the wall of the iliac arteries
- presence of stenosis/occlusion
- presence of aneurysms: maximum diameter
DUPLEX CRITERIA FOR EVALUATION OF ARTERIAL STENOSIS

1) ELEVATED VELOCITIES:
- diagnostic criteria use PSV (> 125 cm/s): ratios of distal/proximal PSV (2:1)
- elevated end-diastolic velocity

2) DIAMETER REDUCTION:
- transverse or longitudinal measurements indicating reduction in luminal diameter (are supportive, not diagnostic)

3) SPECTRAL BROADENING OR COLOR MOSAIC PATTERN:
- presence of turbulent
- aliasing of color Doppler signal

4) COLOR BRUIT, COLOR PERSISTENCE:
- color bruit, providing evidence of vibration in the tissue surrounding arterial narrowing
Iliac artery stenosis

Lower limb arterial stenosis
Most common sites

- aorto-iliac: 25%
- femoro-popliteal: 65%
- infra-popliteal: 10%

ILIAC ARTERY HIGH GRADE STENOSIS

a) reduction in luminal diameter with aliasing and high velocity flow (> 500 cm/s.) directly over the stenotic segment
b) monophasic, post stenotic waveform recorded just distal to the stenosis, in the absence of reversed component
ILIAC ARTERY HIGH GRADE STENOSIS WITH MONOPHASIC WAVES DOWNLOAD

- aliasing, color bruit (a) and high velocity flow (b) over the stenotic segment (rt. common iliac artery: PSV = 260 cm/s.)
- monophasic flow download: EIA (c), CFA (d), PA (e), ATA and PTA (f)
BILATERAL ILIAC ARTERIES HIGH GRADE STENOSIS (RT. > LT)

a) transverse scan: bilateral aliasing
b) longitudinal scans: rt. iliac art. stenosis. Aliasing, color bruit and high velocity flow (PSV = 490 cm./sec.) over the stenotic segment and monophasic, post stenotic, waveform (PSV = 48 cm./sec.) distal to the stenosis, with no reversed component (more significant stenosis compared to the contralateral)
c) longitudinal scans: lt. iliac art. stenosis. Aliasing, color bruit and PSV = 239 cm./sec. over the stenotic segment and post stenotic waveform (PSV = 80 cm./sec.) with low reversed component distal to the stenosis
ILIAC ARTERY MODERATE STENOSIS WITH BIPHASIC WAVES DOWNLOAD

- high resistance flow with PSV = 70 cm/s. before the iliac stenosis (a) and high velocity flow (b) over the stenosis (rt. com. iliac art.: PSV = 190 cm/s.);
- biphasic wave distally (c) sup. fem. art., (d) popl. art. and (e) post. tibial art.
ILIAC ARTERY STENOSIS WITH BIPHASIC WAVE DOWNLOAD

a) rt. iliac artery stenosis: reduction in luminal diameter, aliasing and high velocity flow directly over the stenotic segment (PSV = 305 cm./sec.). The PSV just distal to the stenosis is = 78 cm/sec. The PSV ratio > 2 is indicative of hemodynamic stenosis

b) lt. iliac artery: biphasic waveform (PSV= 150 cm./sec)
**LEFT ILIAC ARTERY STENOSIS**

a) rt.: regular triphasic waveform in iliac (PSV = 112 cm/s.) and common femoral artery (PSV = 105 cm/s.)
b) lt.: high velocity, monophasic flow, over the iliac stenotic segment (PSV = 148 cm/s.). The waveform distal to the stenosis (common femoral artery PSV = 25 cm/s.) is biphasic
ILIAC ARTERY OCCLUSION

a) regular flow in rt. external iliac artery and (b) common femoral artery
c) Lt. iliac art. occlusion: high resistance flow in rt. common iliac art.
a) poor, monophasic, post stenotic waveform recorded in the common femoral artery
ILIAC ARTERY OCCLUSION

a) rt. iliac art. occlusion: no flow in rt. common iliac art. (transverse scan)
b) monophasic, post stenotic waveform recorded just distal to the occlusion, in the absence of reversed component (external iliac art. and femoral art.)
c) regular flow in lt. external iliac artery and femoral artery
US IN ILIAC ARTERIES PATHOLOGY: PROTOCOL

Description of the:

- profile and the wall of the iliac arteries
- presence of stenosis/occlusion
- presence of aneurysms: maximum diameter
ANEURYSM OF THE RT ILIAC ART. AND STENOSIS OF THE LT ILIAC ART.
a) transverse scan of the aorta and common iliac arteries: the diameter of the aorta is regular (= 1,77 cm.). Diameters of the common iliac arteries: rt. = 1,81 cm. (aneurysm); lt. = 1,09 cm.
b) rt. iliac art.: monophasic waveform (PSV = 48 cm./sec.) distal to the aneurysm with no reversed component
c) lt. iliac art. longitudinal scan: stenosis with high velocity flow (PSV = 238 cm./sec.) over the stenotic segment
ANEURYSM OF THE RIGHT ILIAC ARTERY

a) color longitudinal image with typical swirling flow within the aneurysm
b) power longitudinal image (iliac aneurysm diameter = 2.83 cm.; proximal neck diameter = 0.91 cm.)
c) power transverse image (iliac rt diam. = 2.81 cm.; lt diam. = 1.05 cm.)
ANEURYSM OF THE RIGHT ILIAC ARTERY

B mode longitudinal image: common iliac aneurysm with thrombus (hyperechoic image that partially fills the aneurysm)
FUSIFORM ANEURYSM OF THE COMMON ILLIAC ARTERY

a) color transverse images of aorta (diameter = 1,56 cm.) and (b) iliac arteries (rt. diameter = 0,59 cm., lt. diameter = 0,95 cm.)

b) longitudinal images. Diameters of the lt. common iliac artery (color/b-mode): origin = 0,46 cm.; proximal = 0,84 cm.; (d) ext. iliac art. (color) = 0,68 cm.
The specificity and sensitivity of ultrasound for the detection of AAAs in asymptomatic patients is almost 100%.


Diagnosis of arterial disease of the lower extremities with duplex ultrasonography. A meta-analysis

- detection of a stenosis $\geq$ to 50 per cent or occlusion in the aortoiliac tract: sensitivity of 86% and specificity of 97%

abdominal aorta and iliac arteries

**US limitation and pitfalls**

**DUPLEX US MAIN LIMITATION AND PITFALLS**

- accuracy is diminished in aorta and iliac arterial segments in some individuals (due to obesity or the presence of bowel gas)
- dense arterial calcification can limit diagnostic accuracy
- sensitivity is diminished for detecting stenoses downstream from a proximal stenosis
- pitfalls
abdominal aorta and iliac arteries

*US limitation and pitfalls*

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abdominal aorta and iliac arteries

US limitation and pitfalls

ABDOMINAL AORTA IN OBESE PATIENT WITH BOWEL GAS

- echo images hampered by bowel gas and obesity: (a) transverse (b mode) and (b) longitudinal (color) scans.
abdominal aorta and iliac arteries

US limitation and pitfalls

ILIAC ARTERY IN OBESE PATIENT WITH BOWEL GAS

- echo images hampered by bowel gas and obesity: (a) longitudinal and (b) transverse scans.
abdominal aorta and iliac arteries

US limitation and pitfalls

DUPLEX US MAIN LIMITATION AND PITFALLS

- accuracy is diminished in aorta and iliac arterial segments in some individuals (due to obesity or the presence of bowel gas)
- dense arterial calcification can limit diagnostic accuracy
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- pitfalls
abdominal aorta and iliac arteries

US limitation and pitfalls

AORTA AND COMMON ILIAC ARTERY PLAQUES WITH DENSE CALCIFICATION

a) aorta and common iliac artery plaques. The excessive shadowing does not allow a proper assessment of plaques.
b) biphasic flow in external iliac artery (not hemodynamic plaques)
COMMON ILIAC ARTERY PLAQUE WITH DENSE CALCIFICATION

a) common iliac artery plaque. The excessive shadowing does not allow a proper assessment of plaque. But “aliasing” and high velocity flow download the shadow (PSV = 273 cm/s.) can diagnose an iliac hemodynamic calcified plaque

b) monophasic, post stenotic, waveform in external iliac artery
abdominal aorta and iliac arteries

US limitation and pitfalls

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- accuracy is diminished in aorta and iliac arterial segments in some individuals (due to obesity or the presence of bowel gas)
- dense arterial calcification can limit diagnostic accuracy
- sensitivity is diminished for detecting stenoses downstream from a proximal stenosis
- pitfalls
abdominal aorta and iliac arteries

US limitation and pitfalls

1. IA stenotic segment

a) aliasing and high-frequency signal directly over the iliac stenotic segment (IA) with (b) monophasic waveform just distal to the stenosis (CFA)

c) aliasing and high velocity flow over a new stenosis (SFA, middle segment) with (d) a monophasic waveform downstream, in the distal SFA. The sensitivity is diminished for detecting the SFA stenoses

ILIAC ART. (IA) AND SUPERFICIAL FEMORAL ART. (SFA) STENOSIS
abdominal aorta and iliac arteries

US limitation and pitfalls

**DUPLEx US MAIN LIMITATION AND PITFALLS**

- accuracy is diminished in aorta and iliac arterial segments in some individuals (due to obesity or the presence of bowel gas)
- the distal superficial femoral artery is deep so, in Hunter’s channel, the study of this artery can be complex
- dense arterial calcification can limit diagnostic accuracy
- sensitivity is diminished for detecting stenoses downstream from a proximal stenosis
- pitfalls
abdominal aorta and iliac arteries

US limitation and pitfalls

PITFALLS: ABDOMINAL AORTA ANEURYSM

- obtain measurements of the AA in transverse and longitudinal planes at correct axes especially with a tortuous aorta
- obtain measurements of the AA from outer wall to outer wall. In presence of thrombus, one may accidentally mistake the inner rim of the thrombus for the aortic wall
- transverse views are needed because many AAAs have larger transverse than AP diameter
- scanning should be systematically performed from the diaphragmatic hiatus to the bifurcation in order to avoid missing small, localized saccular aneurysms
abdominal aorta and iliac arteries

US limitation and pitfalls

US EVALUATION OF AAA: PITFALLS
measured in true transverse and longitudinal planes at correct axes!
- beware of the tortuous aneurysms (over estimation)
US EVALUATION OF AAA: PITFALLS
measured in true transverse and longitudinal planes at correct axes!
- beware of off centre measurement (under estimation)
abdominal aorta and iliac arteries

US limitation and pitfalls

US EVALUATION OF AAA: PITFALLS
aortic aneurysms with thrombi

Careful attention must be made to include the thrombus in the diameter measurement
- correct diameter measurement: red arrow
- incorrect diameter measurement: yellow arrow (not included the thrombus)

IN PRESENCE OF INTRALUMINAL THROMBUS

1. evaluation of the characteristics of the thrombus
2. evaluation of the residual lumen
abdominal aorta and iliac arteries

**US limitation and pitfalls**

**US EVALUATION OF AAA: PITFALLS**

aortic aneurysms with thrombi

Careful attention must be made to include the thrombus in the diameter measurement.

- Color within the abdominal aortic aneurysm shows turbulent flow within the lumen in the short and long axes and allows a better view of the correct diameter.
US EVALUATION OF AAA: PITFALLS

Transverse views are needed because many AAAs have larger LL than AP diam.

- AAA: transverse diameter (= 65 mm.) larger than AP diameter (= 58 mm.)
abdominal aorta and iliac arteries

US limitation and pitfalls

PITFALLS

mirror image artifact in aorta and peripheral arteries

- in some of the cases, depending on the angle of insonation and the surface structure of the plaques, the artifact shows a connection with the vascular lumen
- MIA is seen strongly reflecting plaques, on the vessel wall distant from the transducer. The artifacts are projected on tissue regions with low-intensity B-mode echoes (in longitudinal and transverse scan).

AORTIC MIRROR IMAGE ARTIFACT (MIA)

a) longitudinal and transverse scans: hyperechoic plaques with mirror image artifacts.
b) connection with the vascular lumen (this could be erroneously taken for an ulceration or a branch).
abdominal aorta and iliac arteries

US limitation and pitfalls

PITFALLS

mirror image artifact in aorta and peripheral arteries

- in some of the cases, depending on the angle of insonation and the surface structure of the plaques, the artifact shows a connection with the vascular lumen (this could be erroneously taken for an ulceration or a branch)

AORTA DISSECTION: COMMON ILIAC ARTERIES MIA?

- longitudinal (a) and transverse (b) scans: abdominal aorta (true and false lumen)
- transverse (c) scans: aorta bifurcation (common iliac arteries)

Diagnosis: double lumen of the CIA? mirror image artifact?
abdominal aorta and iliac arteries

US limitation and pitfalls

PITFALLS

mirror image artifact in aorta and peripheral arteries

- in some of the cases, depending on the angle of insonation and the surface structure of the plaques, the artifact shows a connection with the vascular lumen (this could be erroneously taken for an ulceration or a branch)

ABDOMINAL AORTA: MIA?

- longitudinal (a) scans: aliasing with high velocity flow (b) on the vessel wall distant from the transducer, under a strongly reflecting plaque

Diagnosis: ulceration? branch? mirror image artifact? other?
abdominal aorta and iliac arteries

US limitation and pitfalls

PITFALLS

idiopathic retroperitoneal fibrosis

- is a rare disorder: fibro-inflammatory tissue which usually surrounds the abdominal aorta and the iliac arteries and extends into the retroperitoneum

ABDOMINAL AORTA: RETROPERITONEAL FIBROSIS

- longitudinal and transverse scans: undilated aorta and periaortic fibrosis. These US images can mimic an aortic aneurysm
short videos and playlists on ultrasound examinations of the abdominal aorta and iliac arteries are available on my youtube channel:

http://www.youtube.com/channel/UCij561sX0bQoEjXlWKuPnKg