

Echo-Doppler des artères rénales

O Hélénon

Université Paris Descartes

Hôpital Necker, Paris

- **Technique d'examen**
- **Optimisation technique**
- **Résultats normaux**
- **La séméiologie élémentaire (SAR)**

Technique d'examen 4 objectifs - 4 incidences

Objectifs

1 Etude morphologique

Reins: cortex, sinus et hile
(atrophie, anévrisme,..)

2 Artères intrarénales

A. interlobaires juxta sinusales
≥ 3 sites pôles et région moyenne

3 Artères extrarénales

Portions juxtaostiale et moyenne
Portion hilare et branches lobaires

4 Artères supplémentaires

et aorte sousrénale (dépistage AAA)
de l'AMS à la bifurcation

Installation et équipement

A jeûn (3-4h)

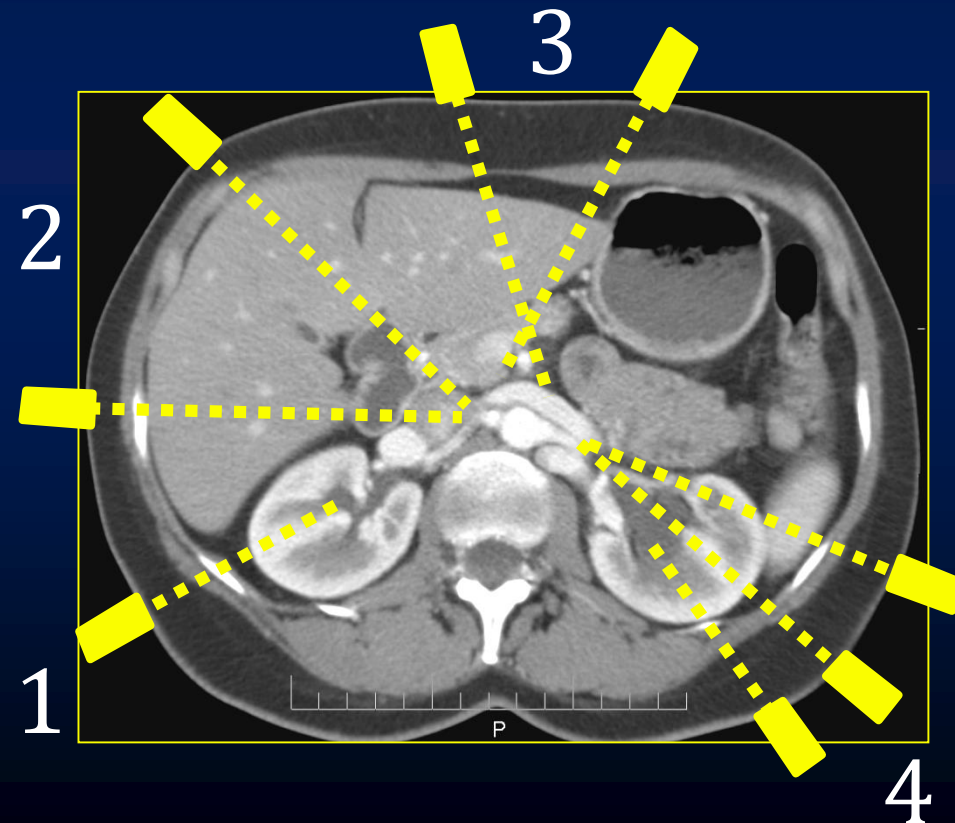
Decubitus latéraux

et horizontal (paroi relaxée, bras allongés)

Apnée inspiratoire et expiratoire (transhép.)

Sonde large bande (5-2MHz)

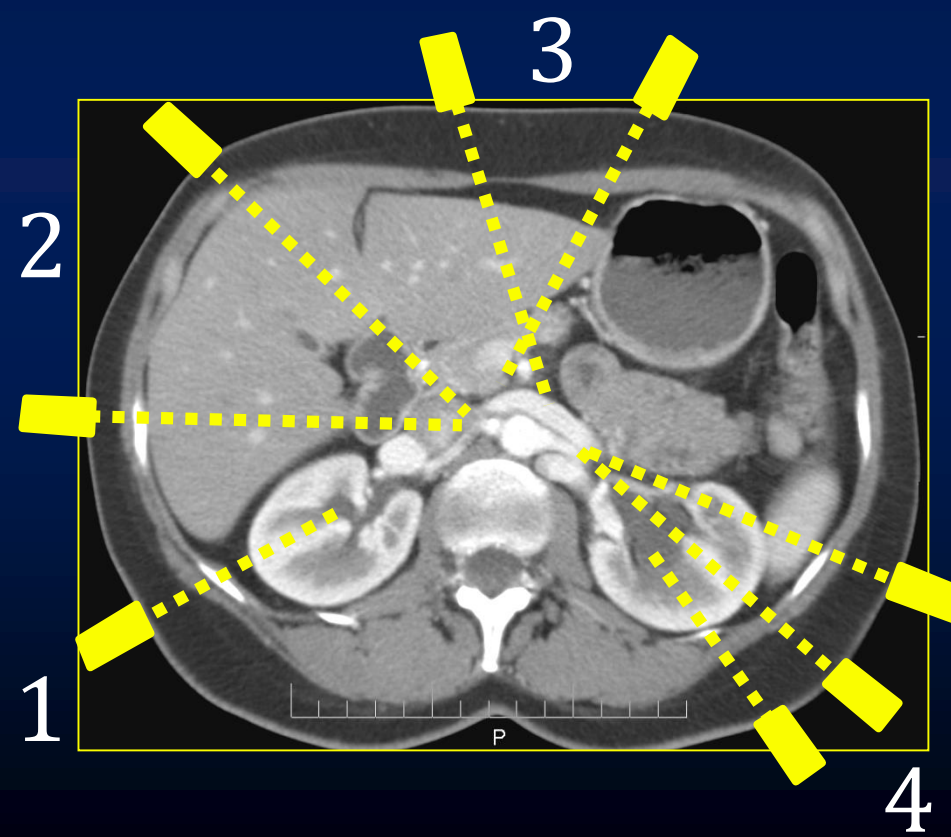
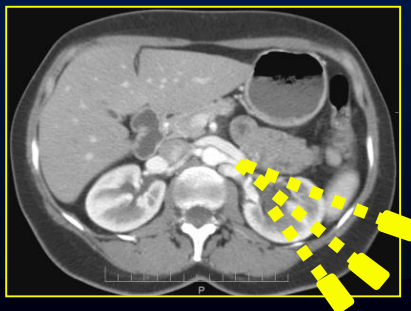
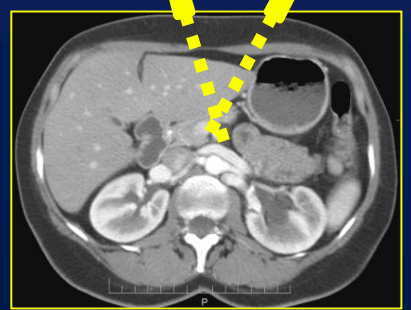
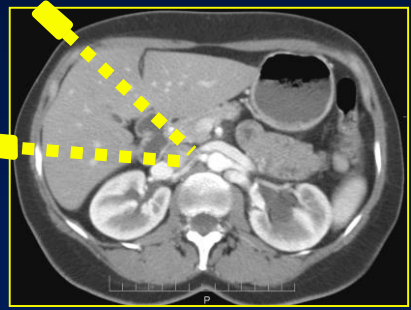
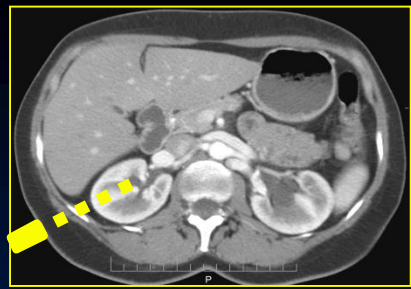
Imagerie non linéaire, Doppler couleur et pulsé



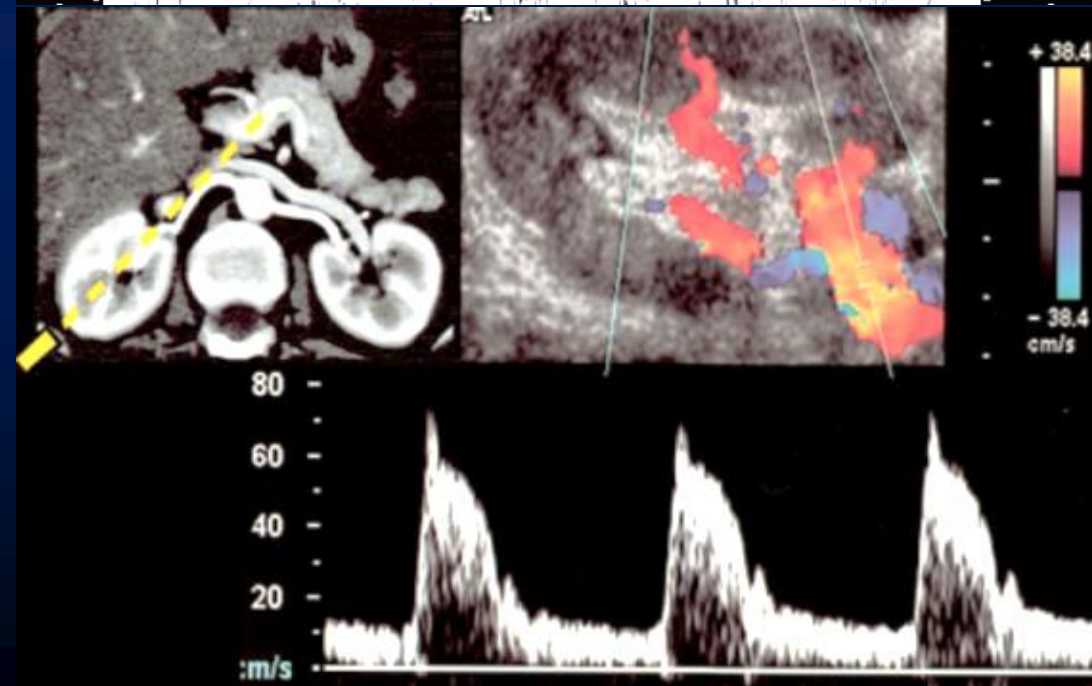
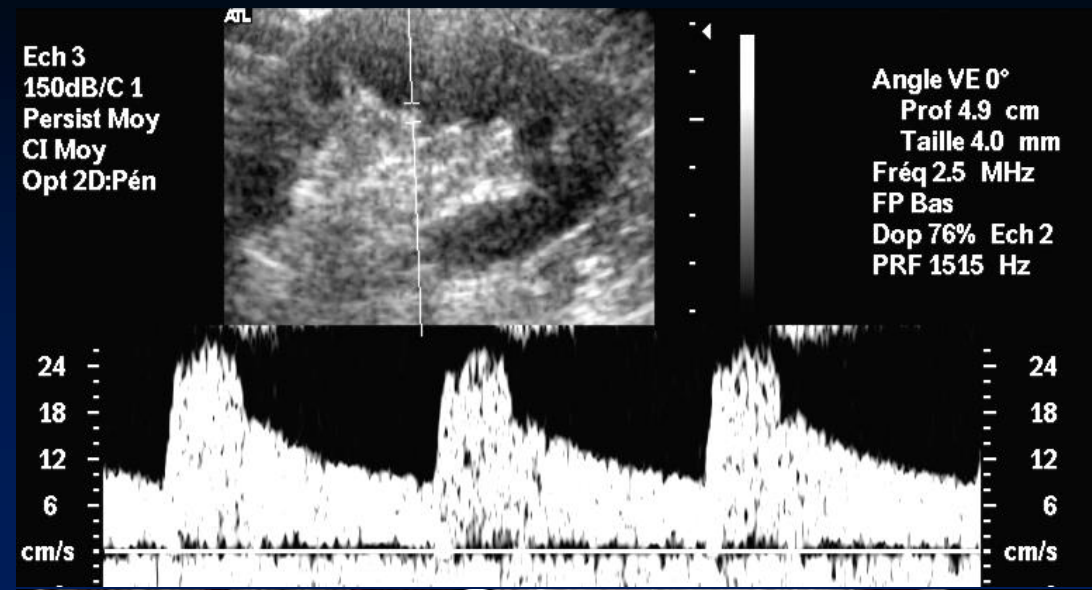
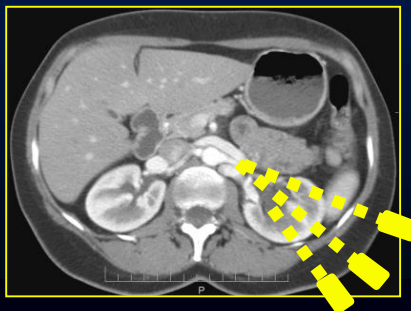
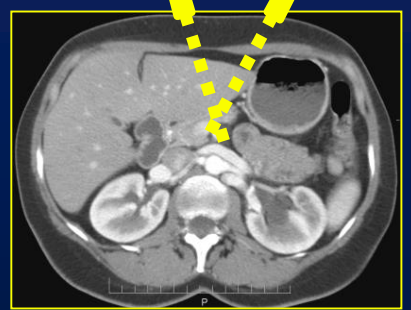
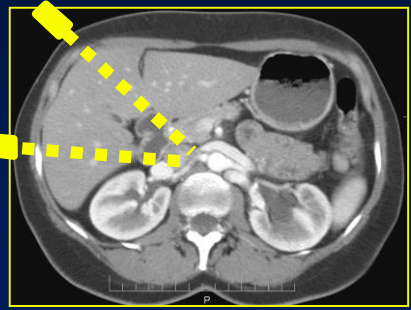
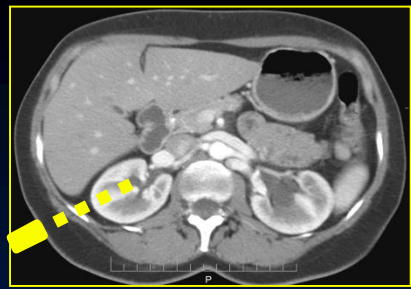
Protocole standardisé

Séquence d'exploration optimisée

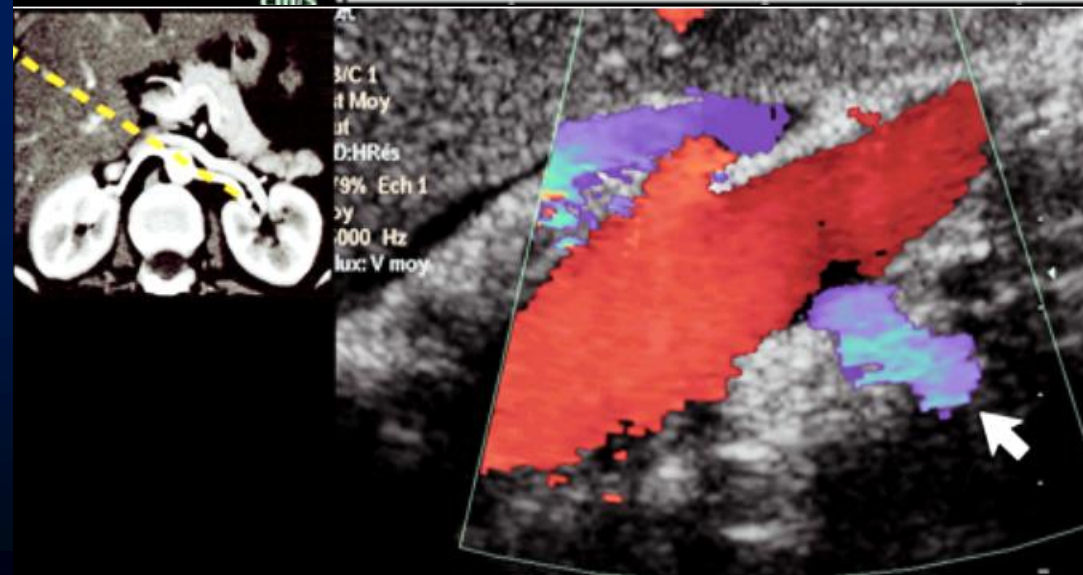
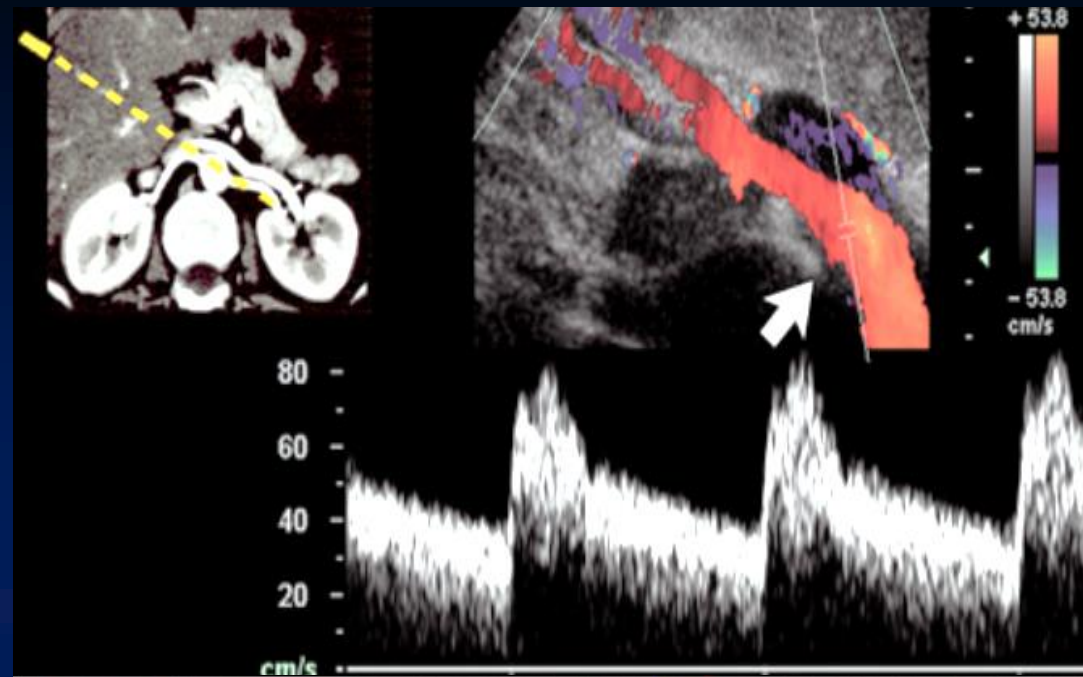
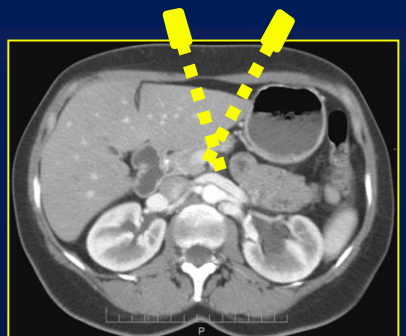
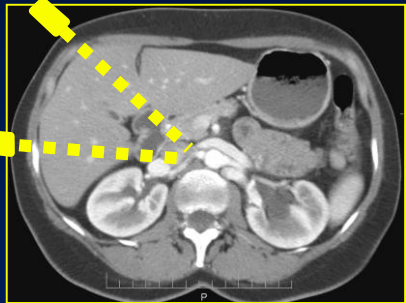
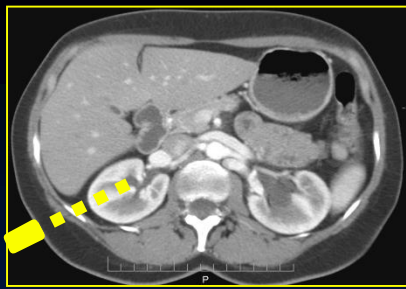
Déroulement idéal d'un examen complet en 4 étapes:



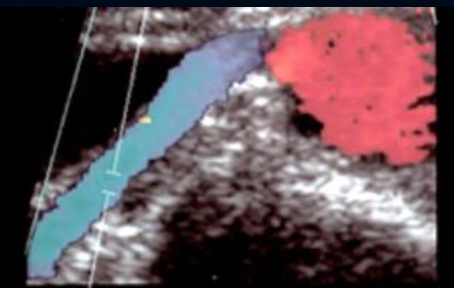
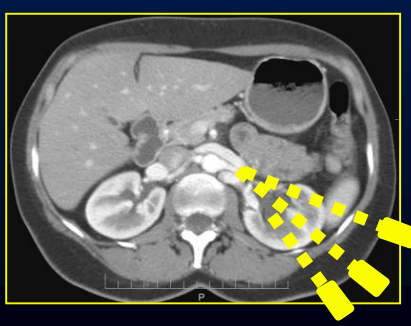
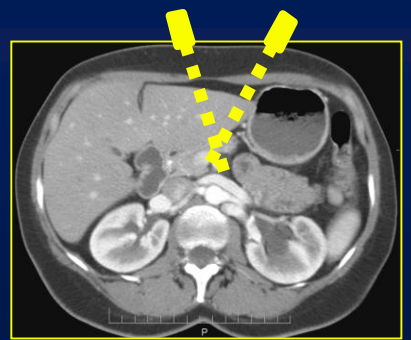
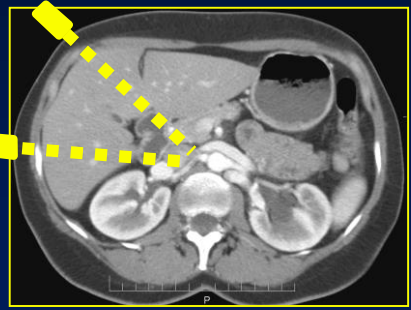
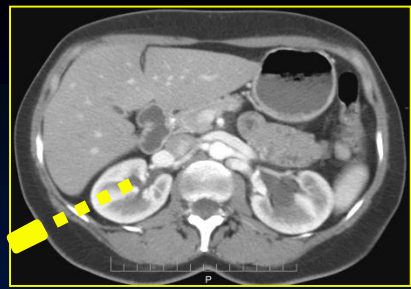
Protocole standardisé



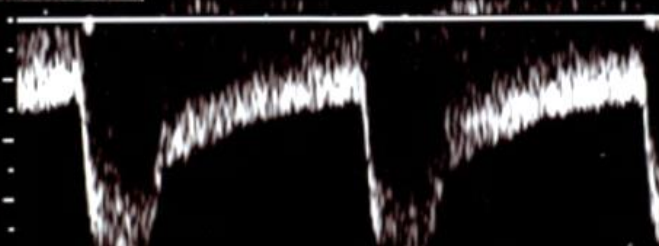
Protocole standardisé



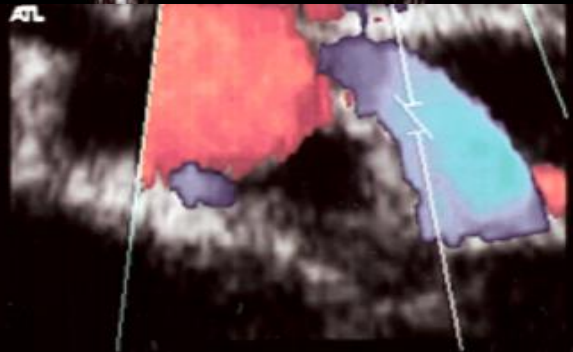
Protocole standardisé



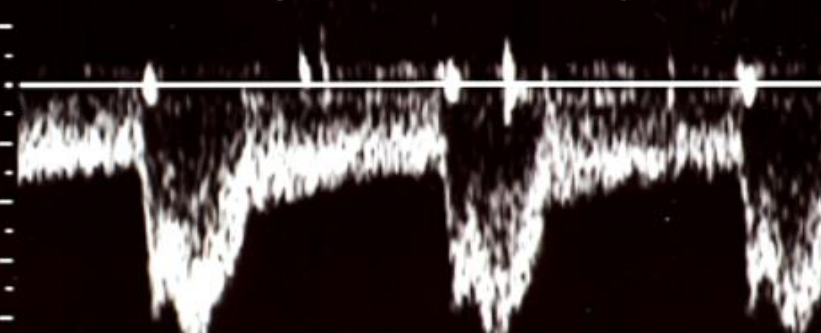
cm/s
-20
-40
-60



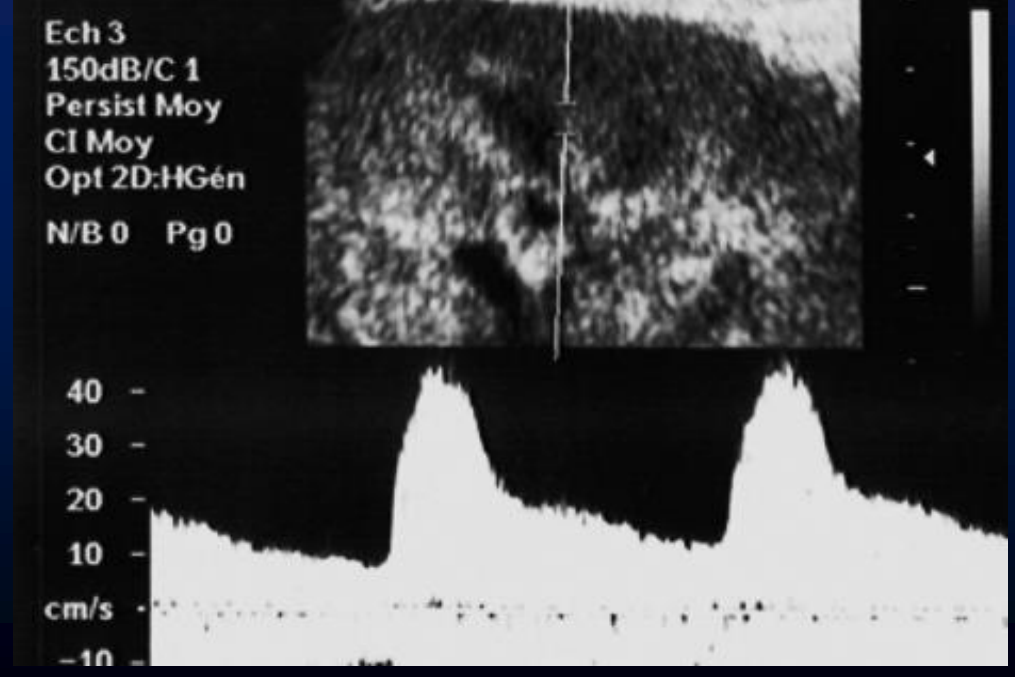
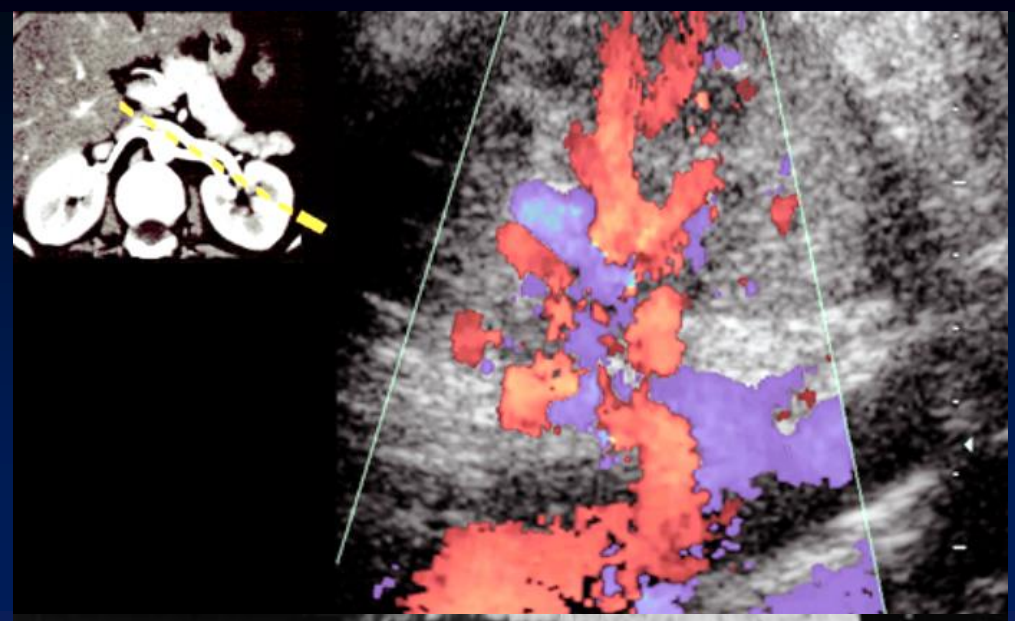
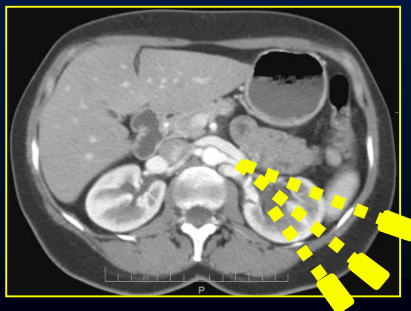
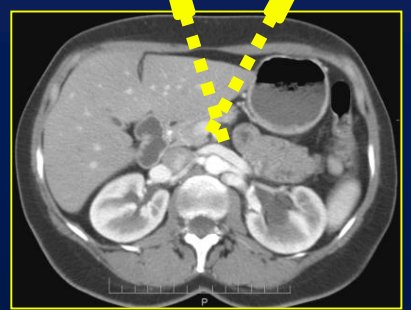
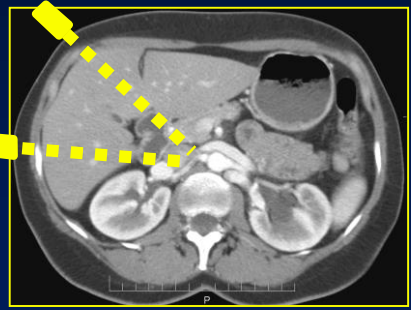
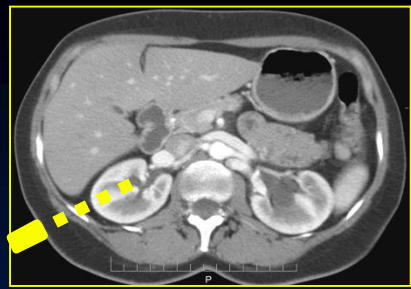
Coul 60% Ech 1
FP Moy
PRF 4000 Hz
Opt Flux: V moy



20
cm/s
-20
-40
-60
-80



Protocole standardisé



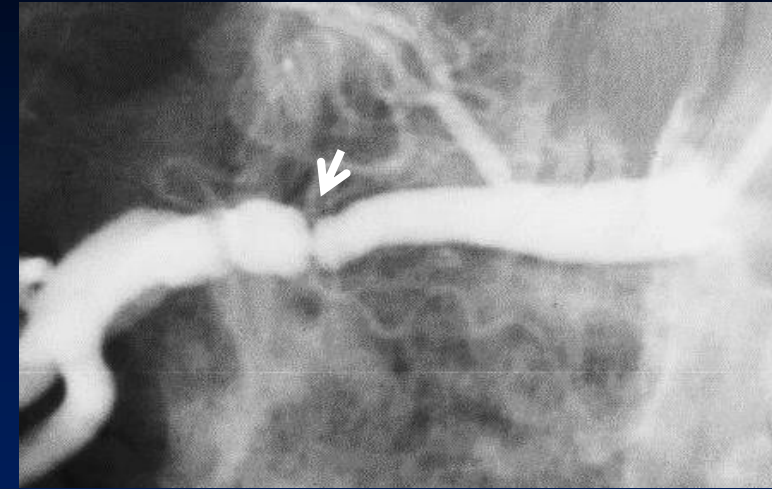
Critères de qualité de l'examen

Examen techniquement complet

Femme et homme jeunes (<40A)

Dysplasie fibromusculaire tjrs distale

→ **Etude complète couleur et pulsée des AR et branches**



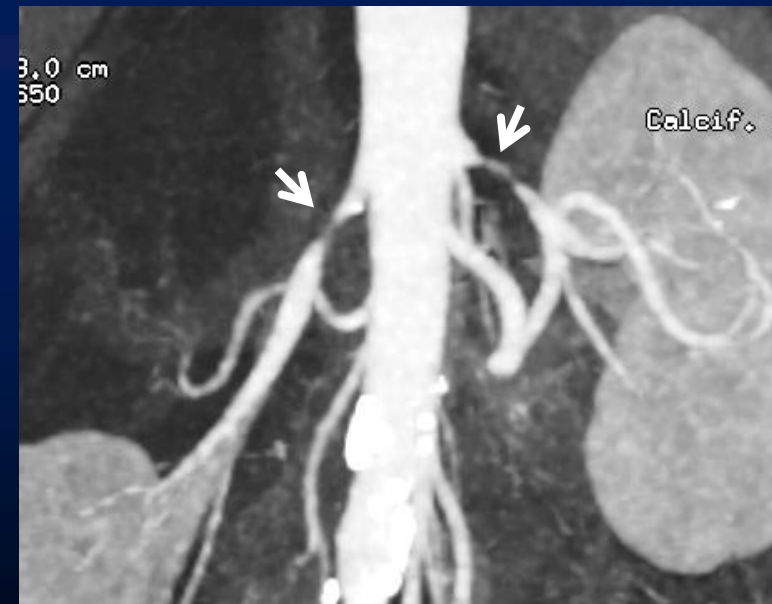
Examen techniquement satisfaisant

Polyartériel après 40 ans

Athérome aorto-ostial et postostial

→ **Doppler pulsé AR proximales nécessaire et suffisant**

Morphologie de l'origine AR optionnelle



Optimisation technique

Artères intrarénales

Affichage analyse spectrale

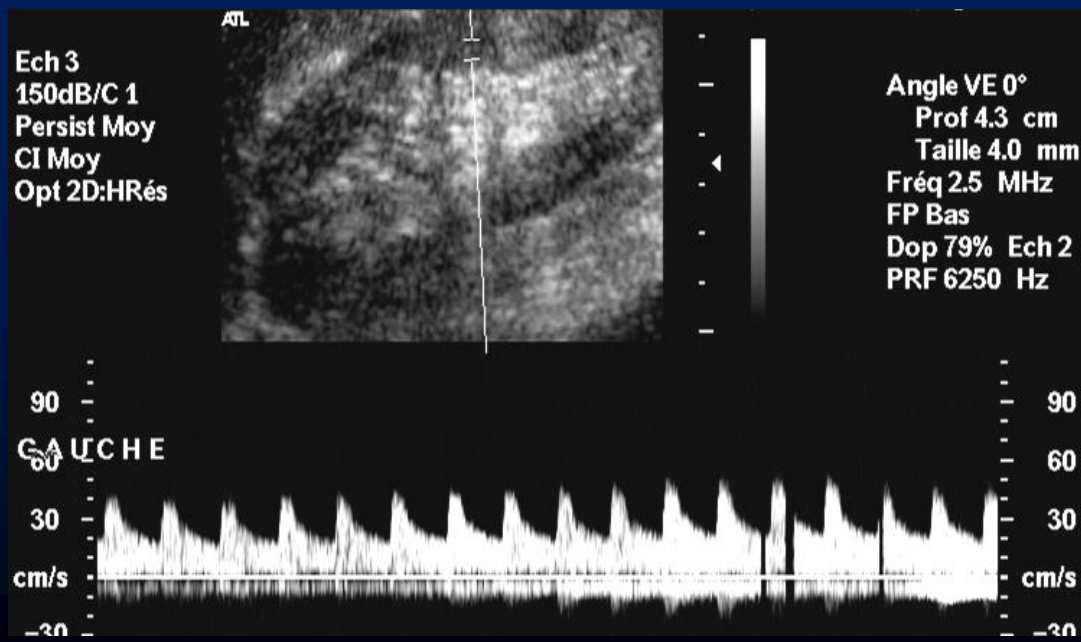
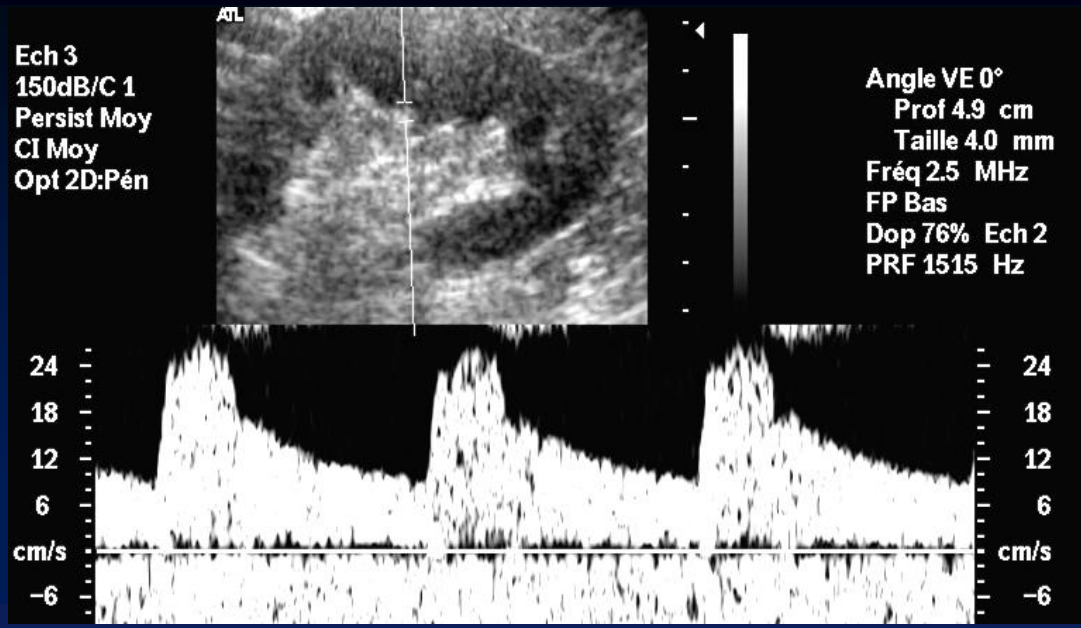
Vitesse affichage: 3-4 cycles

PRF la +basse gain le +haut

But: analyse de l'enveloppe

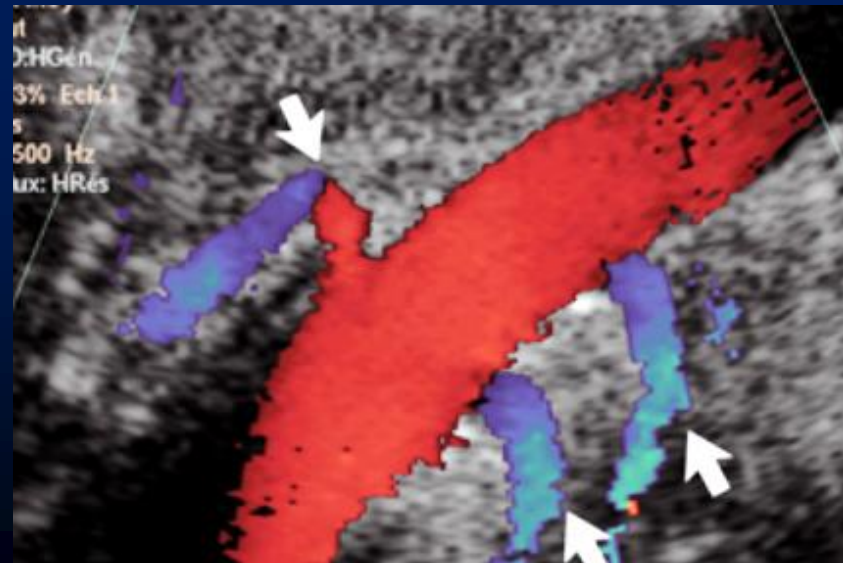
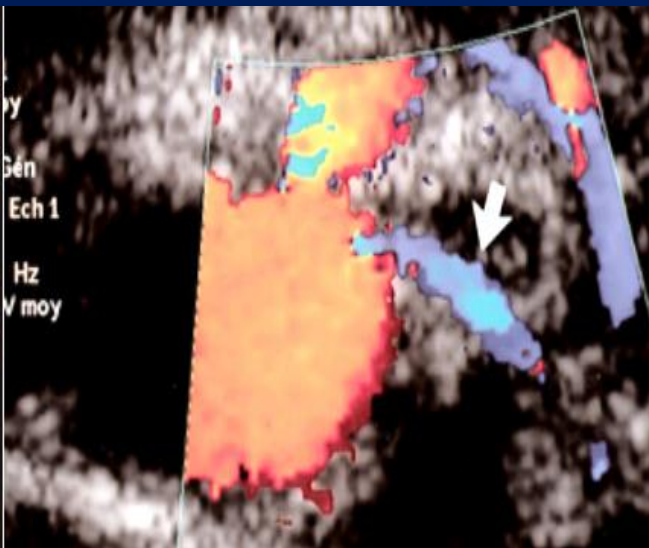
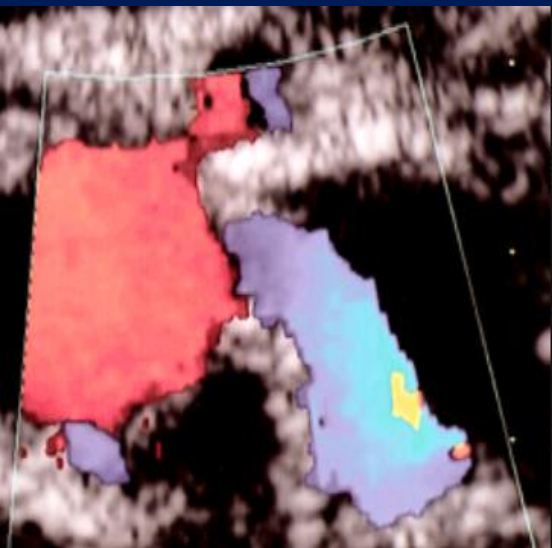
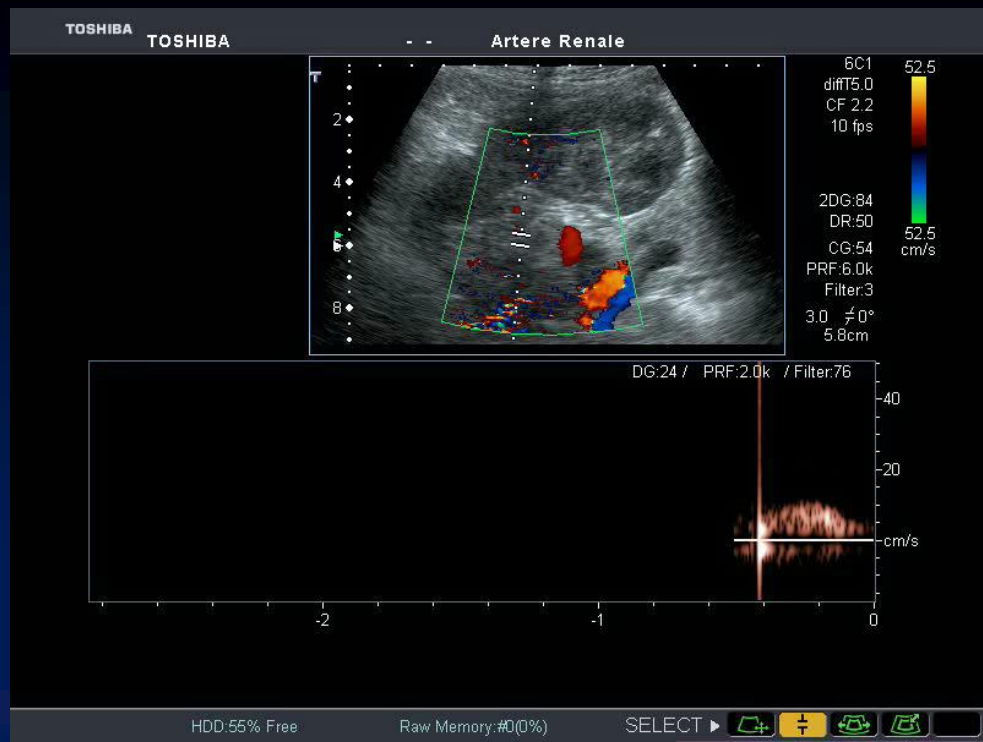
Acquisition plus rapide

Lecture facilitée



Artères supplémentaires 25% pop générale

Y penser tjrs :
Voie antérolatérale dtte
Balayage antérieur ++
Voie posterolatérale



Résultats normaux

AR tronculaires

Bords parallèles

Ostium aussi large ou +

VSM: 60-110 cm/sec

Encodage homogène Flux laminaire

Artères interlobaires

Modulation systolodiastolique

VSM: 25-40 cm/sec

Calculs d'indices

Tps montée systol (TMS) < 70ms

Non obligatoire

Pic syst précoce = TMS nl

Absence de PSP: calcul TMS

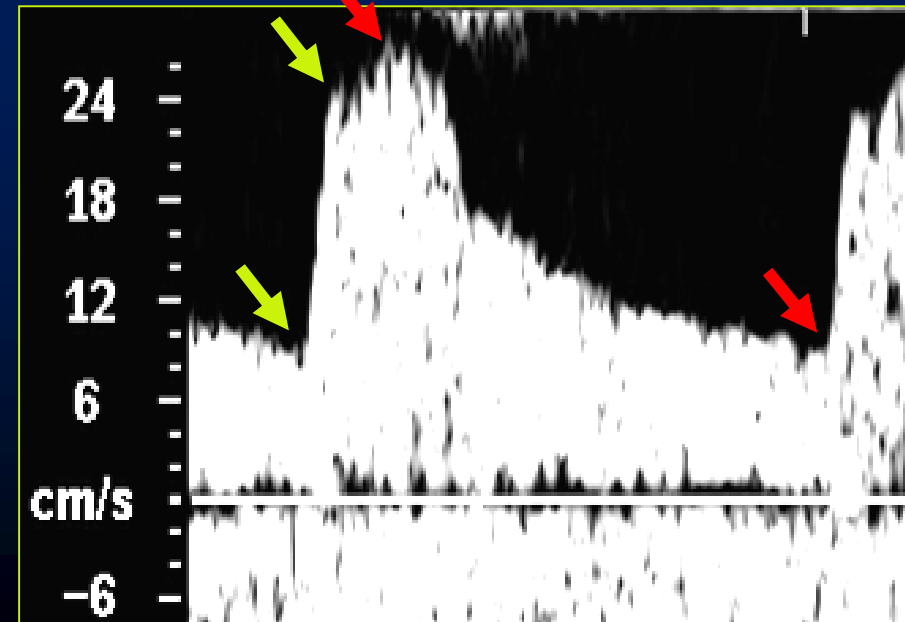
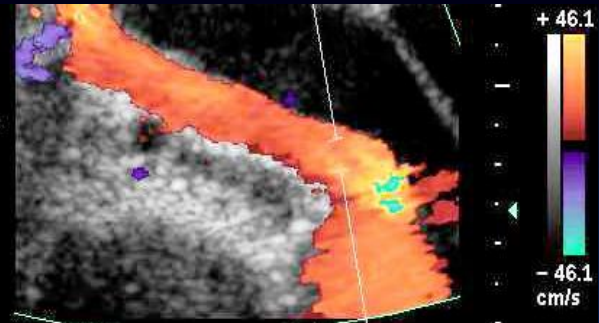
Calcul de l'IR < 0.70 : recommandé*



Coul 69% Ech 1
FP Moy
PRF 3000 Hz
Opt Flux: V moy

DROIT

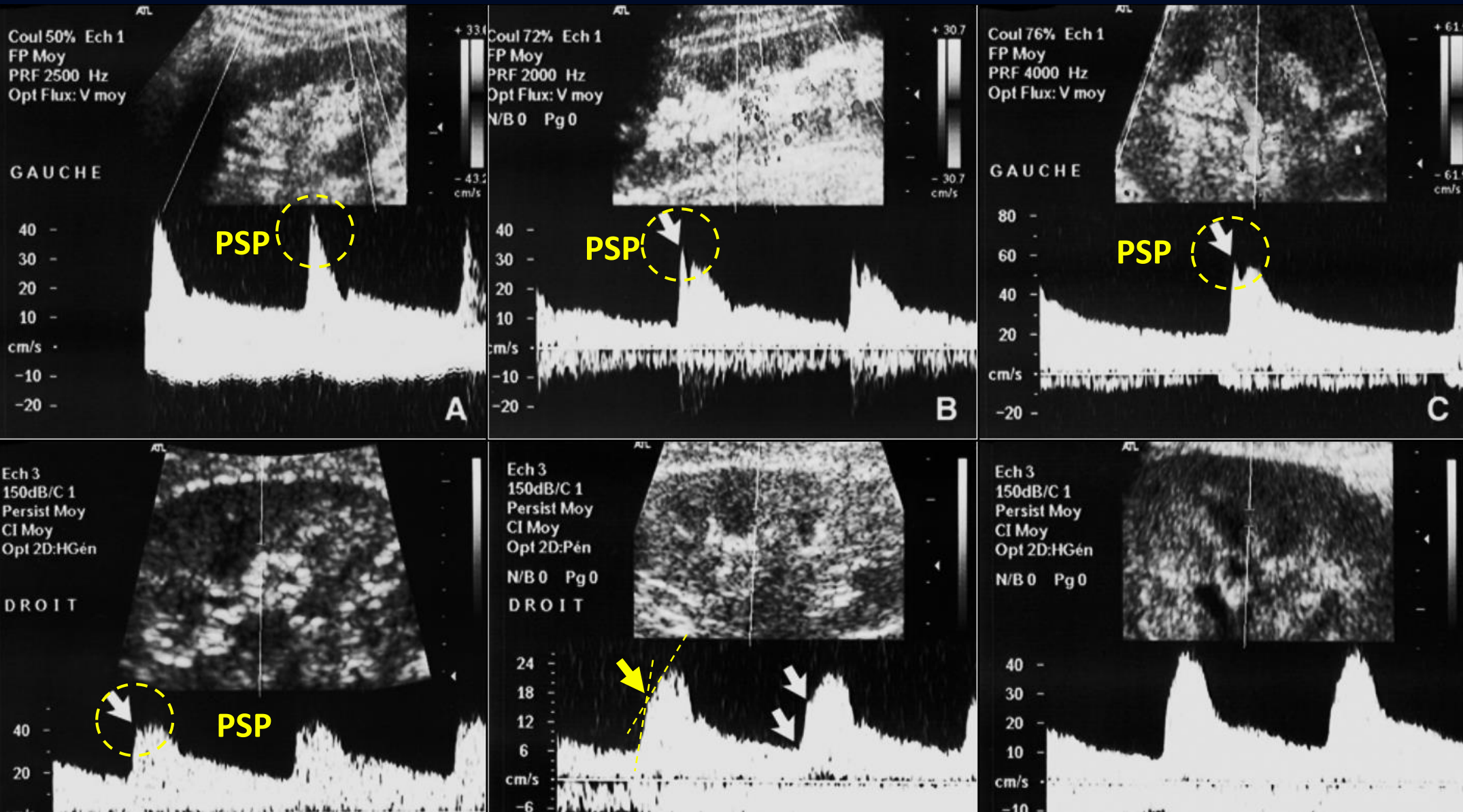
50
40
30
20
10
cm/s



* Radermacher et al N Engl J Med 2001; Soulez et al AJR 2003

Artères rénales interlobaires

Résultats normaux

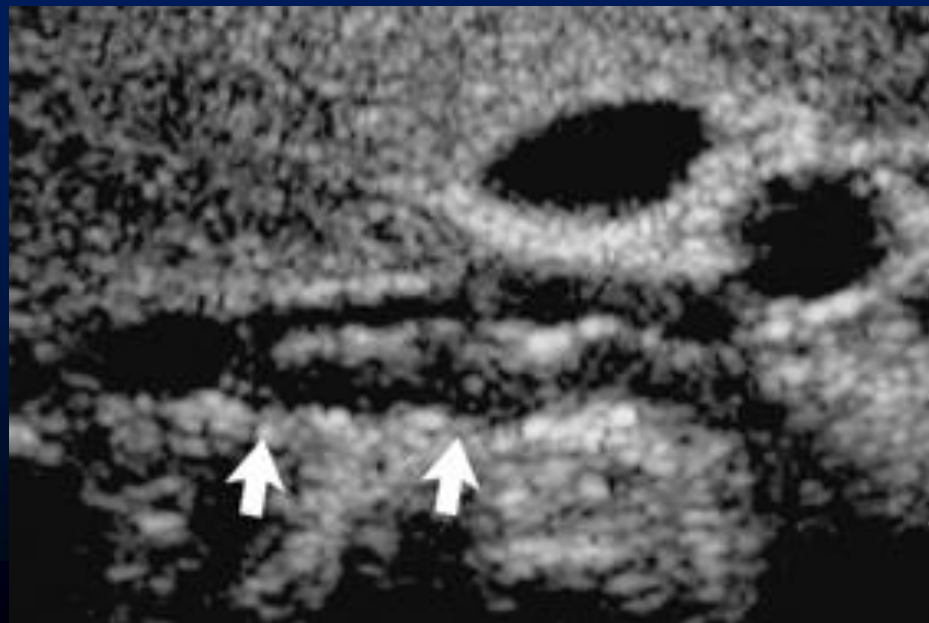
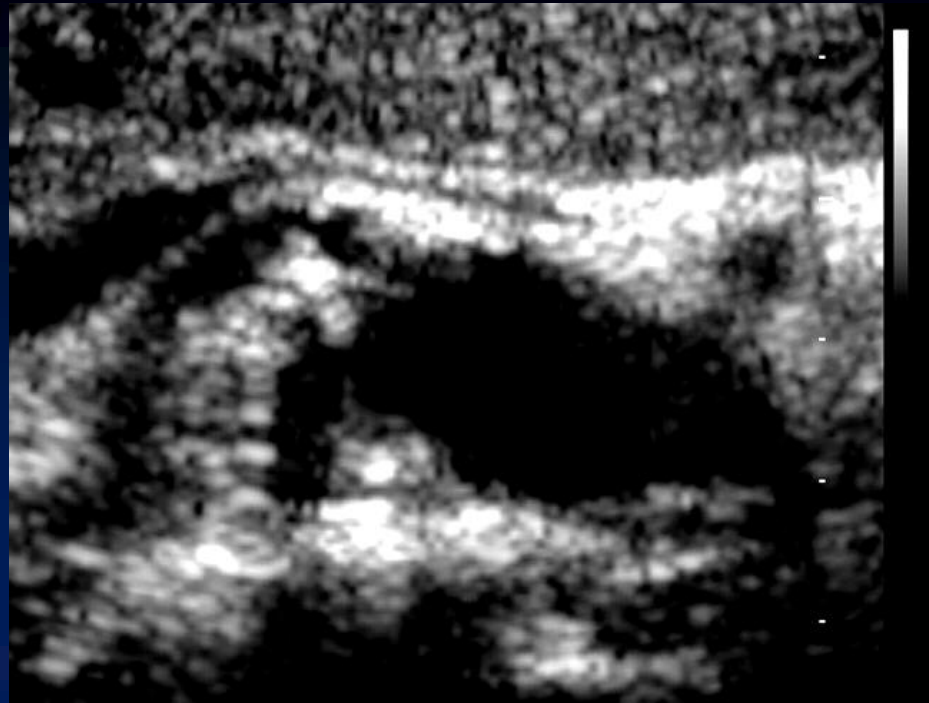


SAR: Critères diagnostiques

Mode B et CDUS

Critères d'orientation

- Infiltration athéromateuse
Plaque calcif
Rarement hypoéchogène
 - Modifications de calibre
Dysplasie moniliforme
 - Anomalies encodage
Aliasing et turbulence
- Artefact périvasculaire
SAR sévères
Dépendant de la PRF



SAR: Critères diagnostiques

Mode B et CDUS

Critères d'orientation

- Infiltration athéromateuse

Plaque calcif

Rarement hypoéchogène

- Modifications de calibre

Dysplasie moniliforme

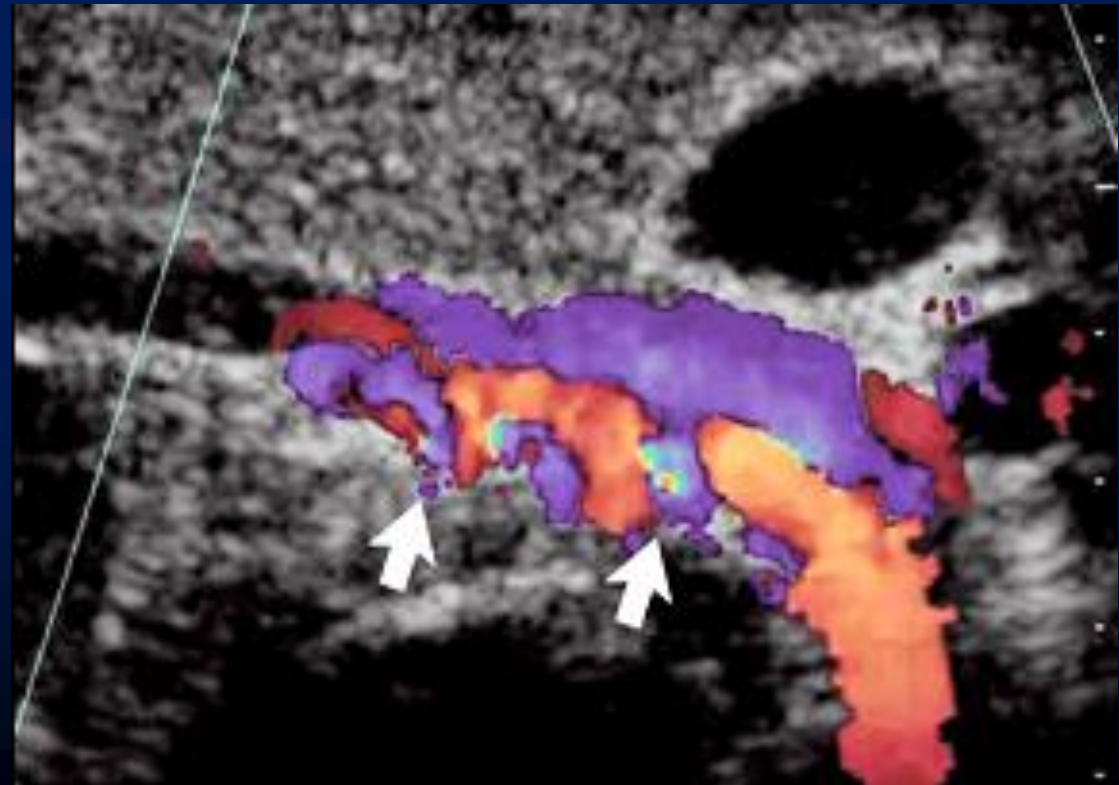
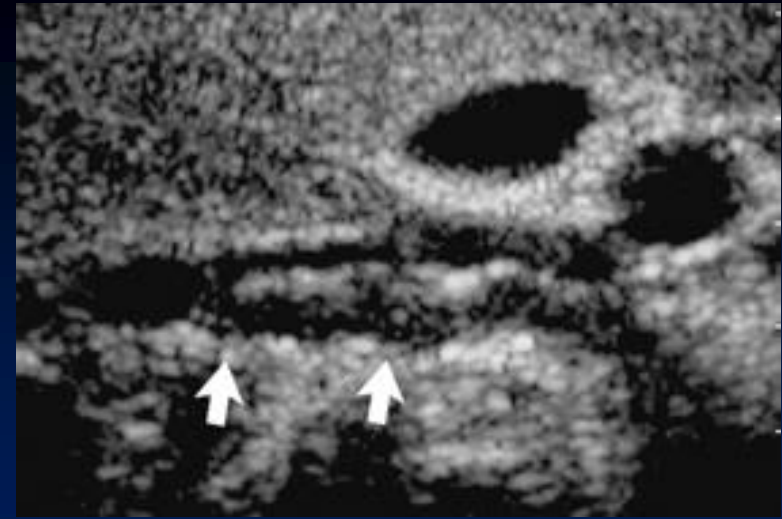
- Anomalies encodage

Aliasing et turbulence

Artefact périvasculaire

SAR sévères

Dépendant de la PRF



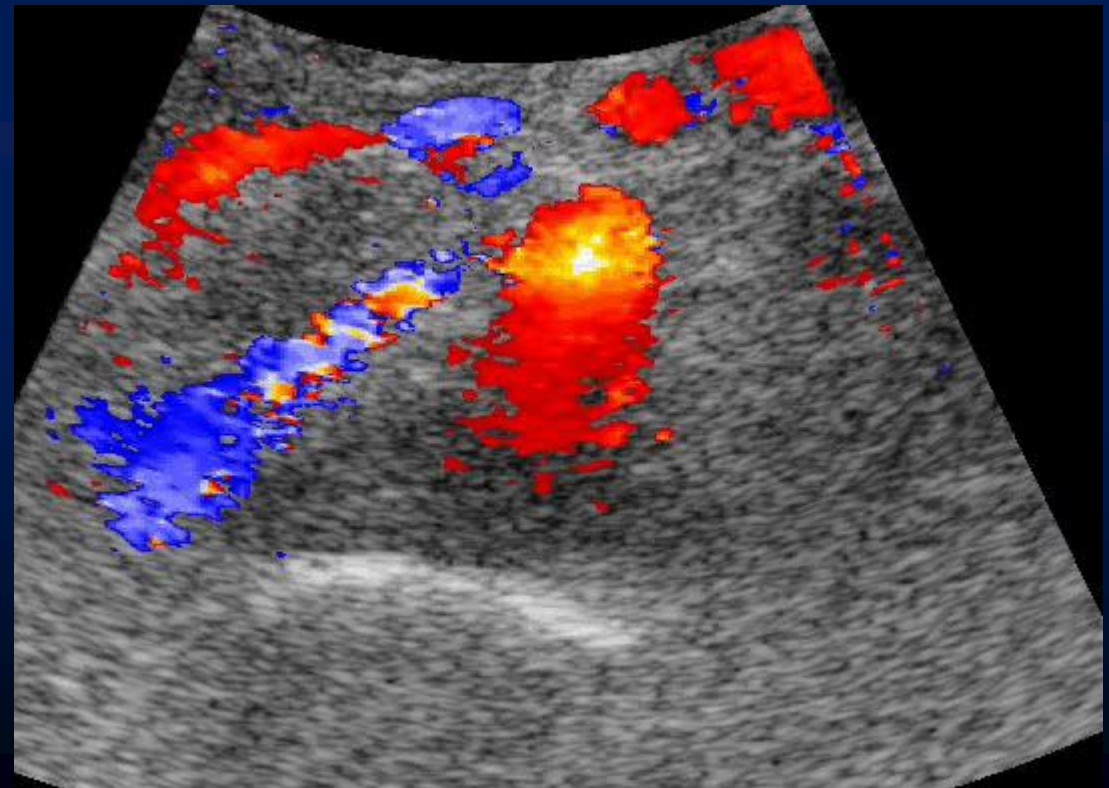
SAR: Critères diagnostiques

Mode B et CDUS

Critères d'orientation

- Infiltration athéromateuse
Plaque calcif
Rarement hypoéchogène
- Modifications de calibre
Dysplasie moniliforme
- Anomalies encodage
Aliasing et turbulence

Artefact périvasculaire
SAR sévères
Dépendant de la PRF

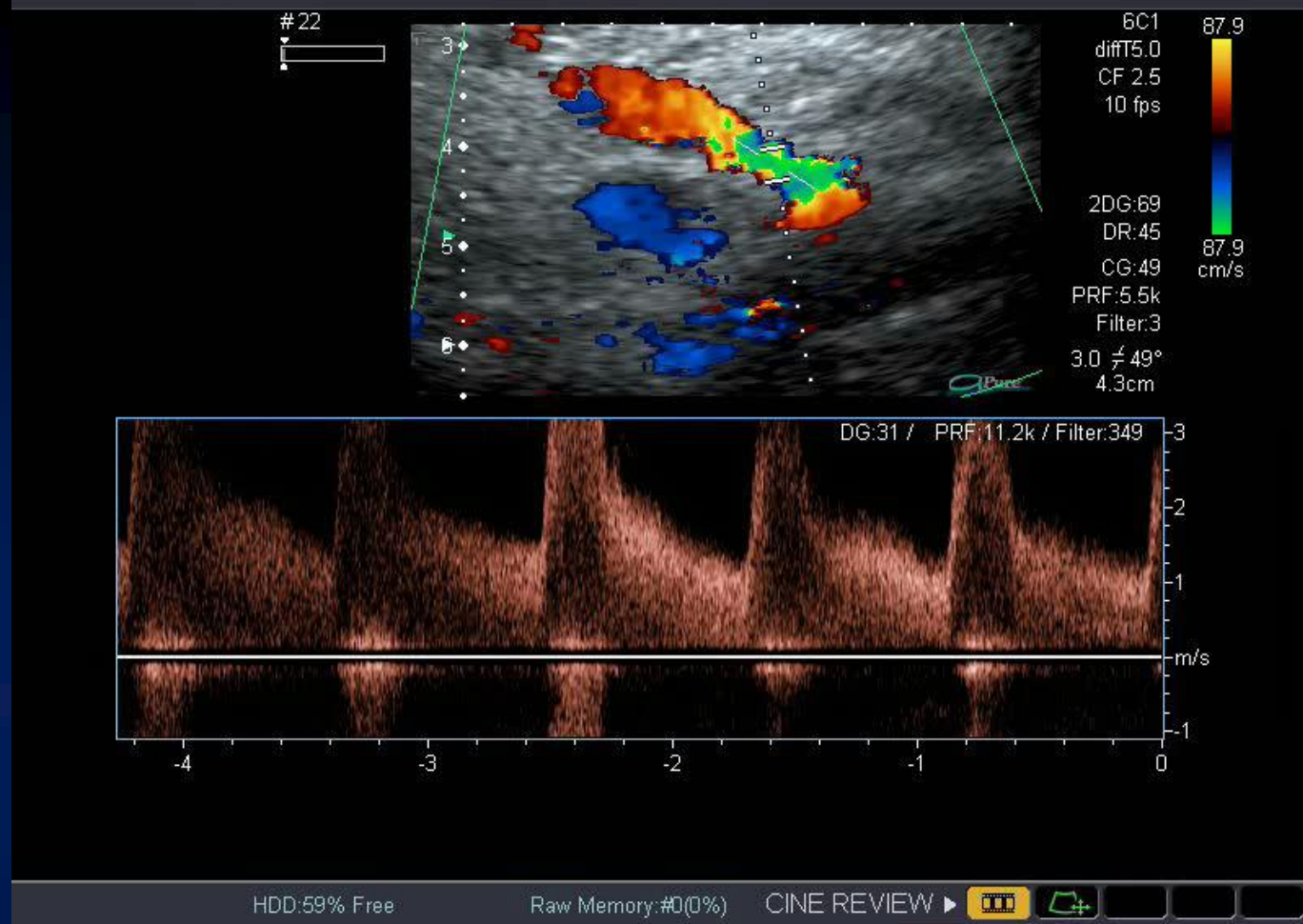


Analyse spectrale

Signes directs
→ **SAR $\geq 50\%$**
($< 99\%$)

- **Accélération intra-sténotique**
Vitesse systol maxi
 $> 150-180$ cm/s

Turbulences post-sténotiques
Angle $< 45^\circ$ ++
Dispersion spectrale
et flux rétrograde



SAR: Critères diagnostiques

Analyse spectrale

Signes directs

→ **SAR $\geq 50\%$**
($< 99\%$)

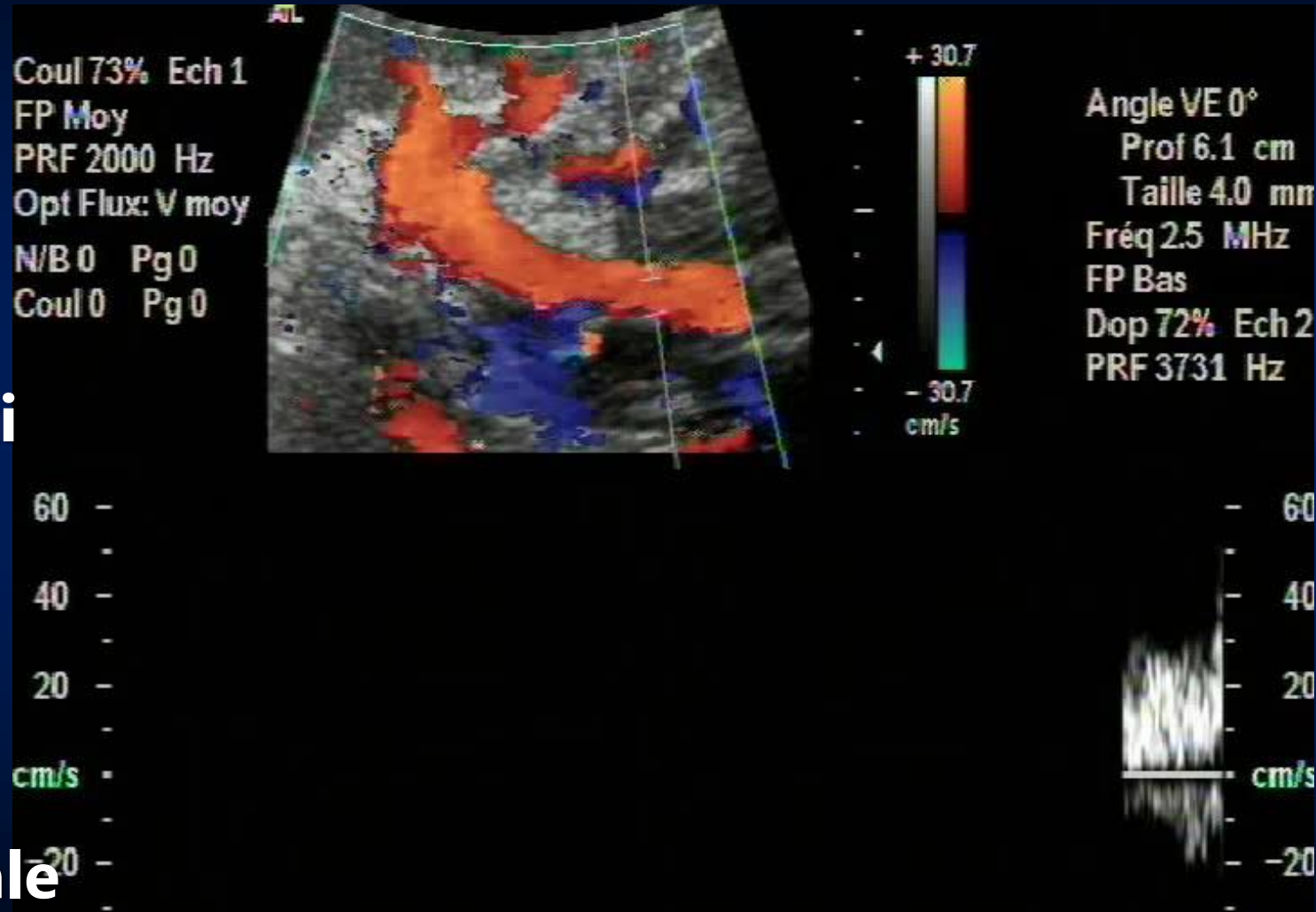
• **Accélération
intra-sténotique**

**Vitesse systol maxi
> 150-180 cm/s**

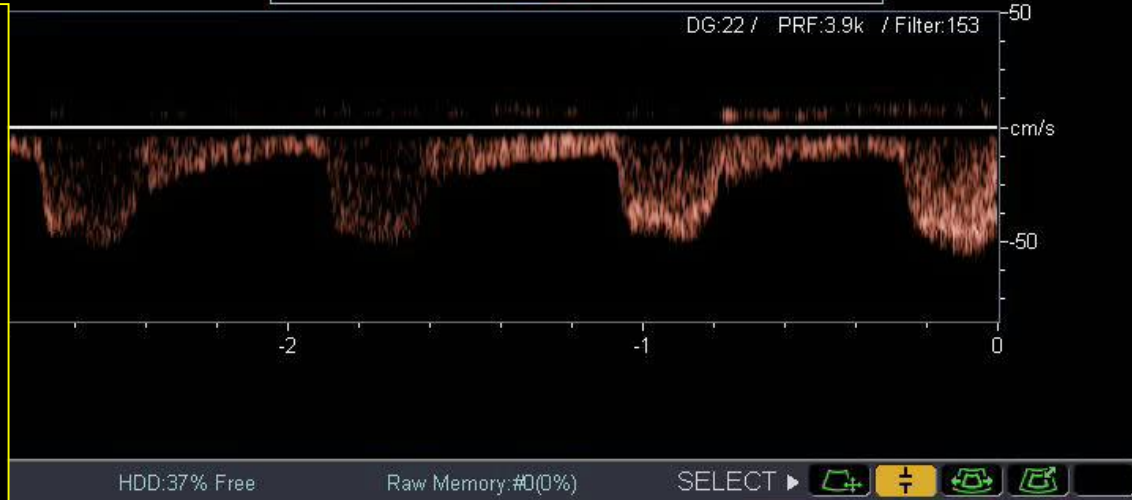
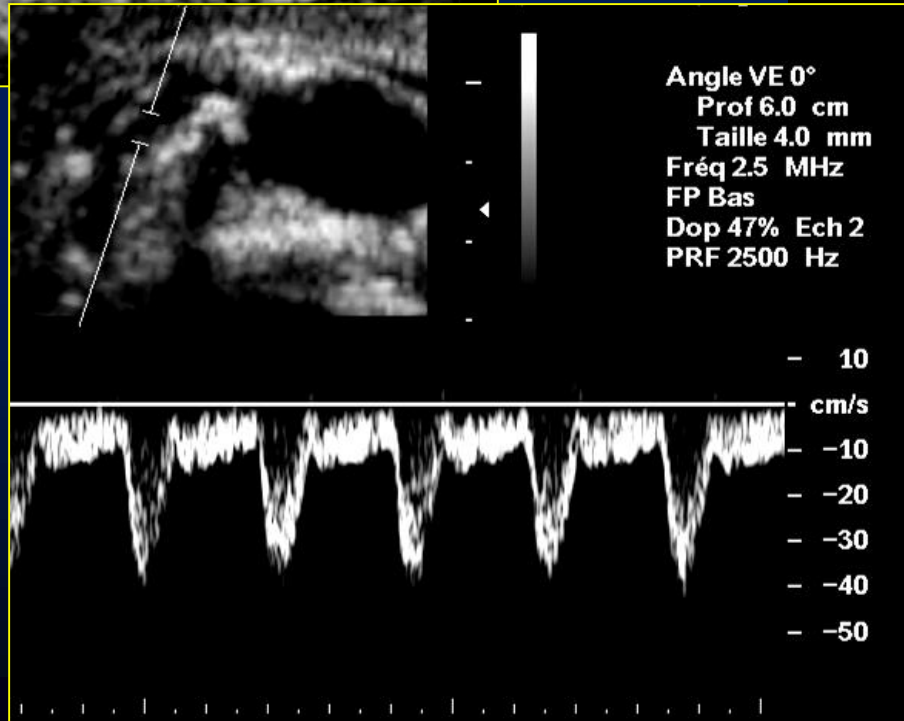
**Turbulences
post-sténotiques**

Angle $< 45^\circ$ ++

**Dispersion spectrale
et flux rétrograde**



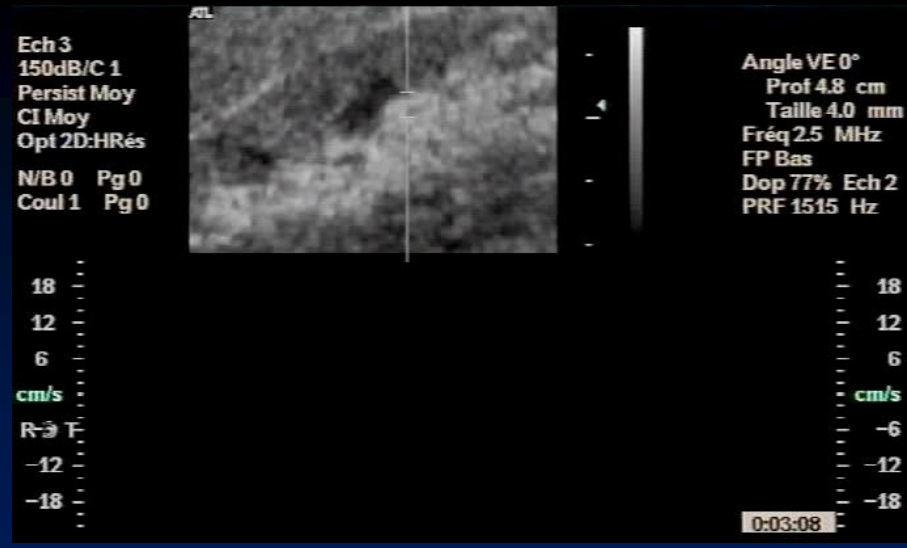
Lésions < 50% → pas de signes directs



SAR: Critères diagnostiques

Analyse spectrale

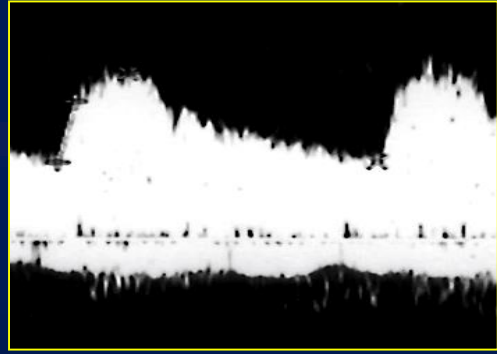
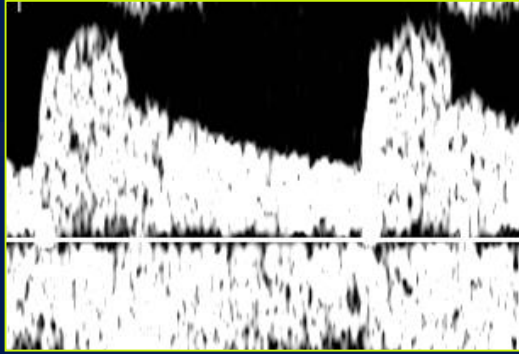
Signes indirects
→ SAR 80 - 100%



«Tardus-parvus» (80%)
flux ralenti et démodulé ++

Modification des indices

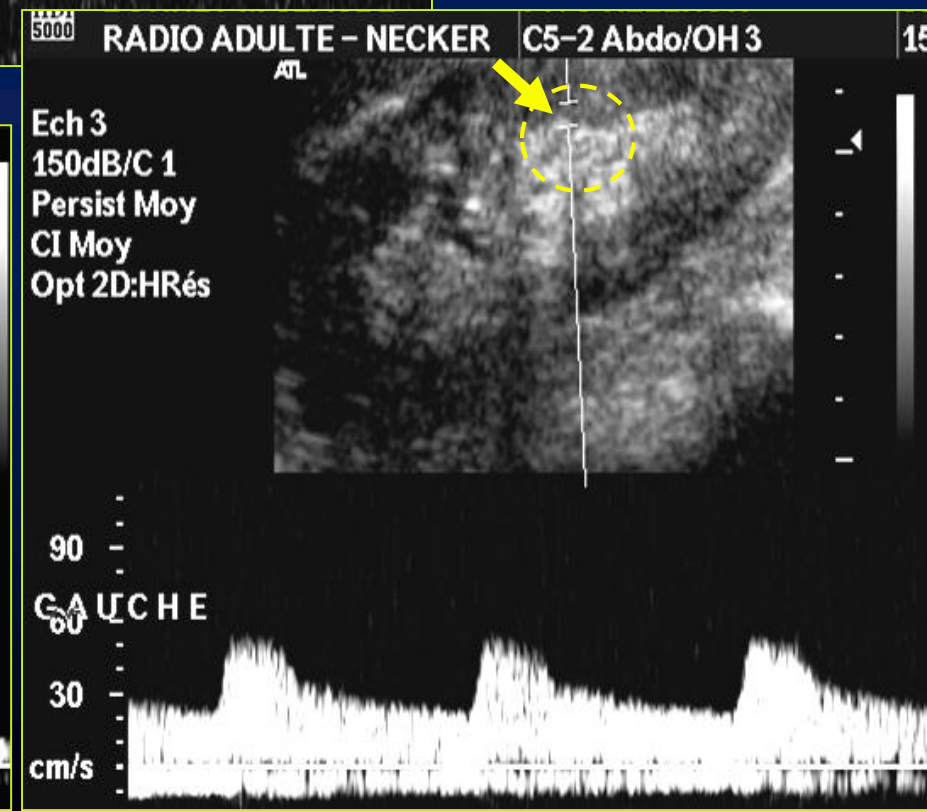
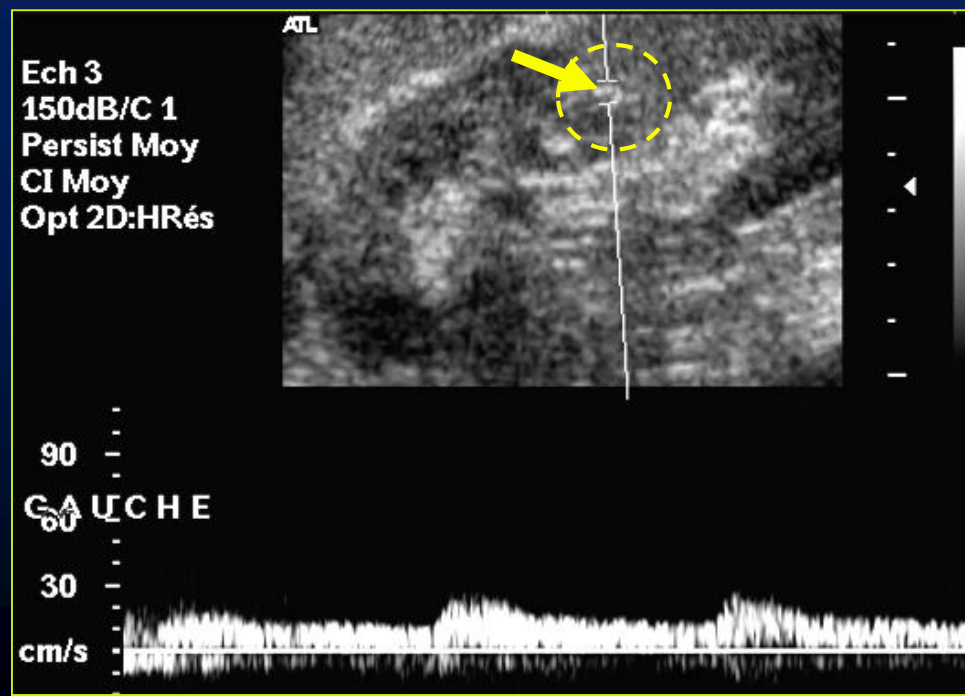
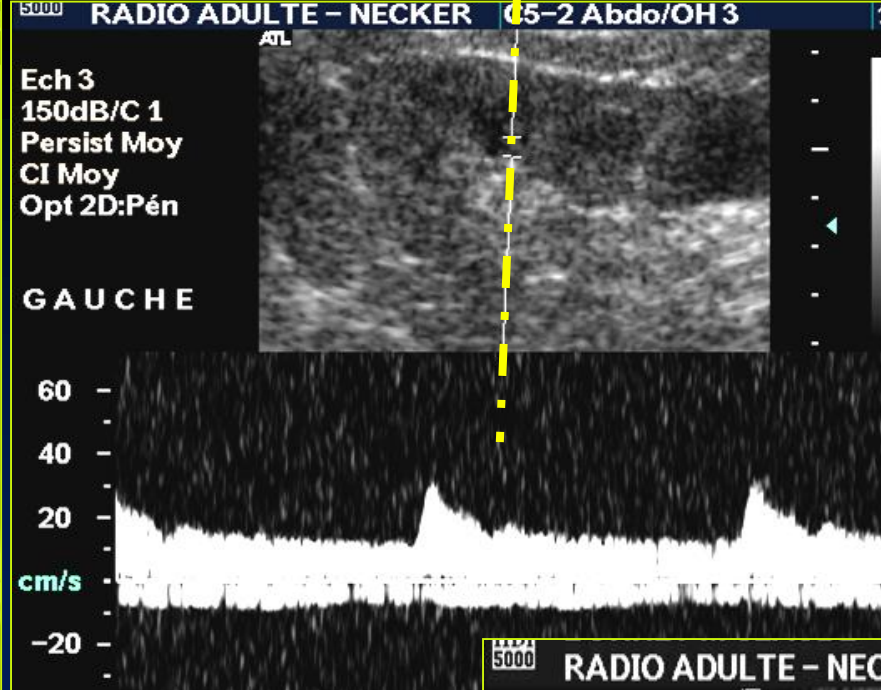
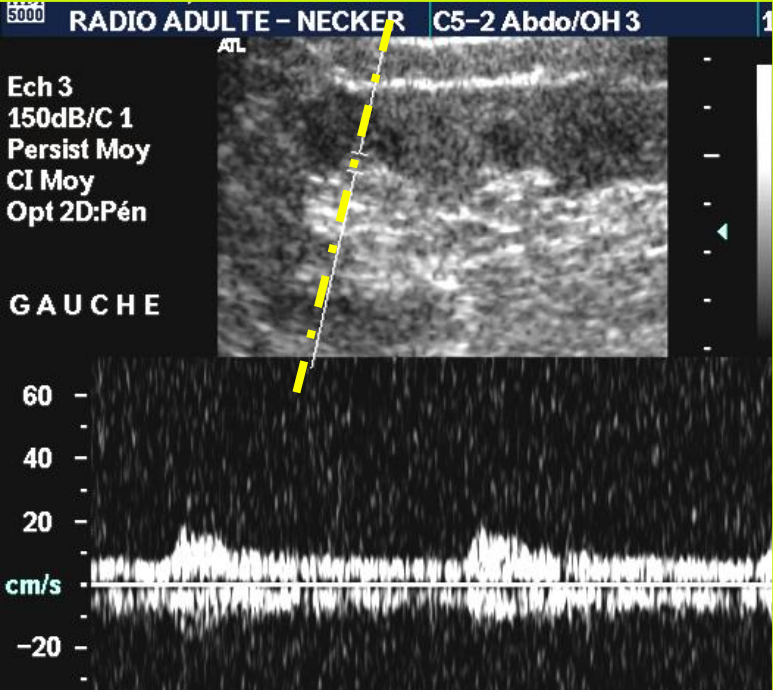
- Absence de PSP + TMS > 70-120ms
- Accélération systolique < 3 m/sec²
- ↘ IR (Delta IR > 0.10)



Variabilité des mesures ++

- Faibles spécificité (F+) et VPP
- Signe négatif: pic systolique précoce (VPN++)





Ech 3
150dB/C 1
Persist Moy
CI Moy
Opt 2D:Pén



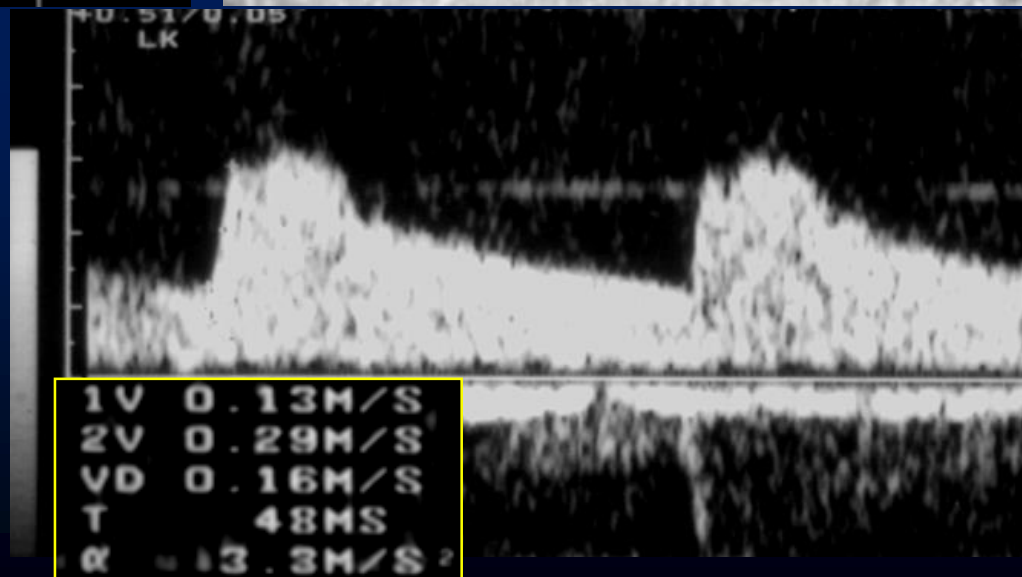
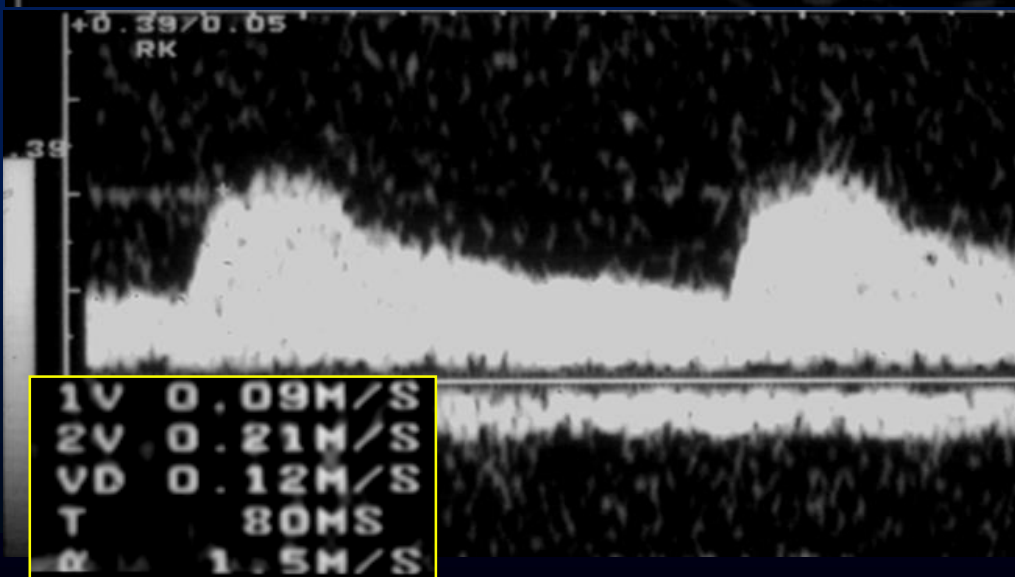
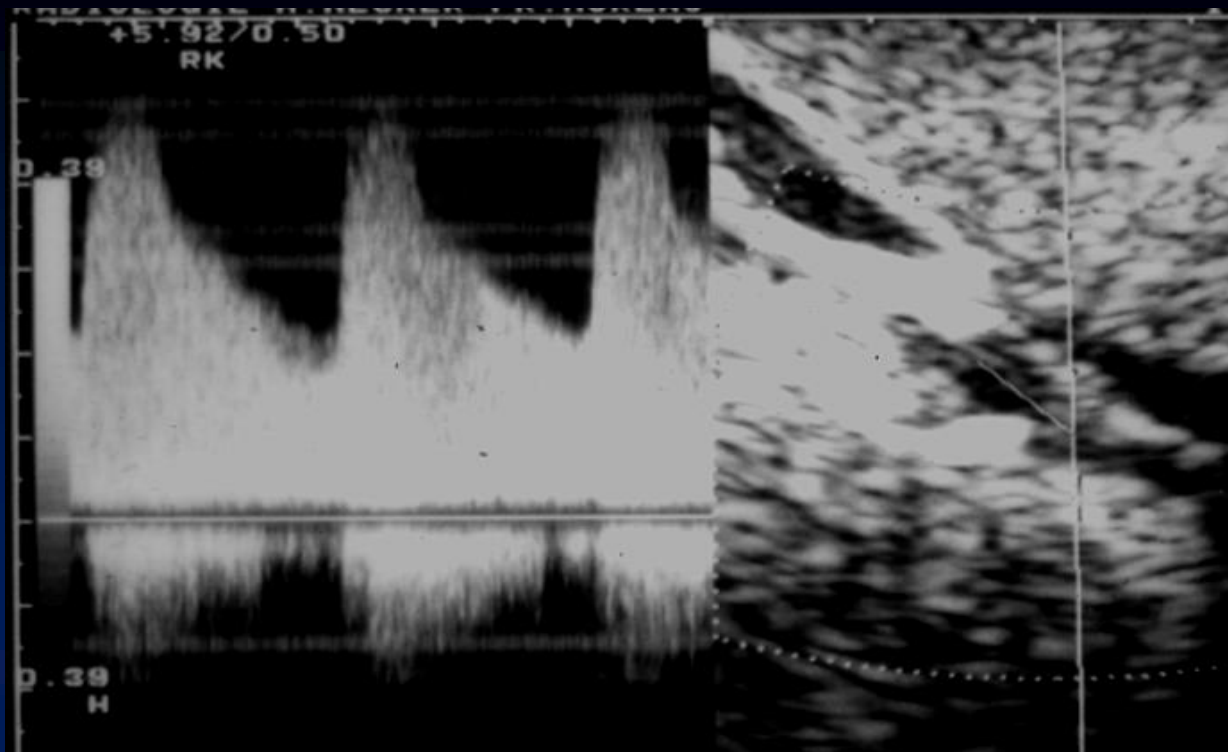
40 -
30 -
20 -
10 -
cm/s

40.00ms
9.62cm/s
240.50cm/s²

Ech 3
150dB/C 1
Persist Moy
CI Moy
Opt 2D:Pén



24 -
18 -
12 -
6 -
cm/s
-6 -
-12 -



% diam.

intraSt

postSt

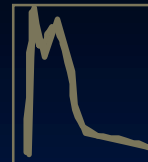
intrarénal

< 50%

< 150

NI

NI

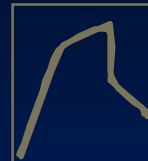


50-75%

> 150

Turb+

NI



80-95%
compensée:20%

> 150

Turb+

subNI
TMS+ Δ IR



80-95%
décompensée:80%

> 150

Turb+

tardusparvus
flux démodulé

> 99%

0

«distalisé»

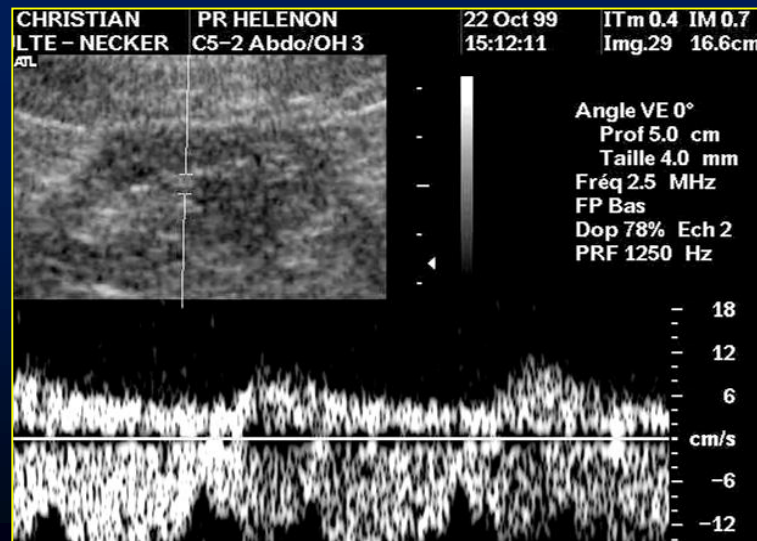
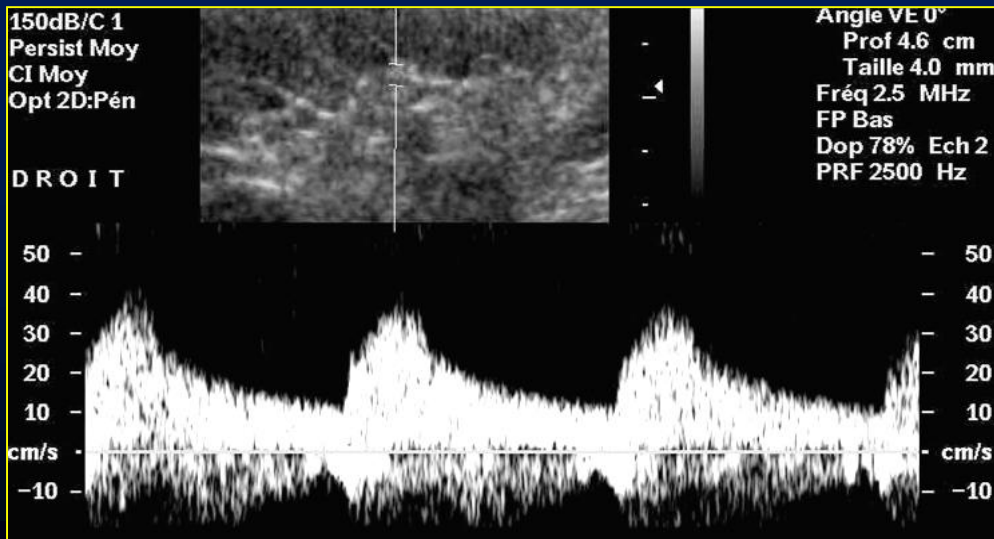
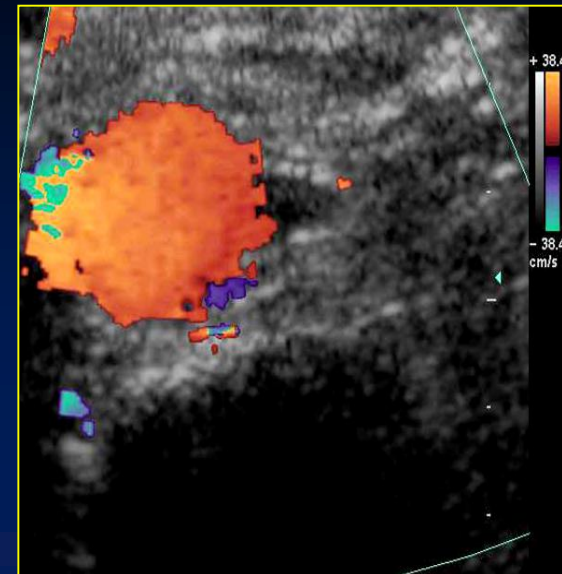
tardusparvus ou 0

100%

0

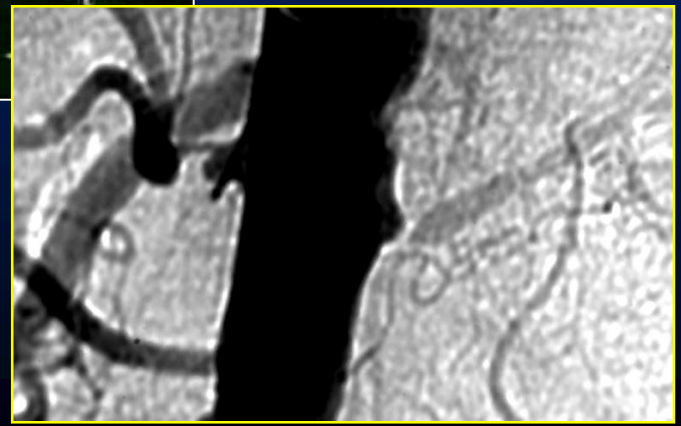
0

tardusparvus ou 0



AL

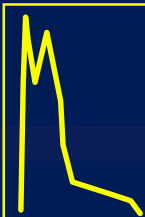
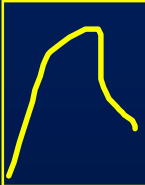

Ech 3
150dB/C 1
Persist Moy
CI Moy
Opt 2D:HRés
N/B 0 Pg 0
Coul 0 Pg 0
GAUCHE



Sémiologie doppler: 6 catégories de SAR

Performances: Se 89% Sp 95-100%

Echecs techniques: 15% (5-20%)

% diamètre	IntraSt	PostSt	Intrarénal	
< 50%	< 150	NL	NL	
50-75%	> 150	Turb+	NL	
80-95% compensée:20%	> 150	Turb+	subNL TMS+ ΔIR	
80-95% décompensée:80%	> 150	Turb+	tardusparvus flux démodulé	
95-99%	0	«distalisé»	tardusparvus ou 0	
100%	0	0	tardusparvus ou 0	

Enregistrements intrarénaux seuls disponibles

1) Amortis et démodulés (tardus parvus)

→ SAR 80-100%

2) Normaux: PSP présent ou TMS < 70ms et Δ IR < 5%

→ SAR 0 - 75% = absence de SAR sévère

→ \pm angioIRM/CT

3) Suspects: PSP absent et TMS > 70ms ou Δ IR > 10%

→ SAR sévère compensée 80-98% suspectée

→ angioIRM/CT