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1. Doc dr sci med spec RADIOLOGIJE (ULTRAMEDIKA)
2. Asis. Mr sci med Spec ginekologije i akušerstva (GAK)

Ehokardiografija fetusa: 2017g. London

- Urođene srčane mane (USM) su vodeća anatomska greška ploda i najčešći uzrok za smrtnost novorođenčeta.
- Prenatalna dijagnostika USM je najslabija od svih drugih organskih sistema i vodeći razlog za vanredno stanje.
- Propust neregistrovanja USM je najčešći razlog sudskog procesa protiv doktrora.

Tehnike EF: 1. World Maternal Fetal Neonatal Medicine Congres

2017 g.:

2D

4D –”STIC” (PROSTORNO-VREMENSKA KORELACIJA).

4D “VOLUMETRIC ULTRASOUND”

- 5D heart - “FETAL INTILLIGENT NAVIGATION ECHOCARDIOGRAPHY” (FINE)

Važnost otkrivanja srčane mane u I Trimestru:

Oko 1/3 plodova sa urođenom srčanom manom (USM) poseduje i hromozmsku anomaliju (HA) ploda.

- Ultrazvučni markeri (UZ) za HA neće dovesti do otkrivanja 2/3 plodova sa USM.

- Samo 35% plodova sa povećanim NT ima USM.
- Pozitivni Doppler markeri ukazuju na USM!

NIPT : “CELI-FREE FETAL DNA”

- 1. Lako se izvodi tj. Iz krvi trudnice
- 2. RELATIVNO VISOKA DETEKCIJA ZA NAJČEŠĆE HROMOZOMSKE ANOMALIJE

  3. NEOTKRIVA STRUKTURNE ANOMALIJE
- **Kvalitetan ultrazvuk pre “NIPT”!** Treba isključiti: teške strukturne defekte , propuštenu aborciju ili “vanishing twin”

Genetska AMNIOCENTEZA i CVS ne otkriva USM!

NAJČEŠĆA ANATOMSKA GREŠKA ploda je USM.

ŠEST puta (6X) je USM češća od HA.

- U LITERATURI praćenje dece traje 10 god nakon hirurškog lečenja.

USPEŠNOST EHOKARDIOGRAFIJE fetusa

- **Prospektivna studija (2003g.)** treba da definiše uspešnost ehokradiografije fetusa (EF) u **I trimestru(11-14ng)**, kod nisko i visoko rizičnih trudnoća,
- Odredi mesto EF u **ranom II trmestru**,
- Objasni ograničenja EF u **III trimestru** i
- Ukaže na mogućnosti i razlike **2D EF** u odnosu na **4D- STIC**.

Pacijenti i metod

- **DNEVNO je pregledano do 5 trudnoća**

- Upotrebljen je isti ehokardiografski protokol u I Tr. trudnoće koji se koristi za pregled u II i III trimestru .
- Uvek je upotrebljen B –mod (2D) i kolor-Doppler (CD) i CPA radi prikaza morfologije srca.

Sonomorfologija srca: 4CV

Kardijalni aksis - POZICIJA, **situs visceralnih organa**, heterotaksija i veličina srca.

Četvorošupljinski presek(**4CV**)

Situs atrija i veličina, **AV sklad**,
Pozicija i otvaranje AVvalvula,**Ostium I** (primum)

Proširen pregled : krvni sudovi

Vaentrikularno arterijalna(**VA) konekcija** :

Pozicija ascedentne aorte (**LVOT**), descedentne Ao, PA.

“X, B i V” znak, “3VV” (RVOT), i 3VT,

Ao luk (AA) sa granama i **Duktalni luk(DA**) u sagitalnom preseku.

Tok a. subklavija

Venska drenaža

Duktus venozus (PI index), PSV!

- Dijastolno punjenje komora(**e i a talas**)
- **Venska drenaza pretkomora**
- SD pupčanika i frekfenca srca (M-mod)

Ehokardiografija fetusa

- **Dužina pregleda** u I trimestru je oko 3-10 min u proseku **7 min.**

- Pregled u I Tr. 10-14 ng.
  ponavljan je u 16ng ili 18-22ng.
  Pregled u III trimestru nije bio obavezan!

- **Sumnja na USM je podrazumevala cvs i genetsku amniocentezu pre konzilijarne odluke o prekidanju trudnoće**.

UZ aparati :1993, 1996(ATL), 2003, 2008, 2014 god.

1. **Philips HDI 5000 Sono CT, X Res**:
   Sonde: L 12-5 MHz i ev 8-4MHz, C2-5MHz
2. **Philips iU 22:**
   Sonde: L 15-7MHz, C5-1MHz
3. **EPIQ G7**
   Sonde: C 9-2MHz X-matrix 6-1MHz, ev 10-3MHz

“Hardver , softver”

- “Hardver” aparata je : Sono CT, “**braodband**” , HD Zoom, broadband CD, CPA, cine-loop, **X-plane , X-MATRIX 4D**
- Dinamični opseg-175 db.
- “Softver” za EF (2D i 4D STIC) u I ,ranom II i II/III trimestru trudnoće.
- “Termalni” indeks (**TIb**) i “Mehanički” indeks (MI) nisu prelazili **1**.

Rezultati (HDI 5000): I Tr od 2003-2011g.

- U periodu od 8 godina pregledano je 2811 trudnica u I trimestru a fetalno srce u 2643.
- Nizak rizik je imalo 2010 a 633 visok rizik za USM.
- Prosečna starost trudnice je bila **37god**(19-45).
- Prosečan CRL je **68mm**(46-84)mm.

Rezultati

- Broj fetusa sa USM je bio 111(4,2%), a bez 2532.
- Sa niskim rizikom je bilo 36 (1,8%), sa visokim rizikom je bilo 75 (12%).
- **U dva slučaja nije vidjen VSD.**
- Minor USM (0,9% od svih) su bile koarktacije aorte (disproporcija komora i velikih krvnih sudova)

HDI 5000: zaključak

- L- SONDOM NEUSPEŠNOST EF je u I Tr. **18.1%**
  C 5-2 i ev- sonda bitno nepovećavaju procenat uspešnosti EF u I Tr. trudnoće.

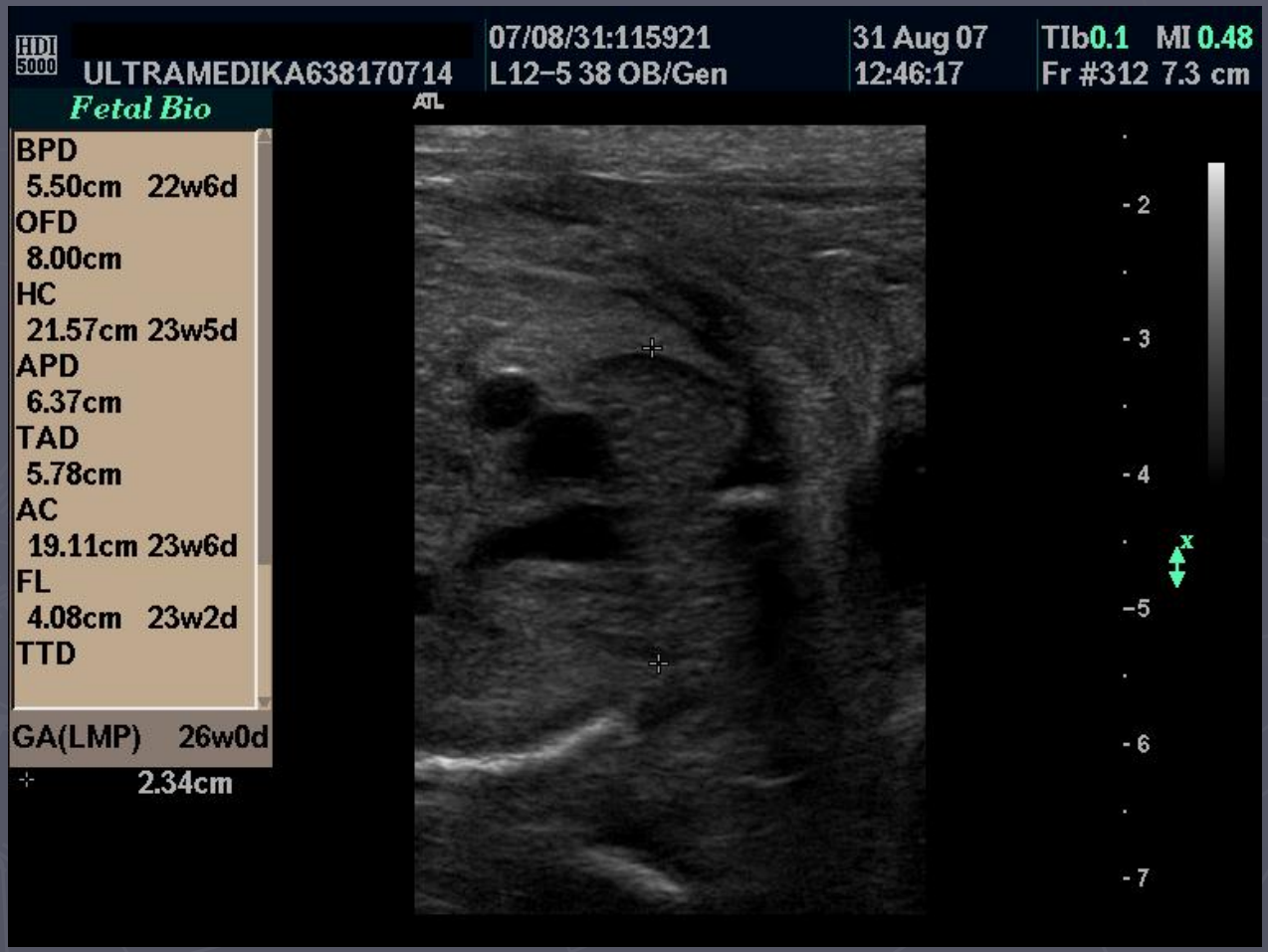
- **II trimestar: uspešan za EF u 89%,**
-
- **III trimestar nekompletna EF u 25%** (BM, položaj ploda itd.)

II TRIMESTAR : 4CV

II-TR: LVOT

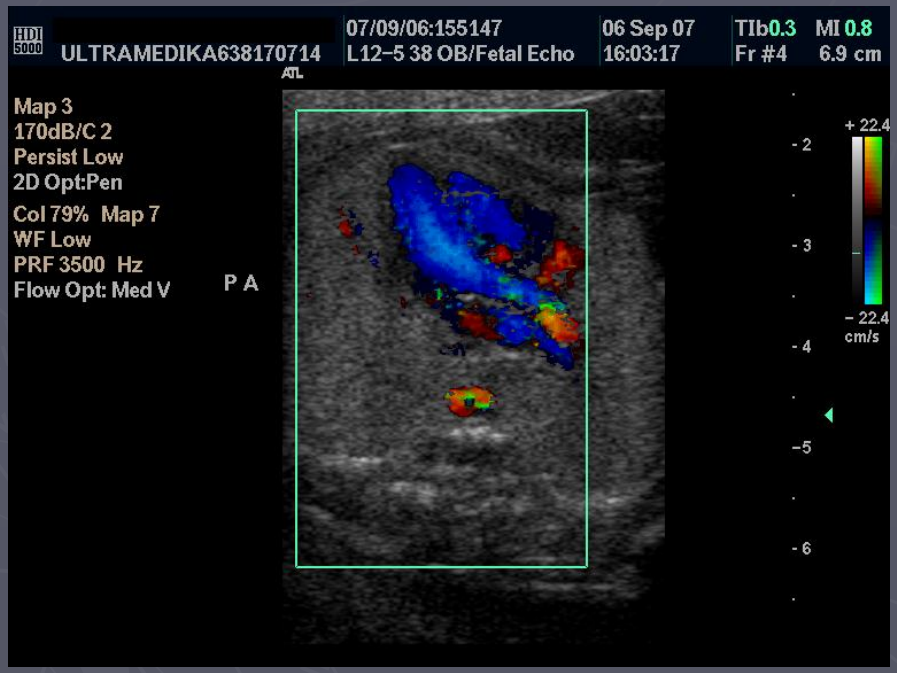

HDI 5000
ULTRAMEDIKA638170714
ATL
08/03/14:120016
L12-5 38 OB/Gen
14 Mar 08
12:19:39
TIb0.1 MI 0.51
Fr #81 5.7 cm
Map 3
170dB/C 2
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT®
XRes™
A O
0.38cm
2
3
4
5

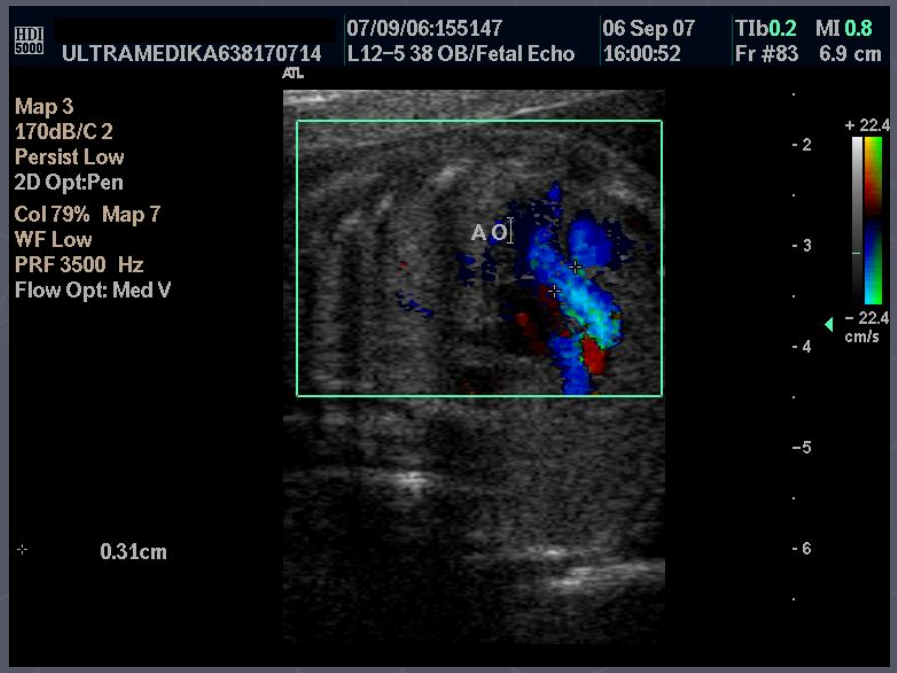
II TR: 3VV, Timus



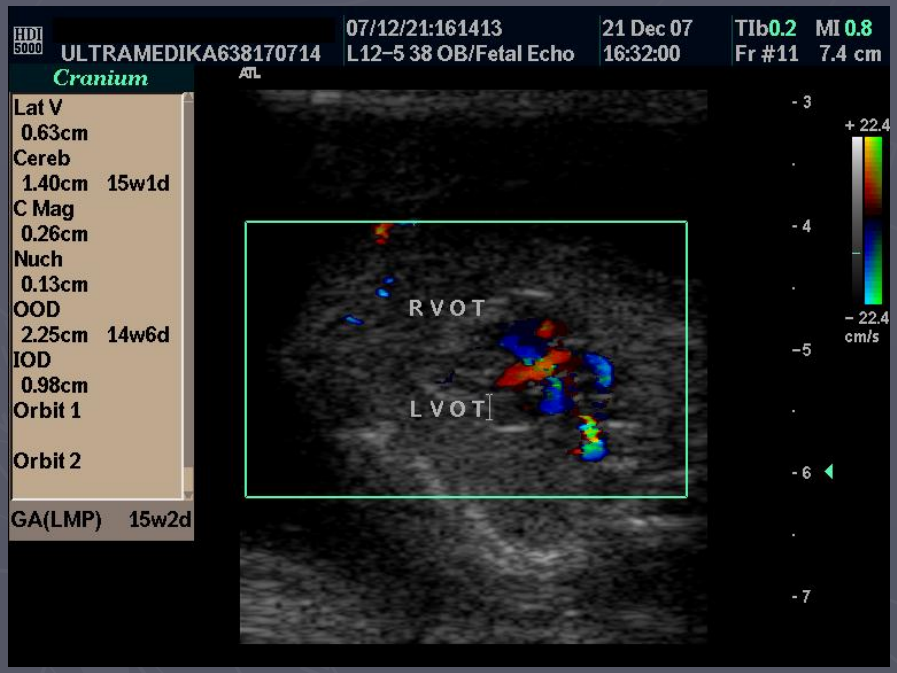
C2-5MHz: RVOT, PA/AO

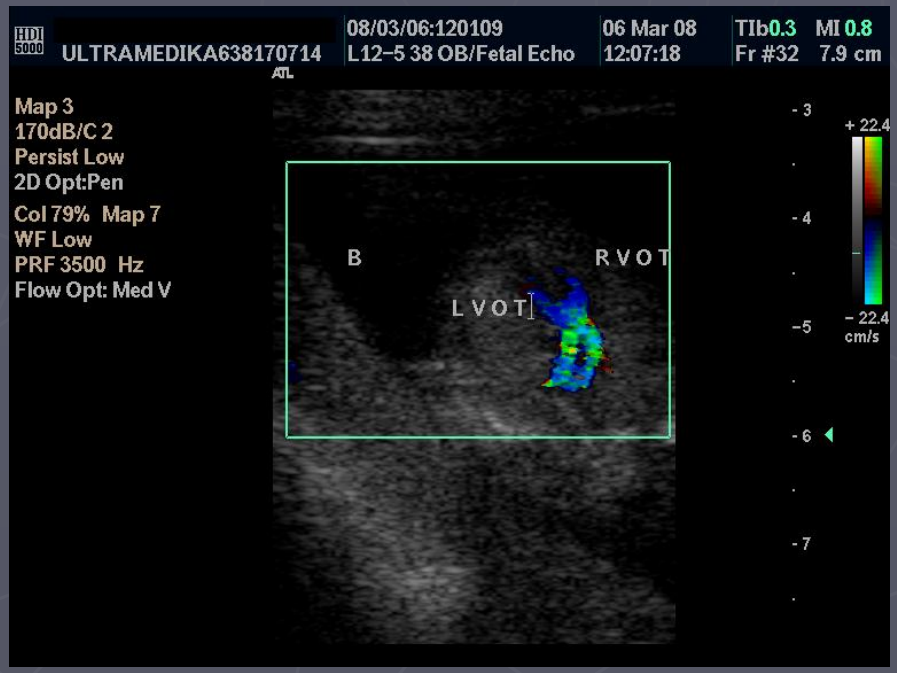
CD: LVOT, Membranozni s.



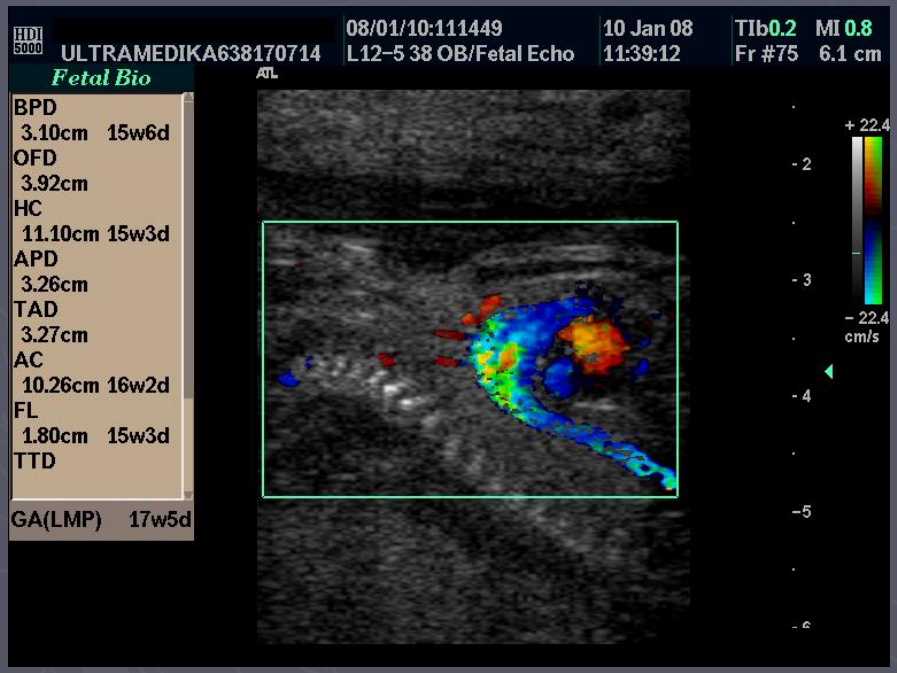


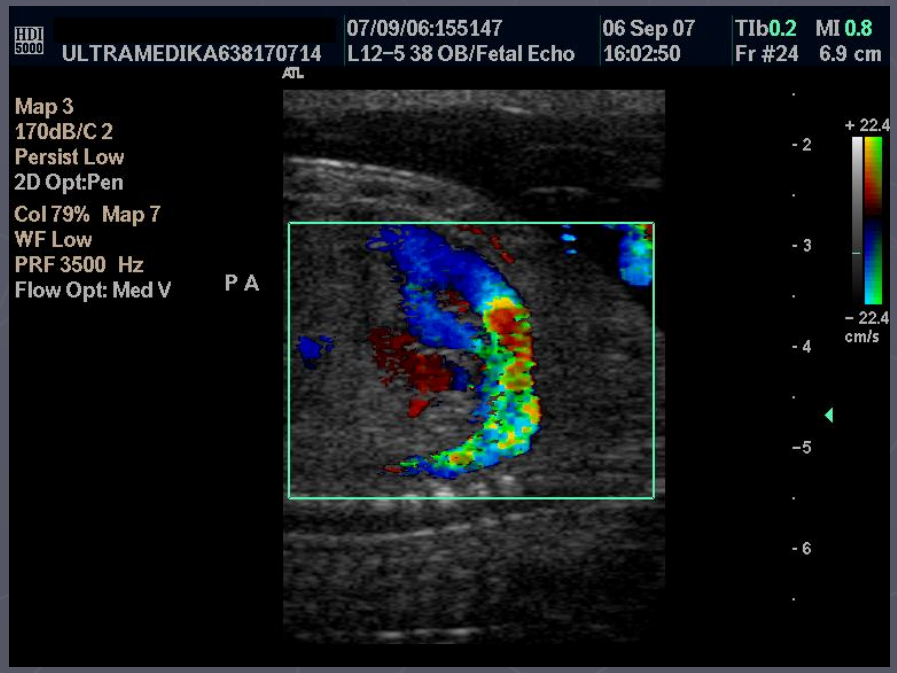
II TR: RVOT-LVOT : “X”



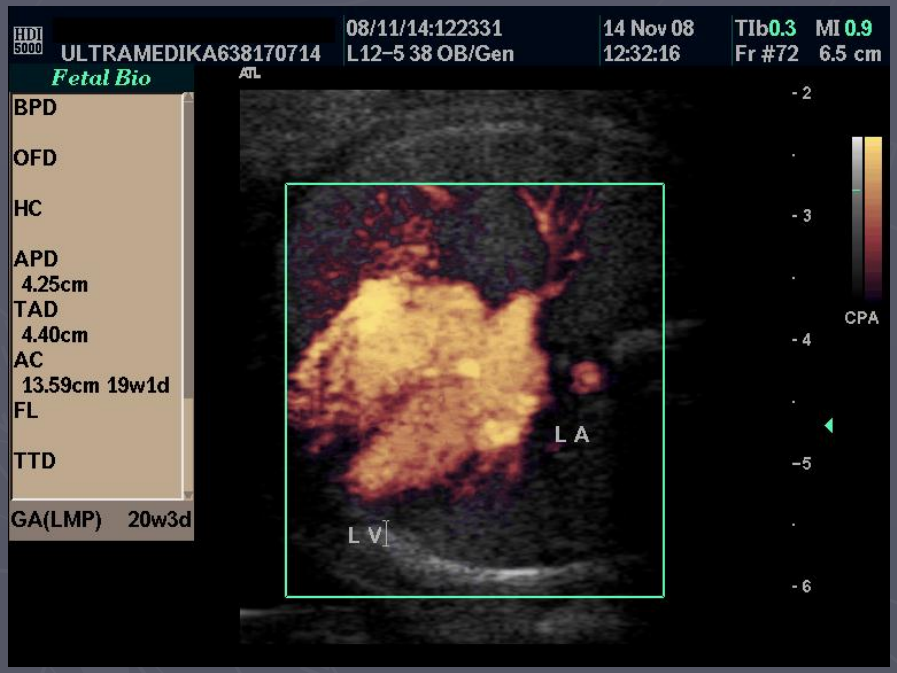


II TR: AA , DA

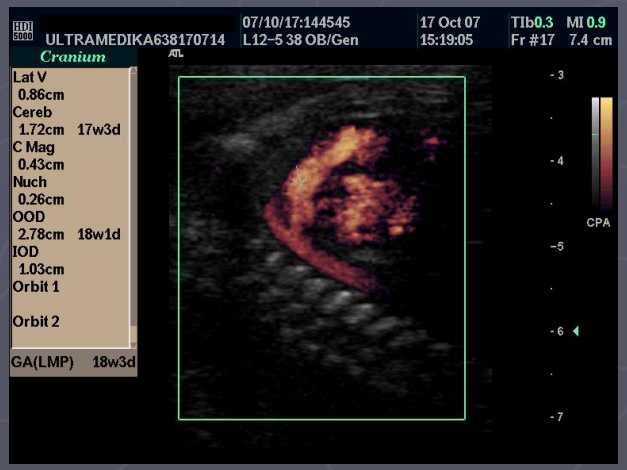

HDI 5000
ULTRAMEDIKA638170714
08/01/10:111449
L12-5 38 OB/Fetal Echo
10 Jan 08
11:39:12
TIb0.2 MI 0.8
Fr #75 6.1 cm
Fetal Bio
BPD
3.10cm 15w6d
OFD
3.92cm
HC
11.10cm 15w3d
APD
3.26cm
TAD
3.27cm
AC
10.26cm 16w2d
FL
1.80cm 15w3d
TTD
GA(LMP) 17w5d
+ 22.4
- 22.4
cm/s


HDI 5000
ULTRAMEDIKA638170714
07/09/06:155147
L12-5 38 OB/Fetal Echo
06 Sep 07
16:02:50
TIb0.2 MI 0.8
Fr #24 6.9 cm
Map 3
170dB/C 2
Persist Low
2D Opt:Pen
Col 79% Map 7
WF Low
PRF 3500 Hz
Flow Opt: Med V
P A
+ 22.4
- 22.4
cm/s

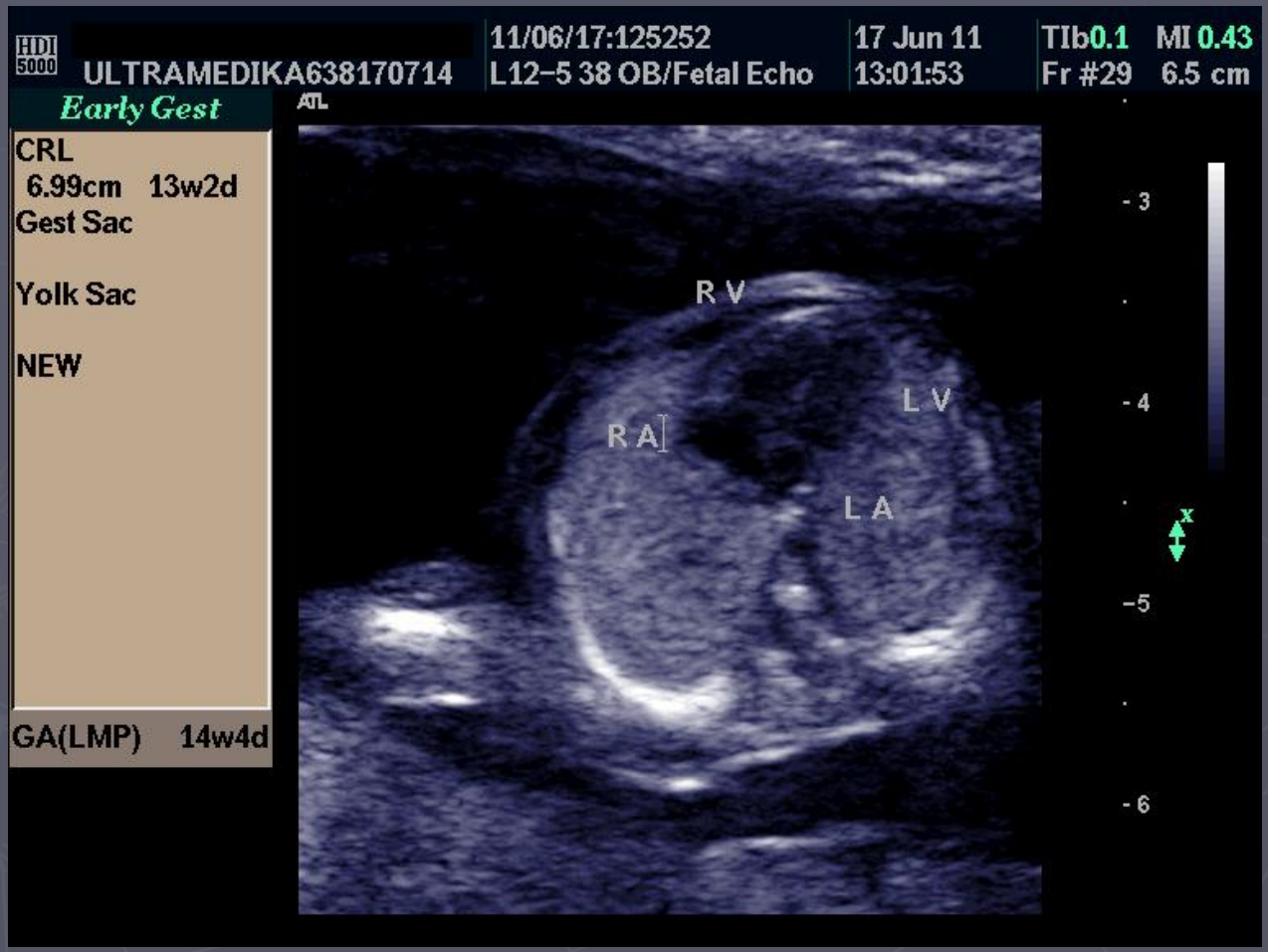
CPA: 4CV,AA,DA


HDI 5000
ULTRAMEDIKA638170714
08/11/14:122331
L12-5 38 OB/Gen
14 Nov 08
12:32:16
TIb0.3 MI 0.9
Fr #72 6.5 cm
Fetal Bio
BPD
OFD
HC
APD
4.25cm
TAD
4.40cm
AC
13.59cm 19w1d
FL
TTD
GA(LMP) 20w3d
L A
L V
CPA

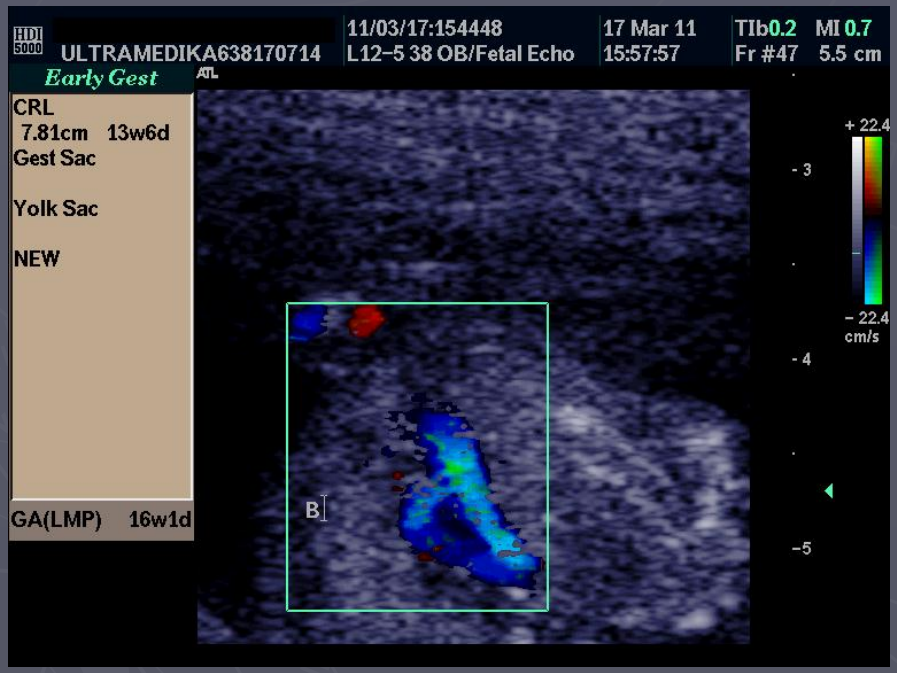

HDI 5000
ULTRAMEDIKA638170714
08/01/10:125622
L12-5 38 OB/Fetal Echo
10 Jan 08
13:17:20
TIb0.2 MI 1.0
Fr #53 5.3 cm
Cranium
0.73cm
Cereb
1.67cm 17w0d
C Mag
0.39cm
Nuch
0.21cm
OOD
2.50cm 16w3d
IOD
1.22cm
Orbit 1
0.79cm
Orbit 2
0.79cm
NEW
GA(LMP) 17w2d
CPA

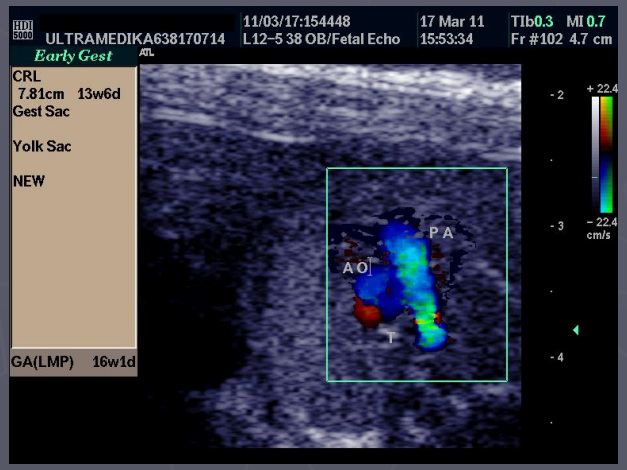

HDI 5000
ULTRAMEDIKA638170714
07/10/17:144545
L12-5 38 OB/Gen
17 Oct 07
15:19:05
TIb0.3 MI 0.9
Fr #17 7.4 cm
Cranium
Lat V
0.86cm
Cereb
1.72cm 17w3d
C Mag
0.43cm
Nuch
0.26cm
OOD
2.78cm 18w1d
IOD
1.03cm
Orbit 1
Orbit 2
GA(LMP) 18w3d
CPA

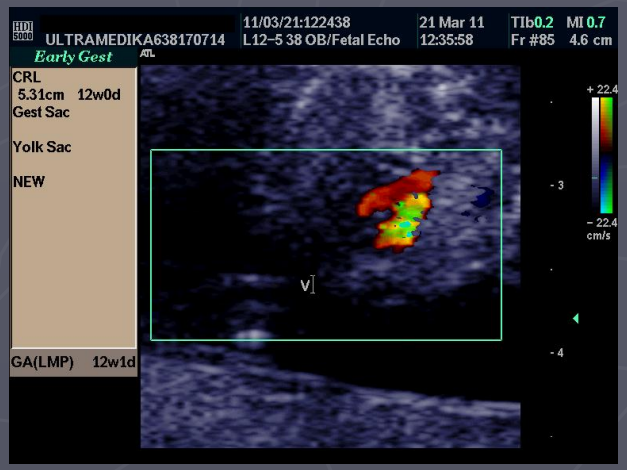
I Trimestar: 11-14ng



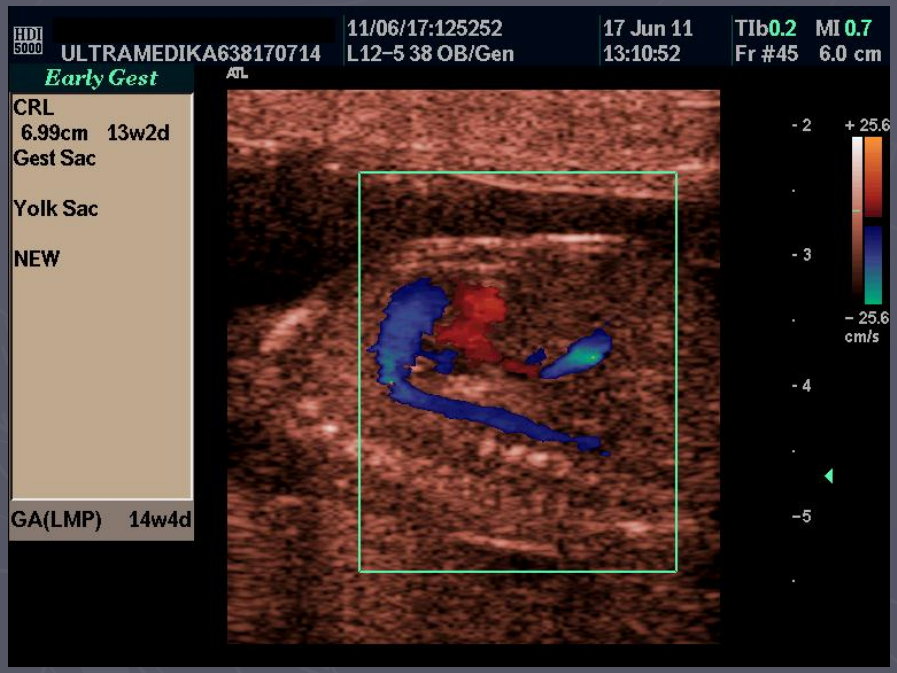
I TR: “B” , ”3VV” , “V”

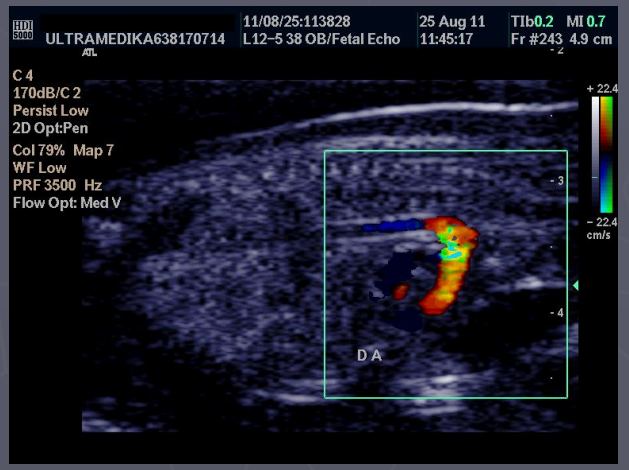

HDI 5000
ULTRAMEDIKA638170714
11/03/17:154448
L12-5 38 OB/Fetal Echo
17 Mar 11
15:57:57
TIb0.2 MI 0.7
Fr #47 5.5 cm
Early Gest
CRL
7.81cm 13w6d
Gest Sac
Yolk Sac
NEW
GA(LMP) 16w1d
B
+ 22.4
- 22.4
cm/s
- 3
- 4
-5

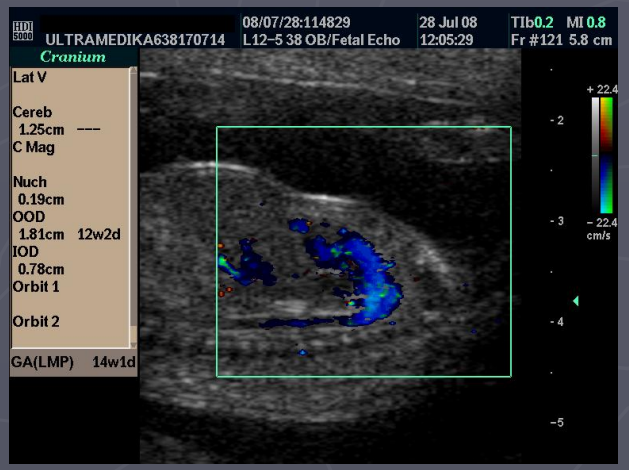

HDI 5000
ULTRAMEDIKA638170714
11/03/17:154448
L12-5 38 OB/Fetal Echo
17 Mar 11
15:53:34
TIb0.3 MI 0.7
Fr #102 4.7 cm
Early Gest
CRL
7.81cm 13w6d
Gest Sac
Yolk Sac
NEW
GA(LMP) 16w1d
P A
A O
T
+ 22.4
- 22.4
cm/s
- 2
- 3
- 4


HDI 5000
ULTRAMEDIKA638170714
11/03/21:122438
L12-5 38 OB/Fetal Echo
21 Mar 11
12:35:58
TIb0.2 MI 0.7
Fr #85 4.6 cm
Early Gest
CRL
5.31cm 12w0d
Gest Sac
Yolk Sac
NEW
GA(LMP) 12w1d
V
+ 22.4
- 22.4
cm/s
- 3
- 4

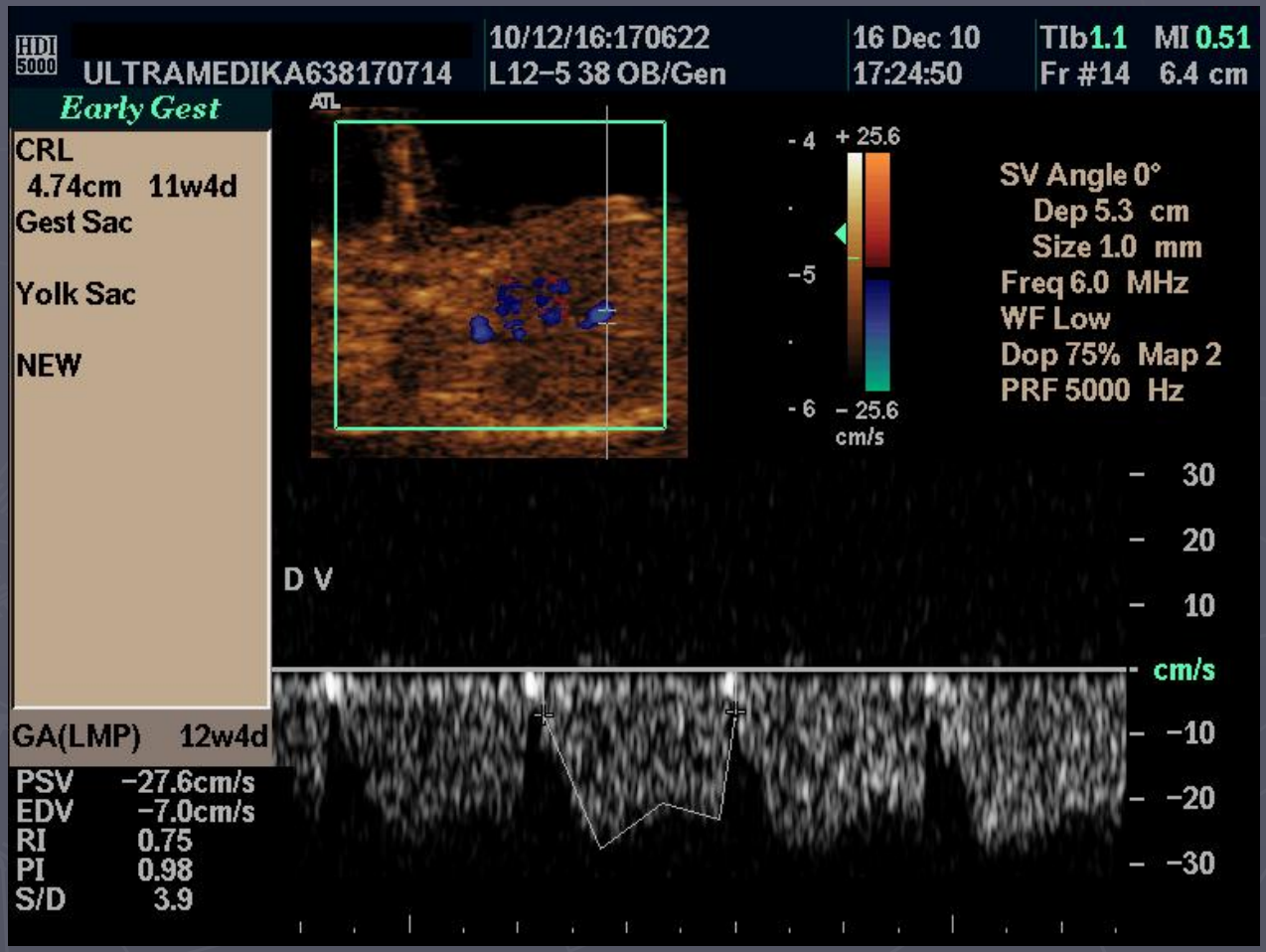
I TR: DA


HDI 5000
ULTRAMEDIKA638170714
11/06/17:125252
L12-5 38 OB/Gen
17 Jun 11
13:10:52
TIb0.2 MI 0.7
Fr #45 6.0 cm
Early Gest
ATL
CRL
6.99cm 13w2d
Gest Sac
Yolk Sac
NEW
GA(LMP) 14w4d
+ 25.6
- 25.6
cm/s

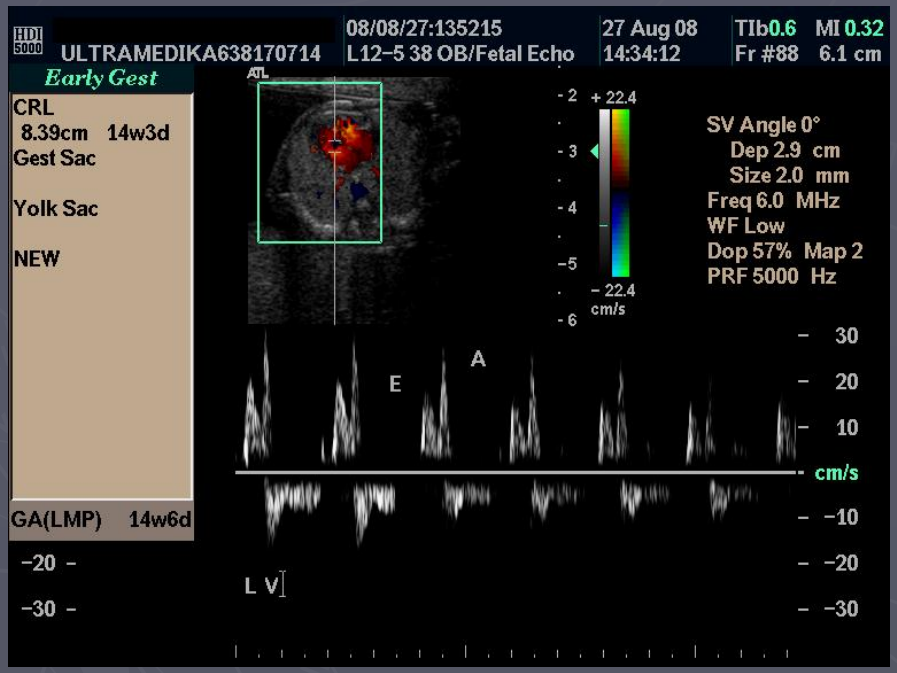

HDI 5000
ULTRAMEDIKA638170714
11/08/25:113828
L12-5 38 OB/Fetal Echo
25 Aug 11
11:45:17
TIb0.2 MI 0.7
Fr #243 4.9 cm
ATL
C 4
170dB/C 2
Persist Low
2D Opt:Pen
Col 79% Map 7
WF Low
PRF 3500 Hz
Flow Opt: Med V
+ 22.4
- 22.4
cm/s
D A

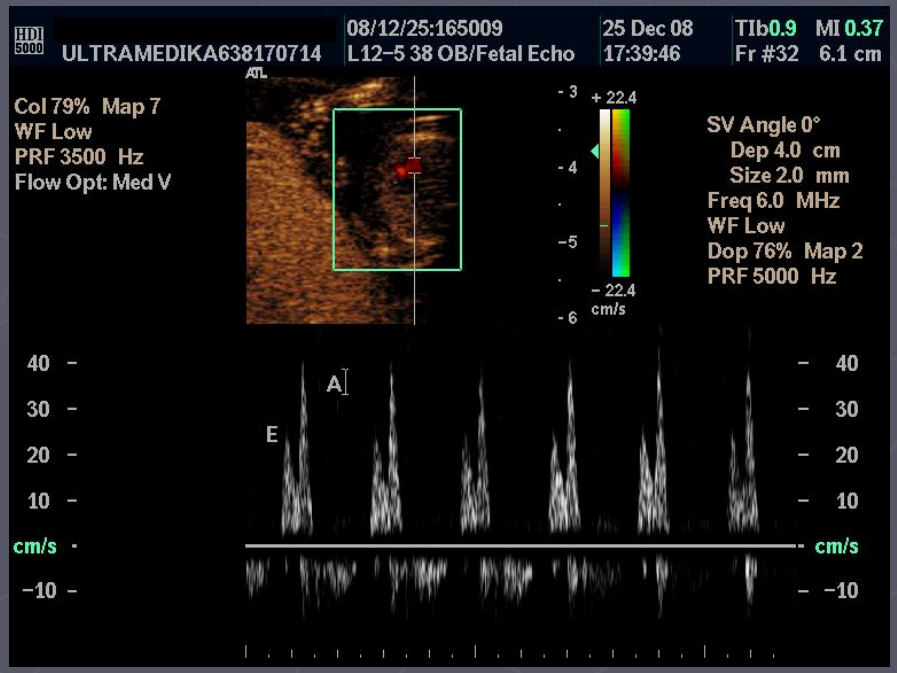

HDI 5000
ULTRAMEDIKA638170714
08/07/28:114829
L12-5 38 OB/Fetal Echo
28 Jul 08
12:05:29
TIb0.2 MI 0.8
Fr #121 5.8 cm
Cranium
Lat V
Cereb
1.25cm ---
C Mag
Nuch
0.19cm
OOD
1.81cm 12w2d
IOD
0.78cm
Orbit 1
Orbit 2
GA(LMP) 14w1d
+ 22.4
- 22.4
cm/s

Doppler: DV-”fast mod”

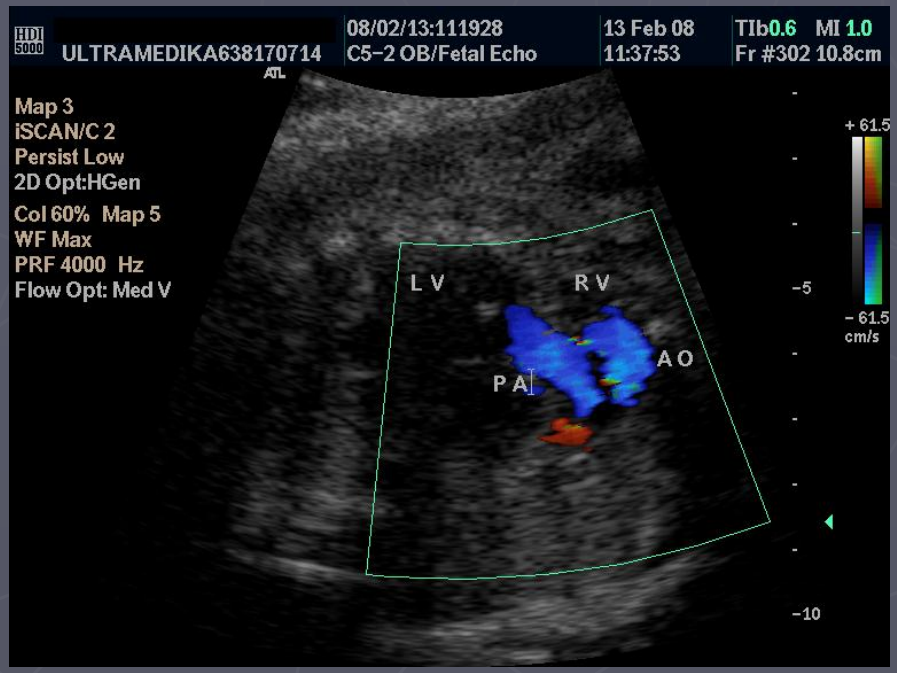


Doppler-CD: “e” i “a”





USM: Transpozicija v. kr. sudova

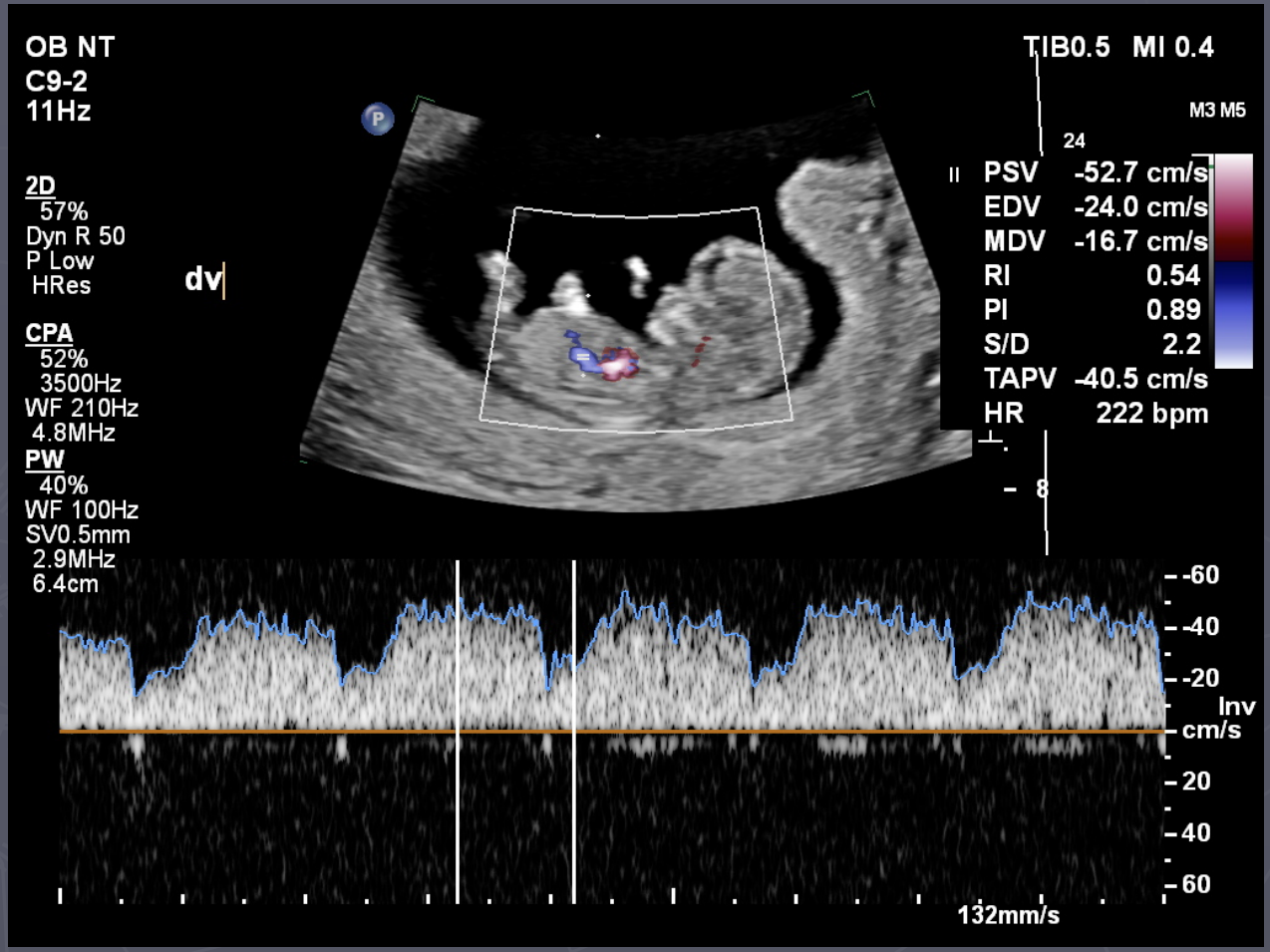


12ng: USM- ektopija kordis, Trikuspidna atrezija

EPIQ G7-rezultati

- BROJ PREGLEDA (2D) EF je 974.
- Prosečna duzina EF u I TR je **5min**.
- **I TR**: UZ sonda je C 9-2MHz sa CPA i CPD sa **93%** uspešnosti. Upotreba od 5% endovag. sonde 10-3MHz
- U **ranom II trimestru** uspešnost je iznosila **97%**.
- U II i III u **27%** je bio moguć pregled sa **4D (STIC**) sa X-matrix 6-1 MHz elektronskom sondom (**3 sec. akvizicija**)
- .

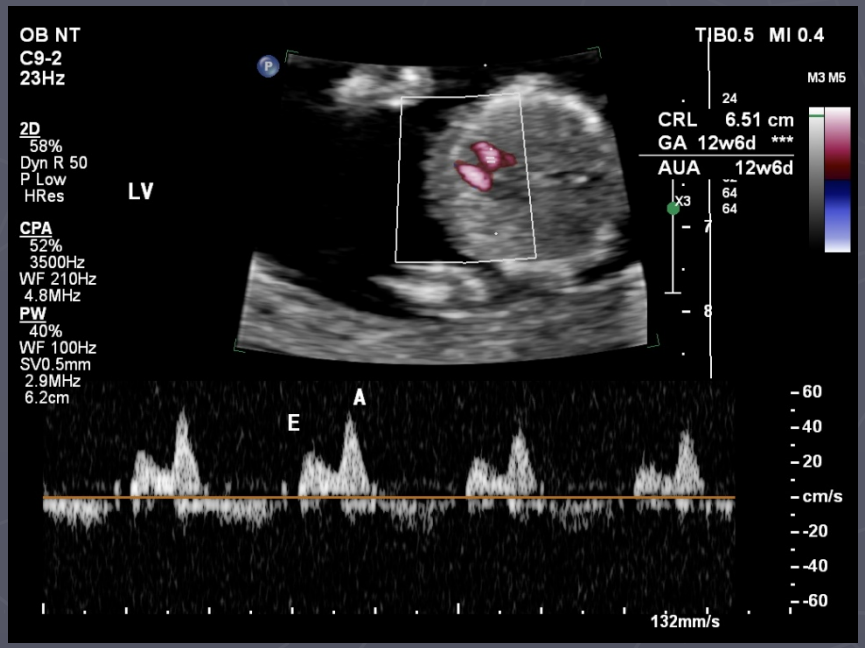
EPIQ 7G, I TR: PI= 0.89, PSV= 53cm/sec



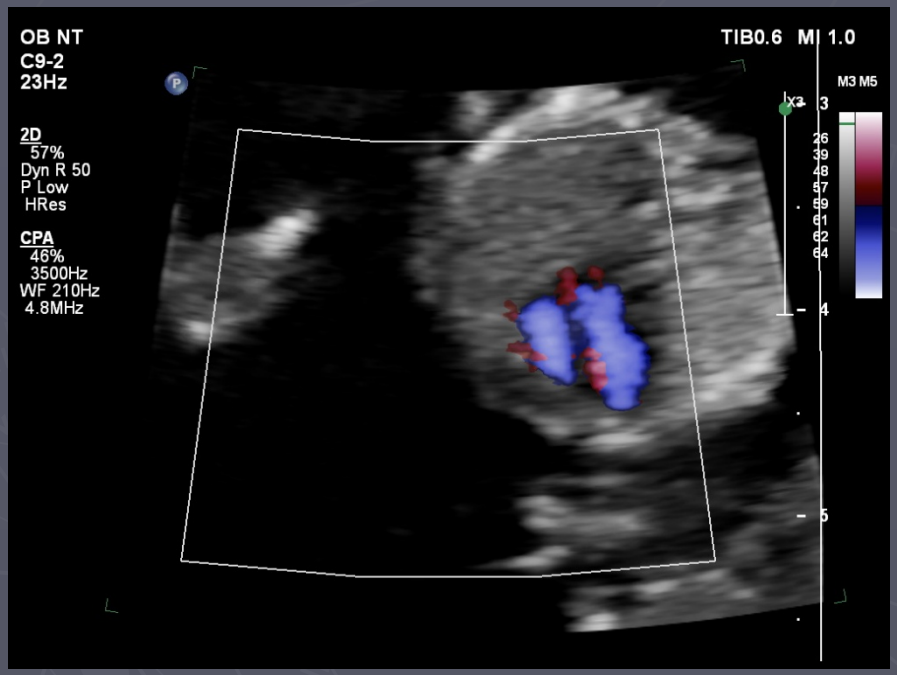
I TR. 12.6ng: C9-2 MHz; 7-8cm

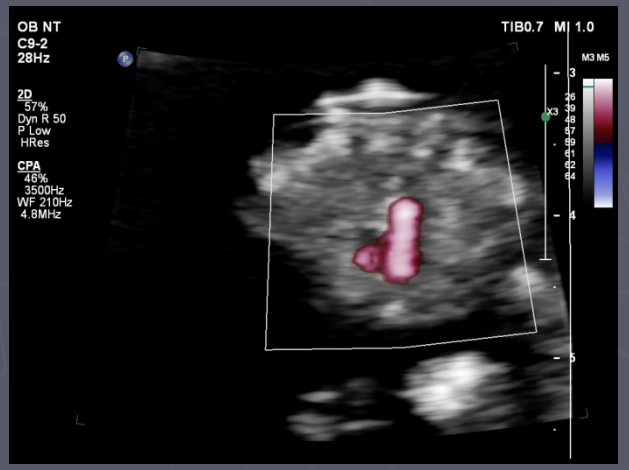
4CV=Ostium I i AV v.

Dijastola LV= “e” i “a”

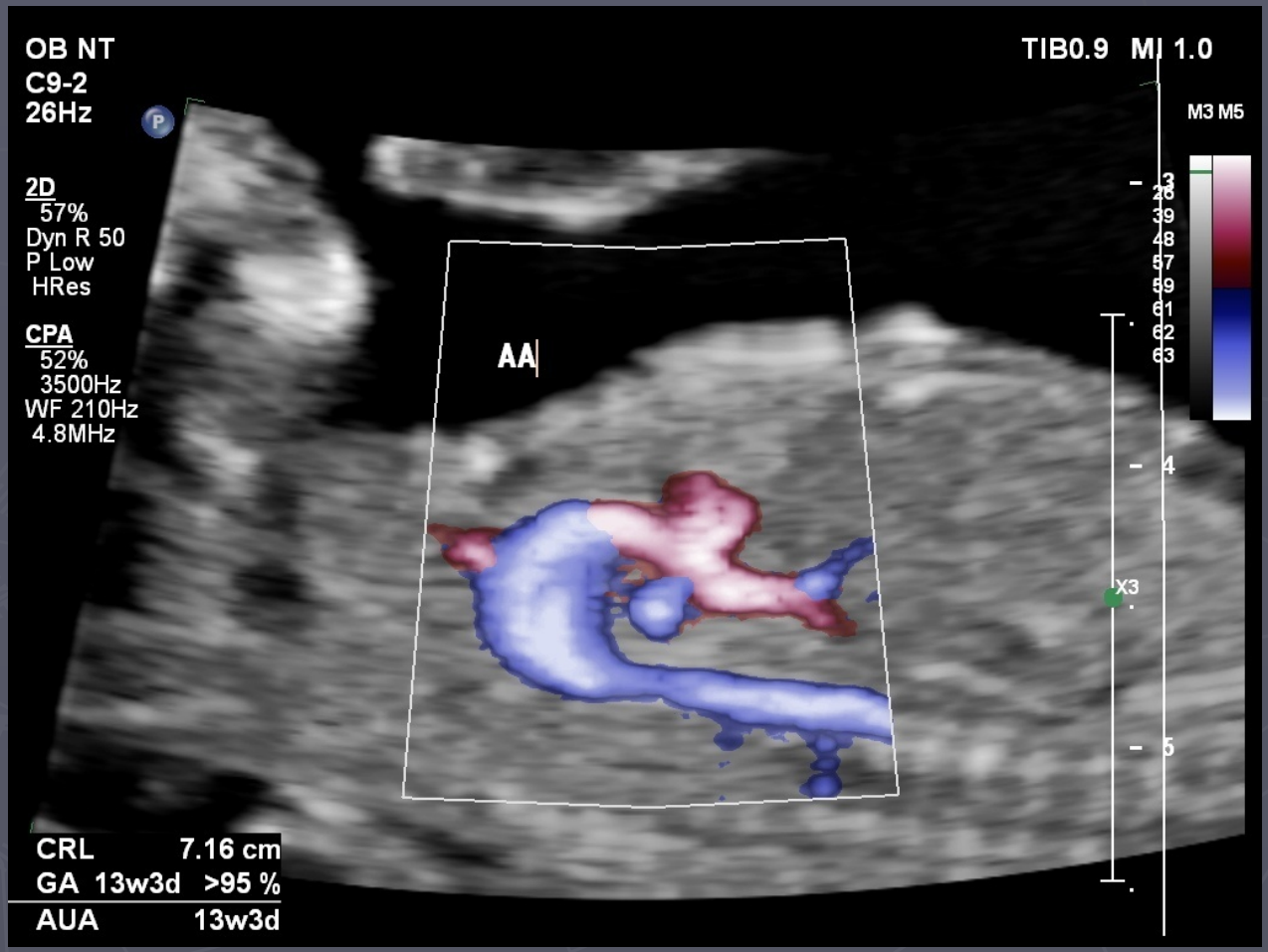


I TR: 4cv, 3vt, 3vv-rvot





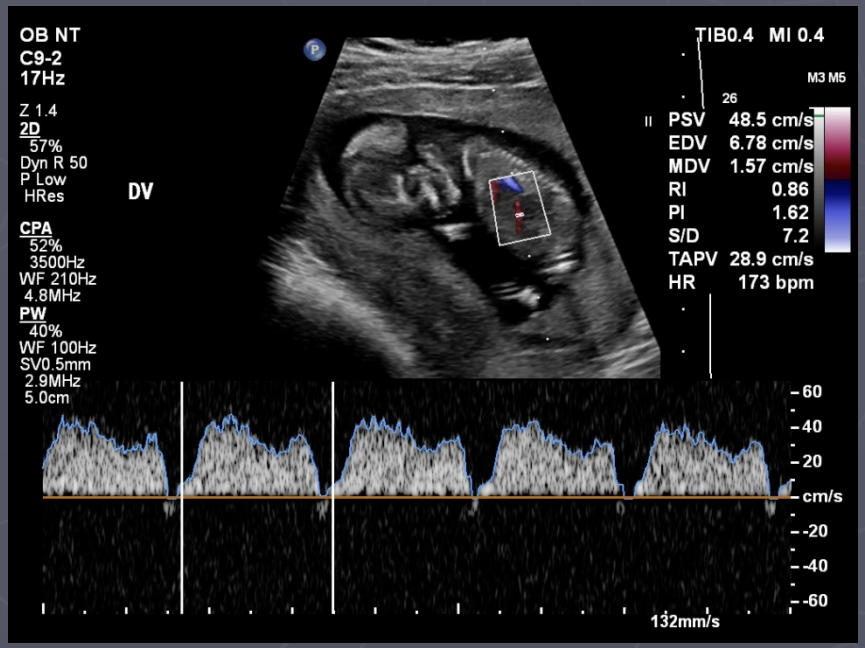
13+ 3 gn: Aortni luk



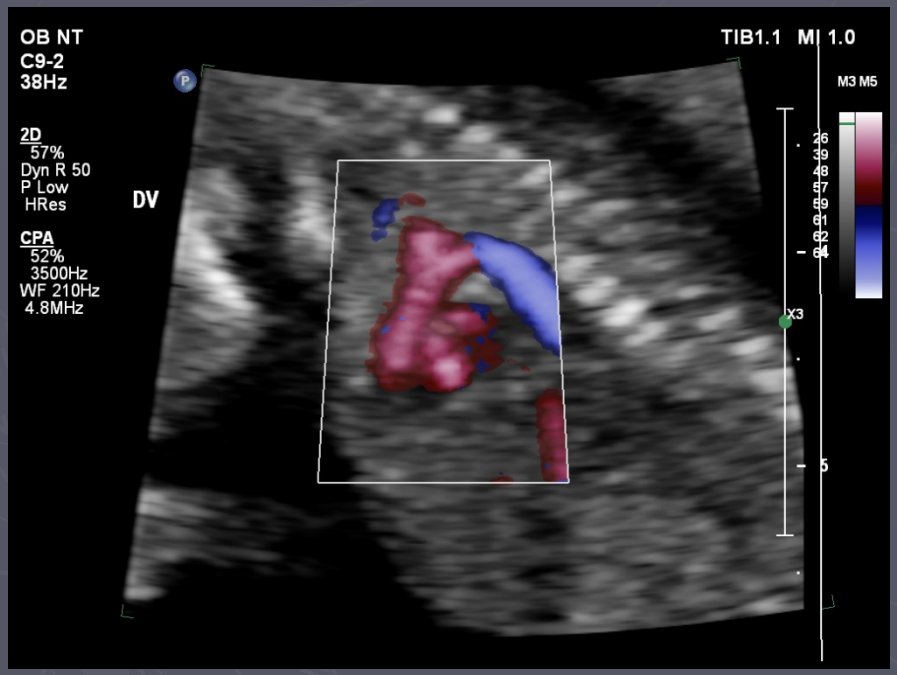
I TR: CPA

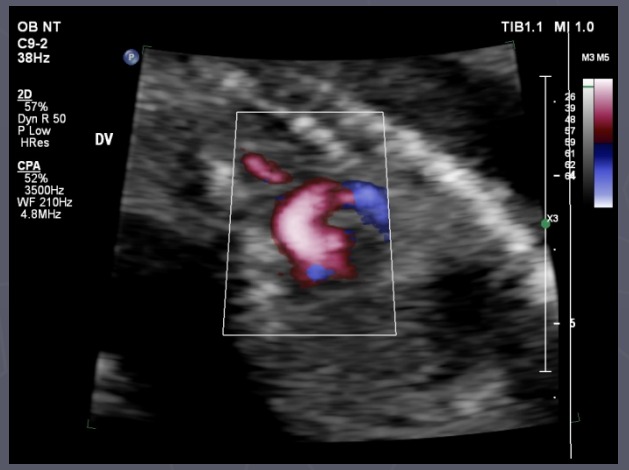
4CV=8,5mm, IVS

Kičma na 1h: DV

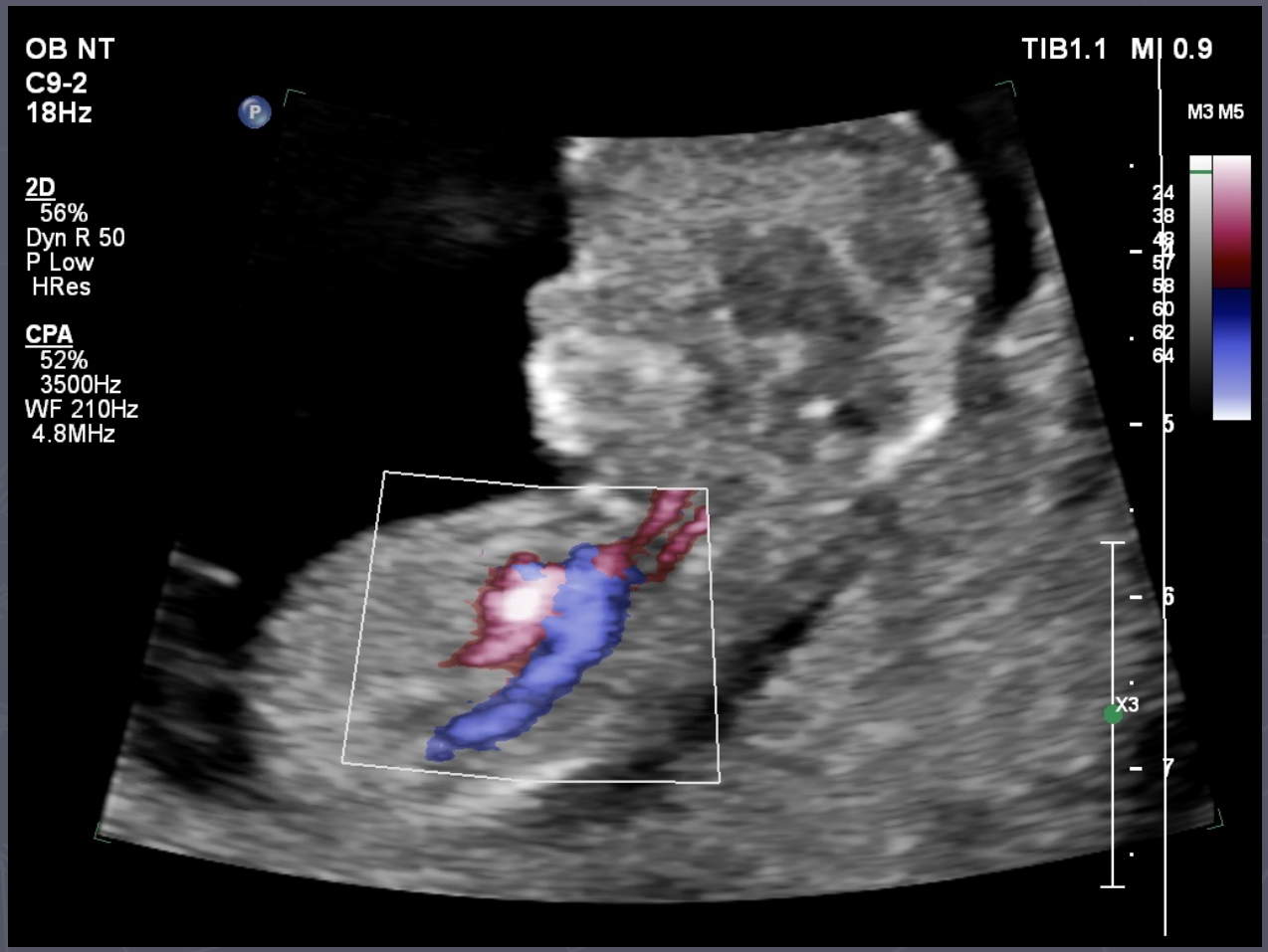


I TR: Duktalni i aortni luk (3 grane)





I tr: AA sa karotidnim a.



USM: I i II TRIMESTAR

- **I trimestar:**
- HLSH (hypoplastic left heart syndrome)
- Pulmonary atresia
- Tricuspid atresia
- **II trimestar:**
- Double-outlet right ventricle
- Transposition great arteries
- Pulmonary stenosis

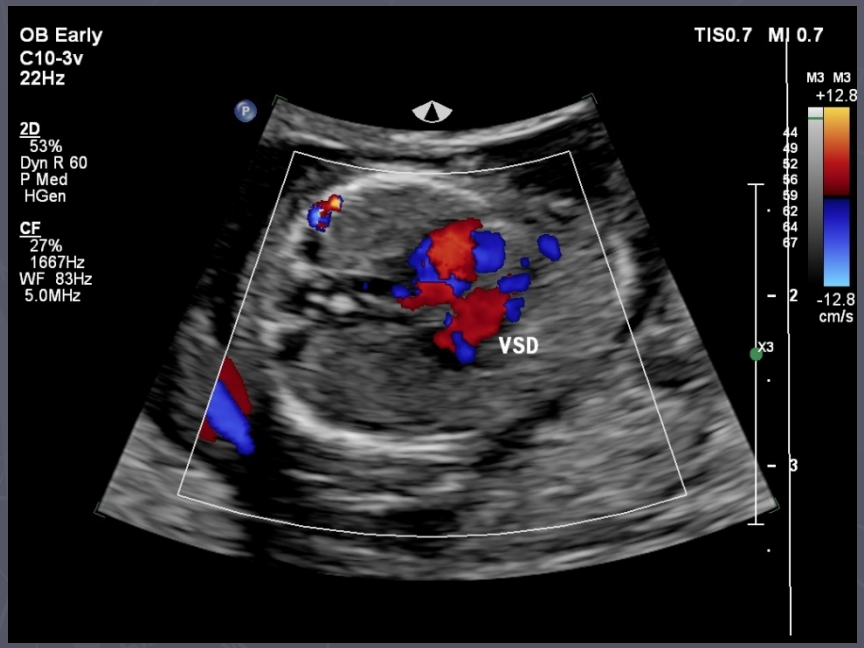
I TR: USM (parc. AV kanal)

VSD, AV VALVULE

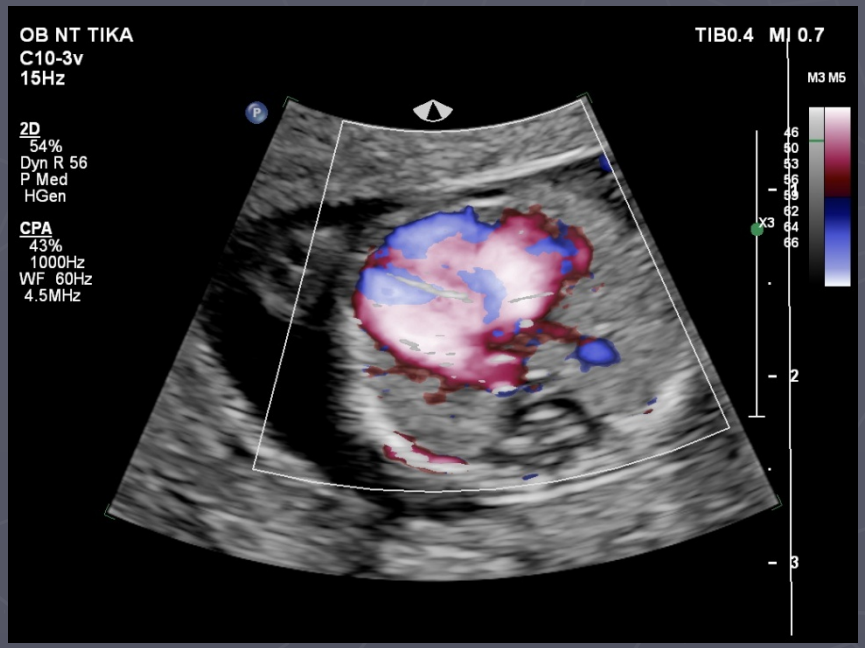
OSTIUM I ?

I TR: USM

C. DOPPLER



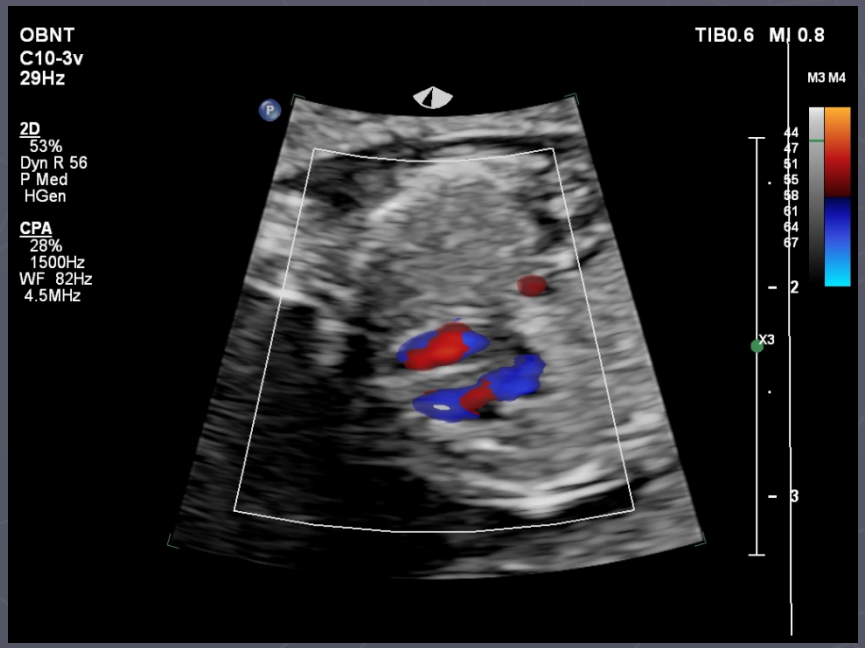
C. POWER DOPPLER



ev 10-3v MHz: 11 ng.

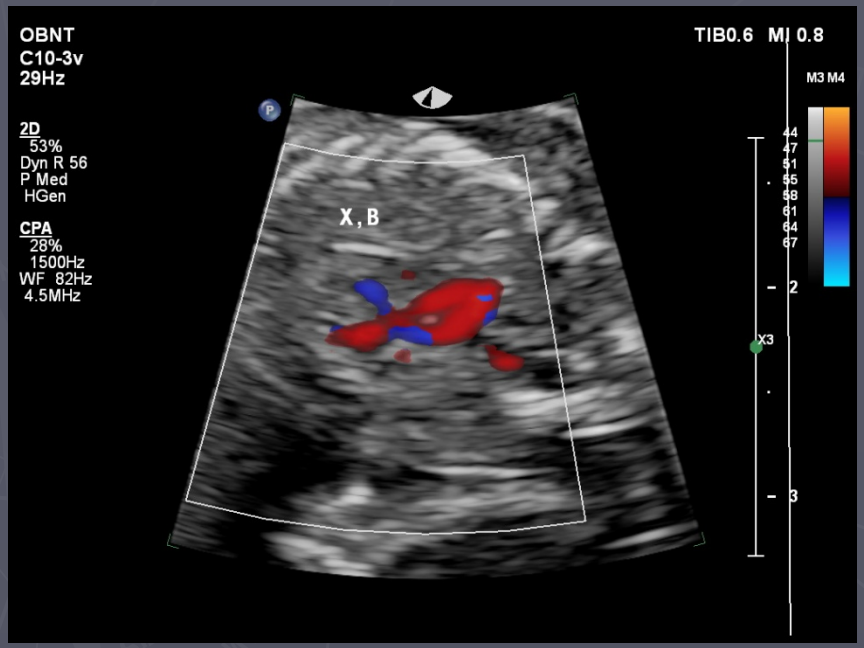
4CV = 7,5mm

4CV - CD

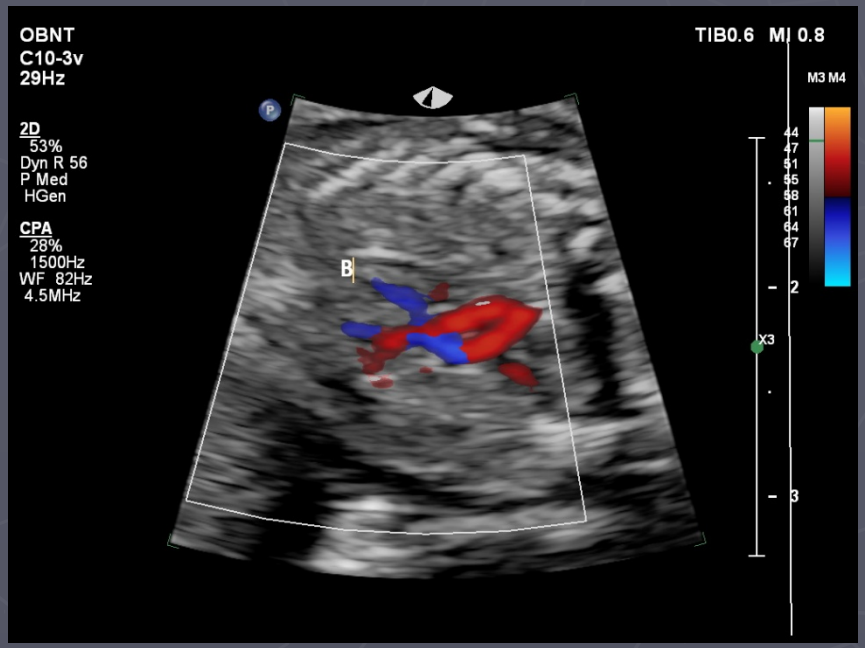


ev 10-3v MHz: 11 ng.

ZNAK: “x” =Pa i Ao

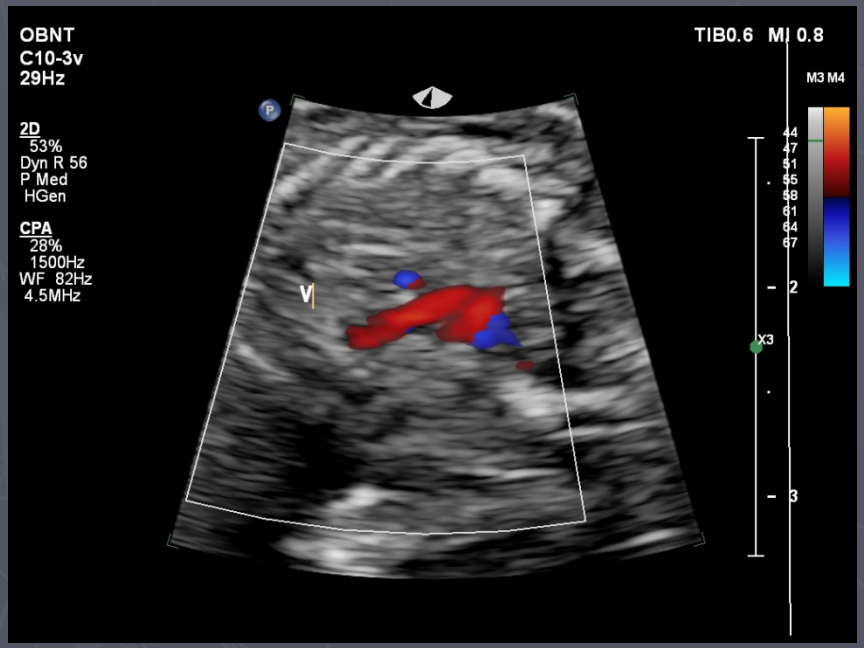


ZNAK: B

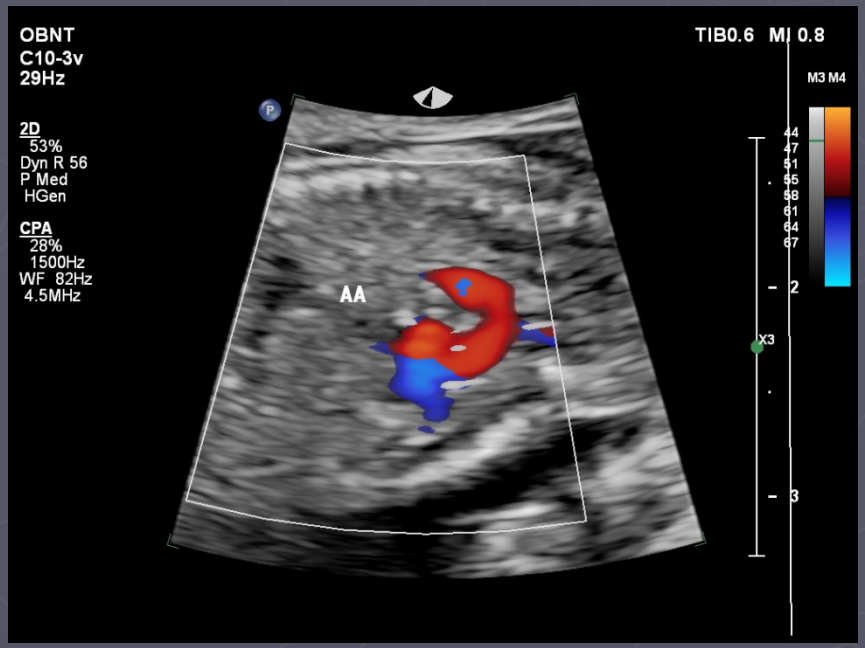


ev 10-3v MHz: 11 ng.

ZNAK : “V”= Ao i D luk

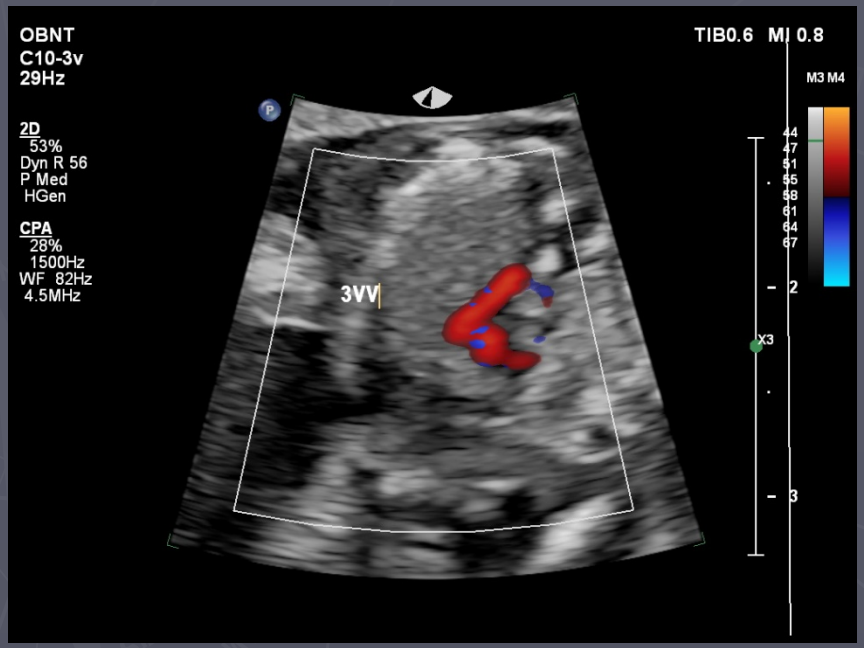


AORTNI LUK

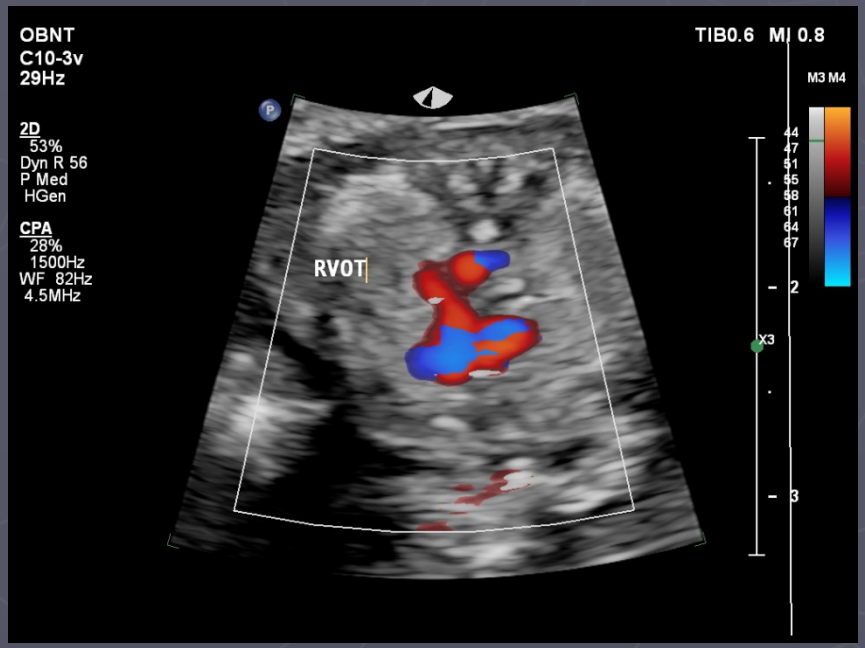


ev 10-3v MHz: 11 ng.

ZNAK: “3VV”=pa,ao i vcs



ZNAK: “RVOT”= Pa +gr.



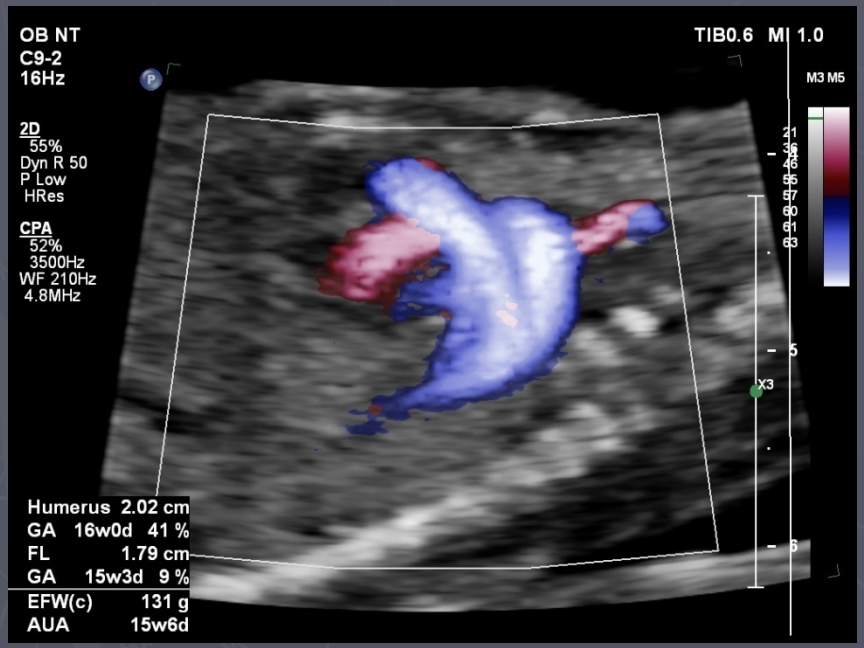
C 9-2 MHz

“4CV”= 16 ng.

“4CV”= 11 ng.

RANI II TR.: 15 + 6 ng.

LVOT, RVOT, “V”

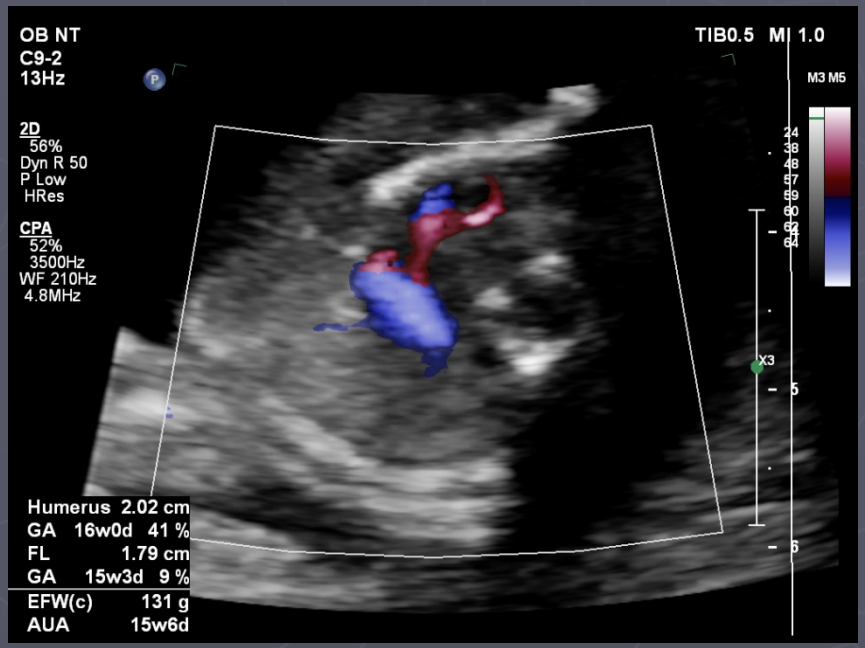


AORTNI LUK i 3 GRANE

15 + 6 ng

FOR. OVALE=2.7mm

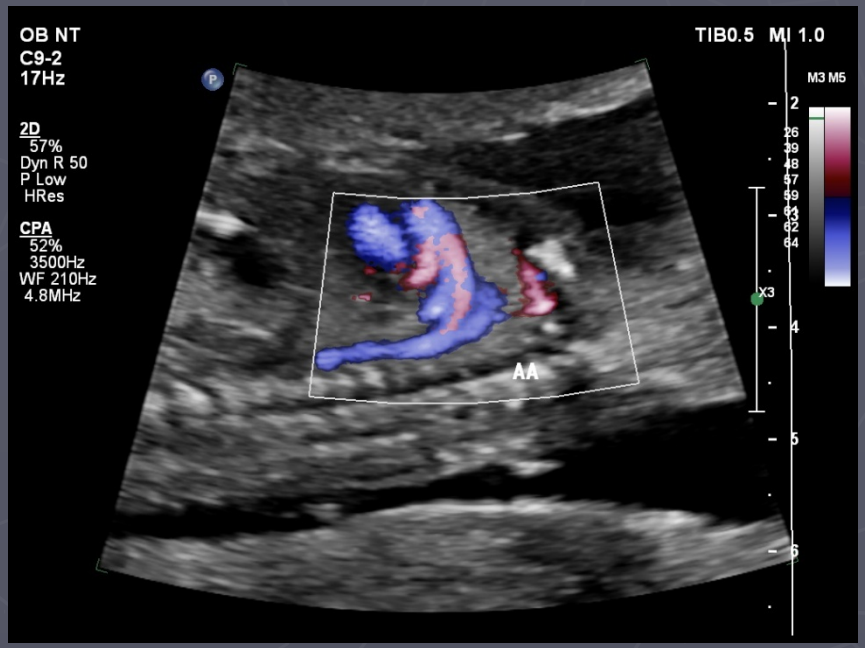
A. SUBKLAVIA D. “ARSA”



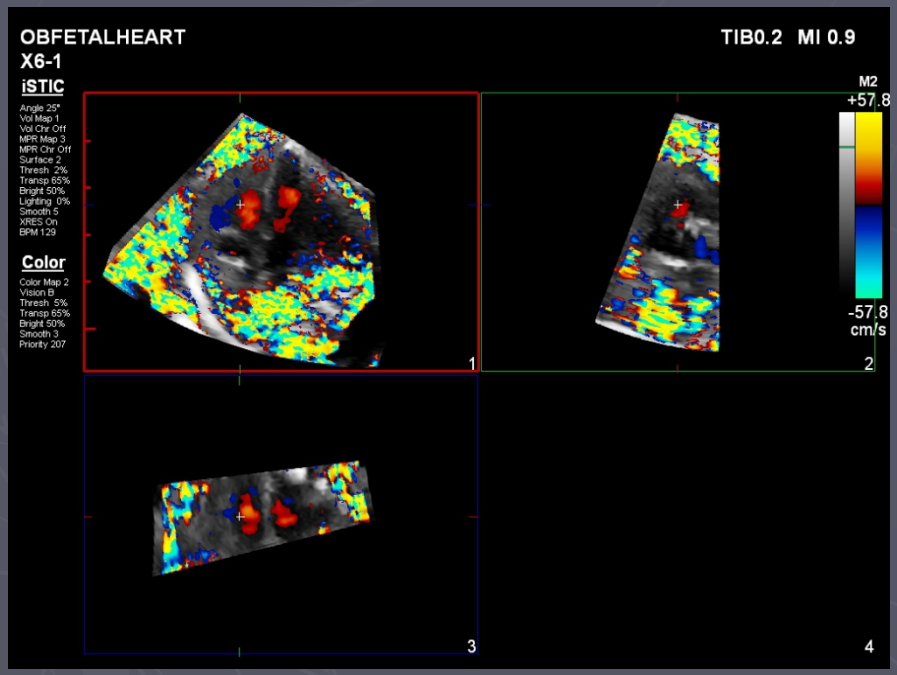
RANI II TR.

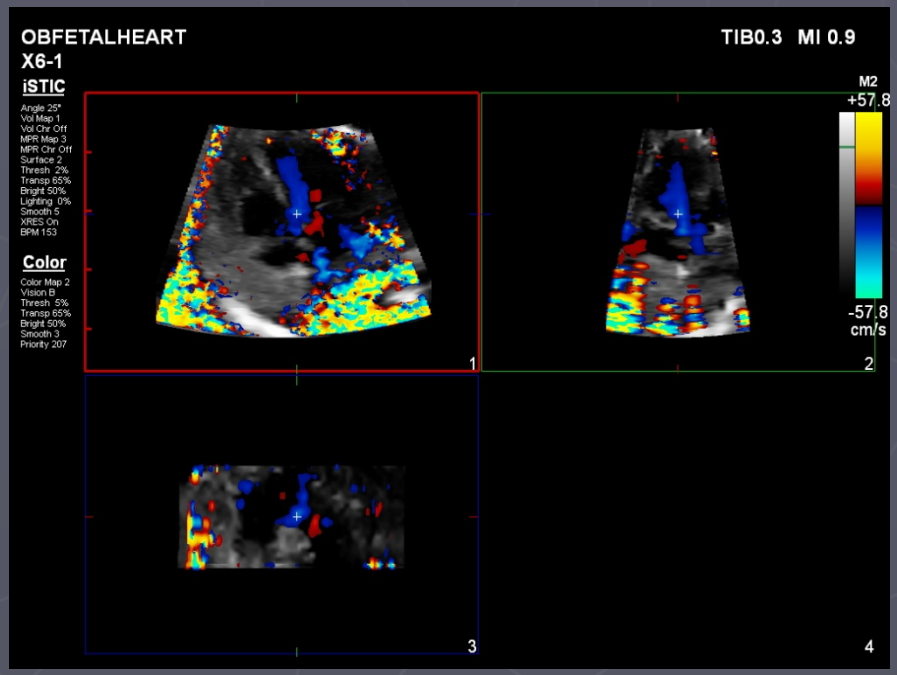
V KONFIGURACIJA

AORTNI I DUKTALNI L.

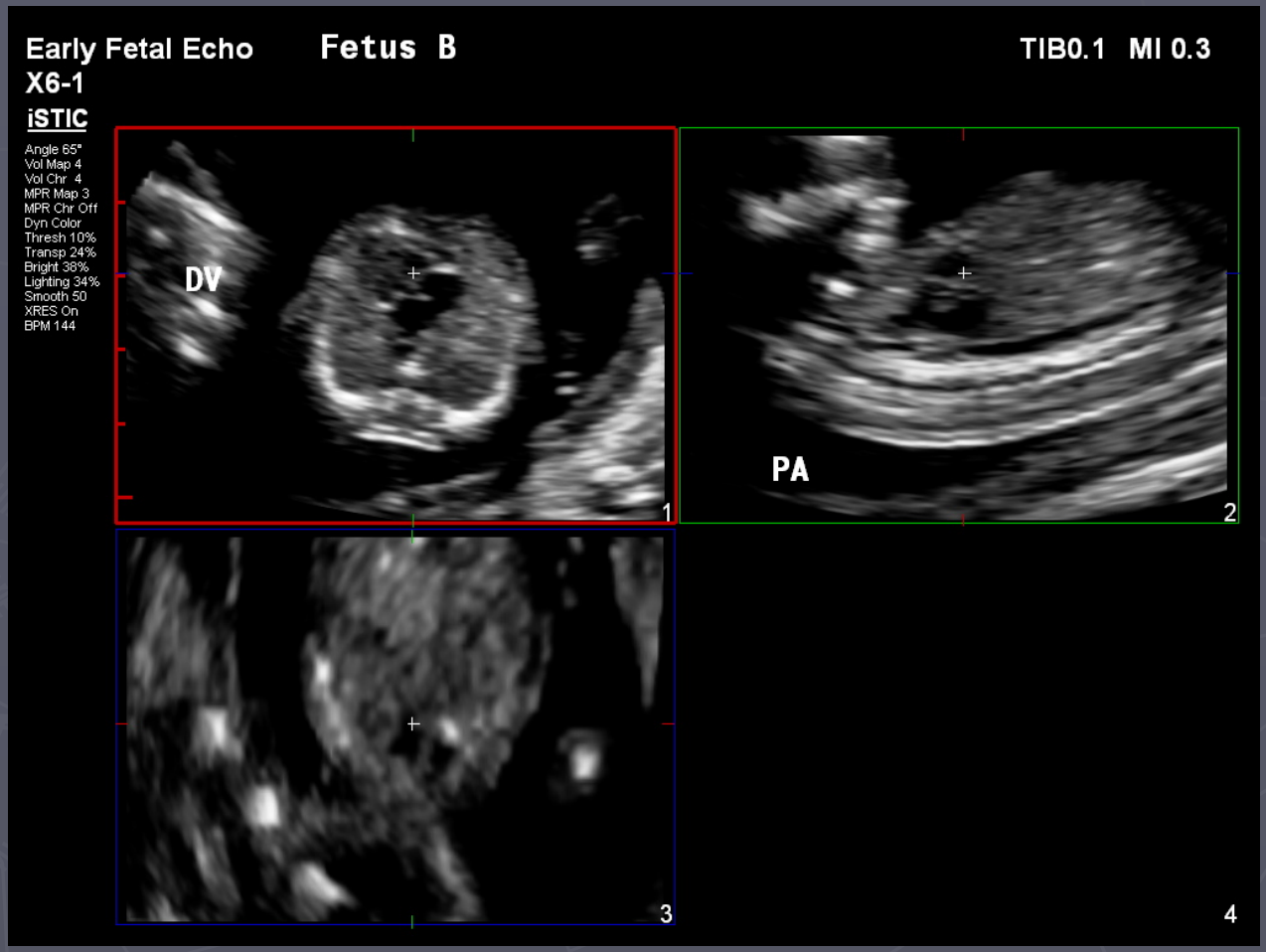


Rani II TR.: 4D “STIC” CD

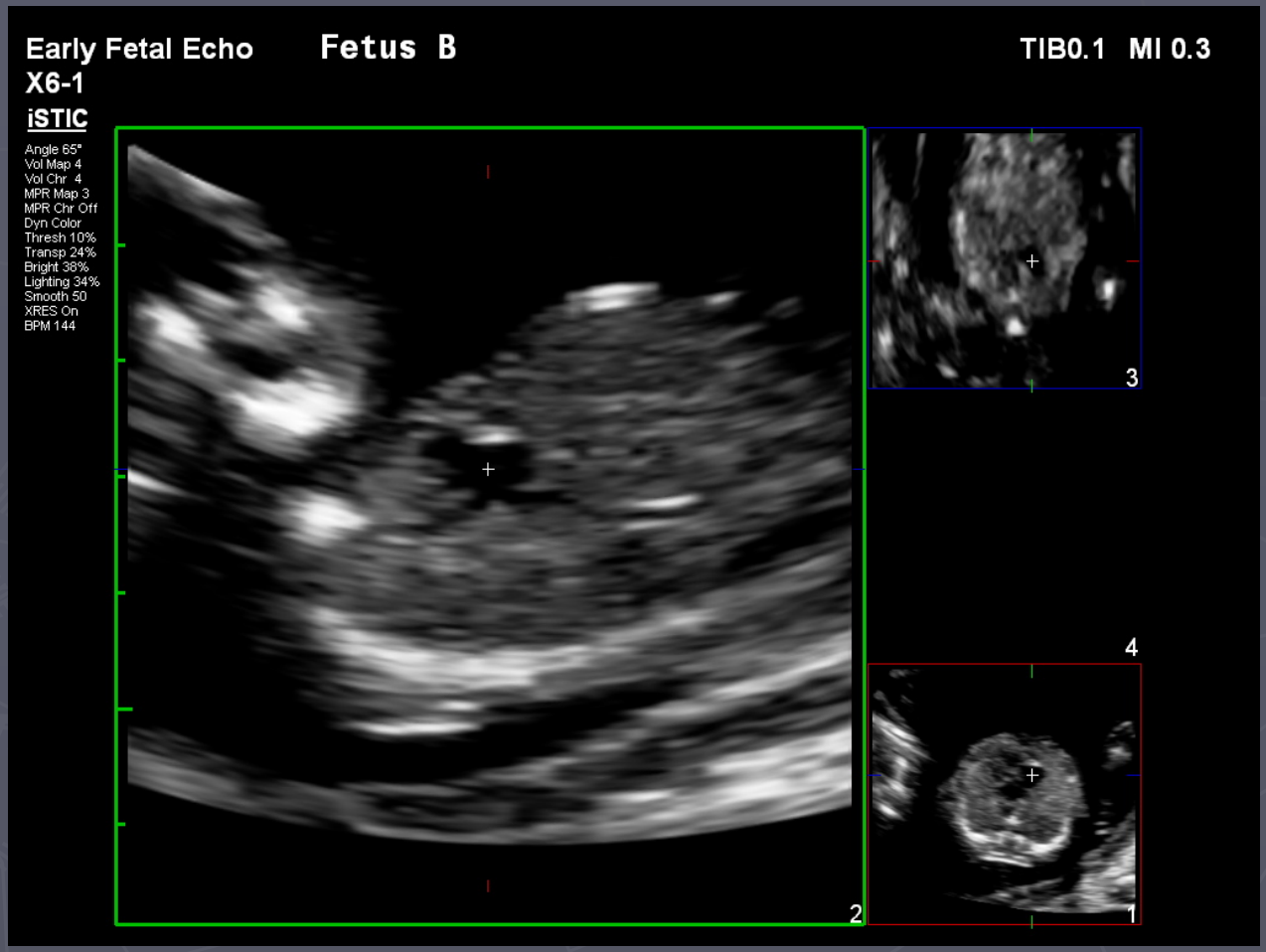




Rani II TR: 4D stic; DV=PA

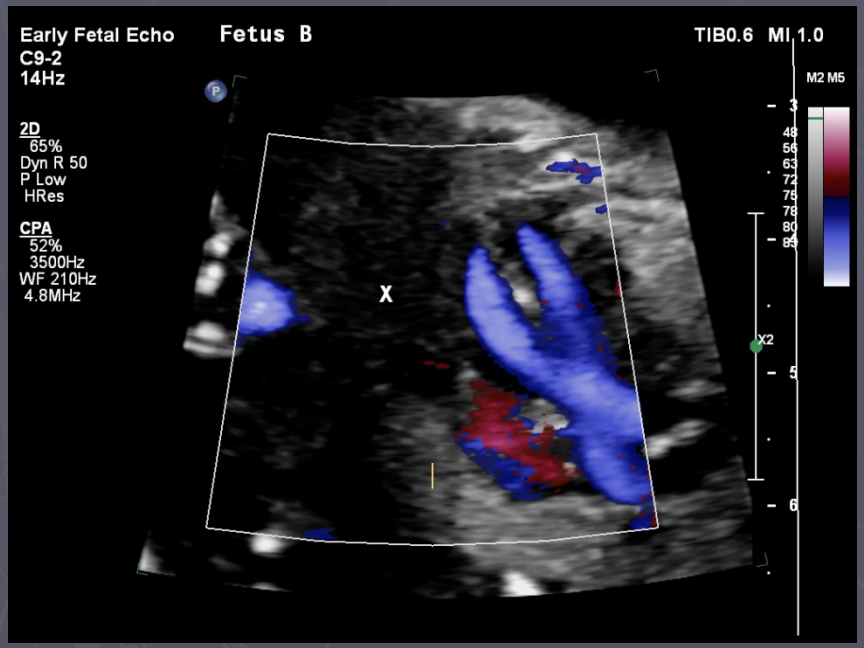


4D stic; DA=venska drenaža

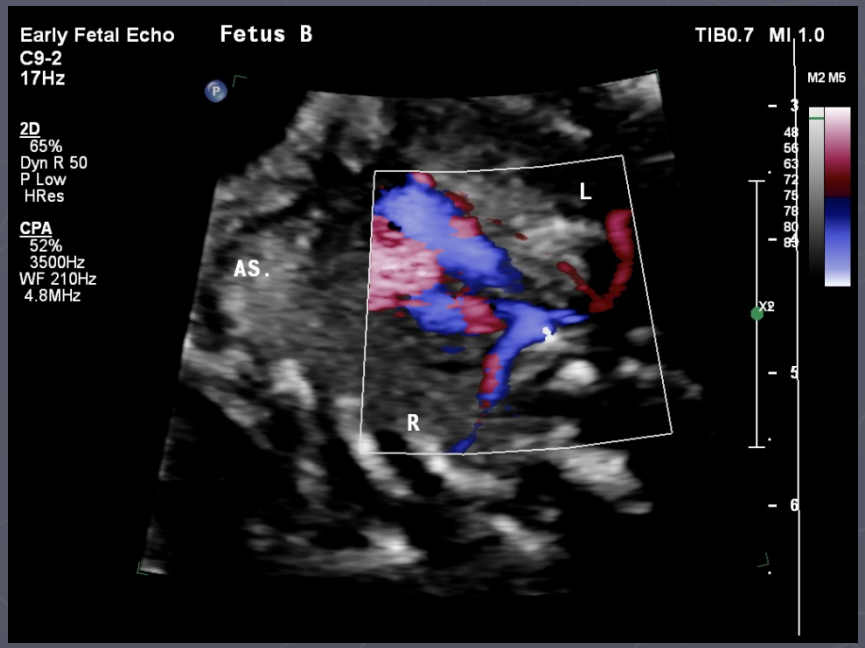


II Trimestar :16-22 g.n

ZNAK : “X”- Ao. i Pa.



ARTERIJE SUBKLAVIJE



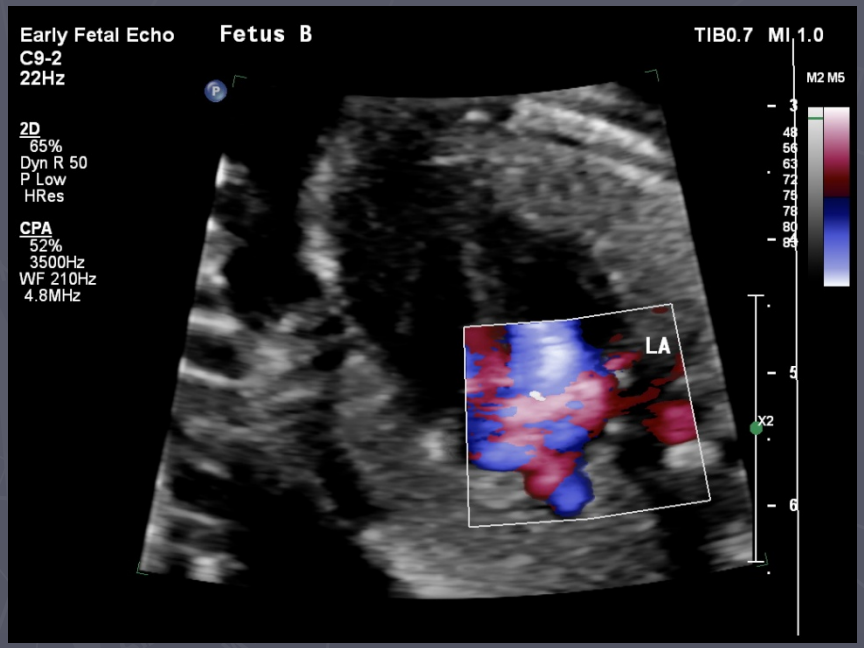
16-18 g.n.

CD: PA + GRANE

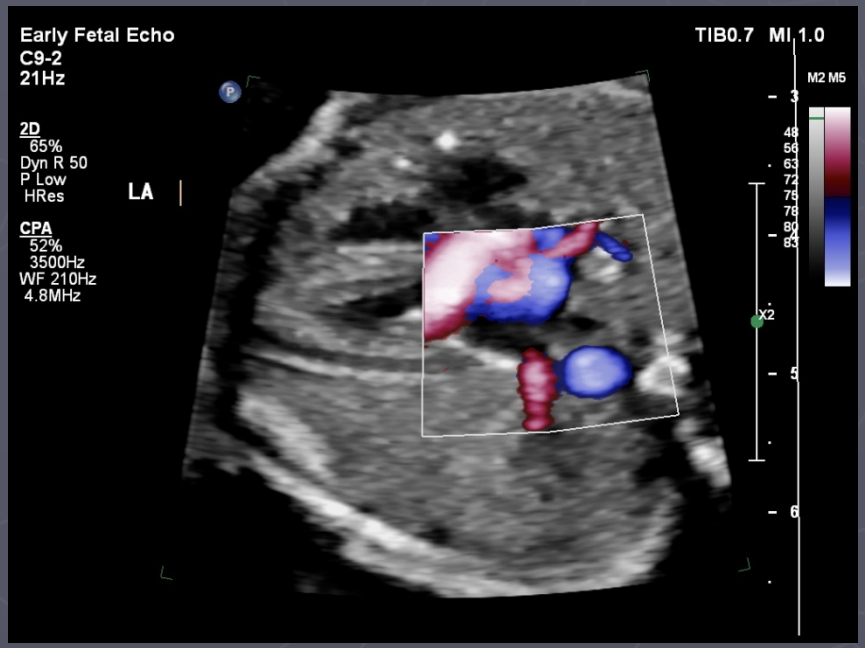
CPA: PA + GRANE

16-18 g.n.

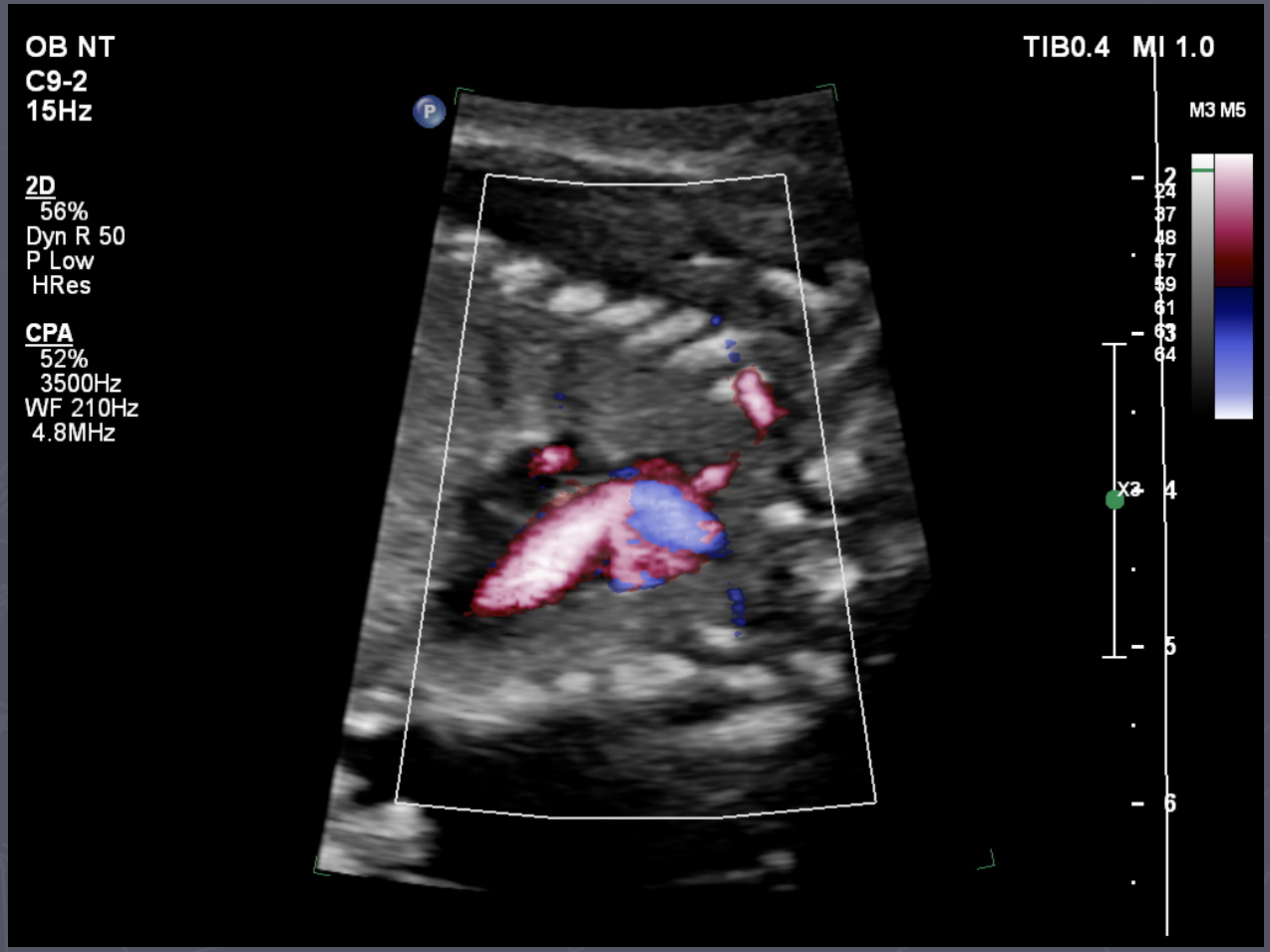
LEVA PRETKOMORA



LEVA PRETKOMORA



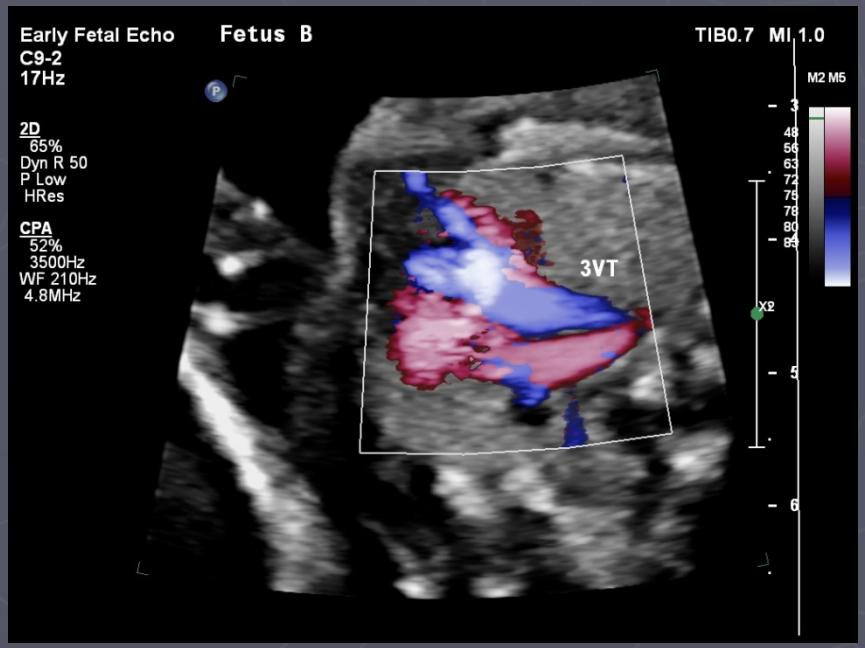
LVOT, AA + 1 GRANA



II Trimestar

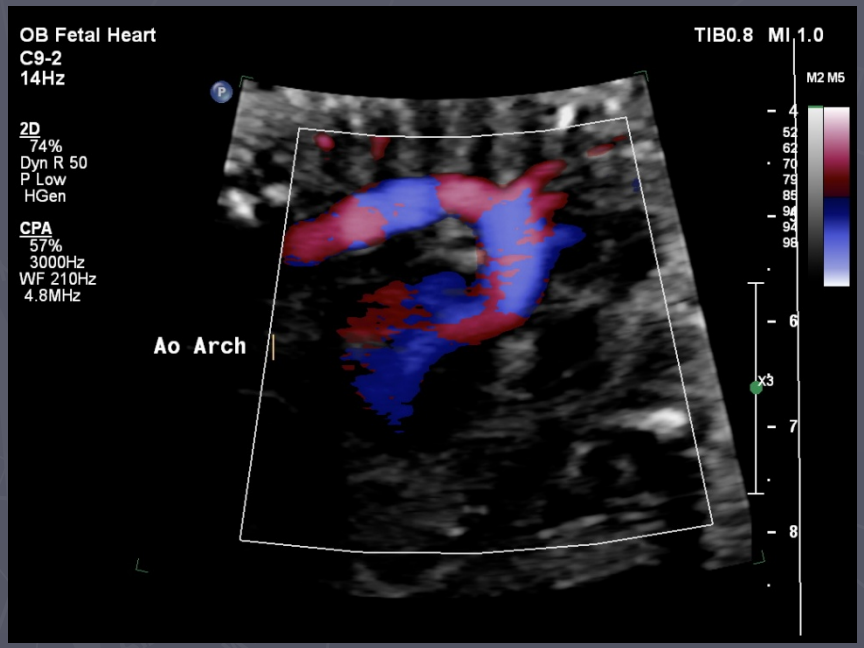
3VV

CPA: 3VV

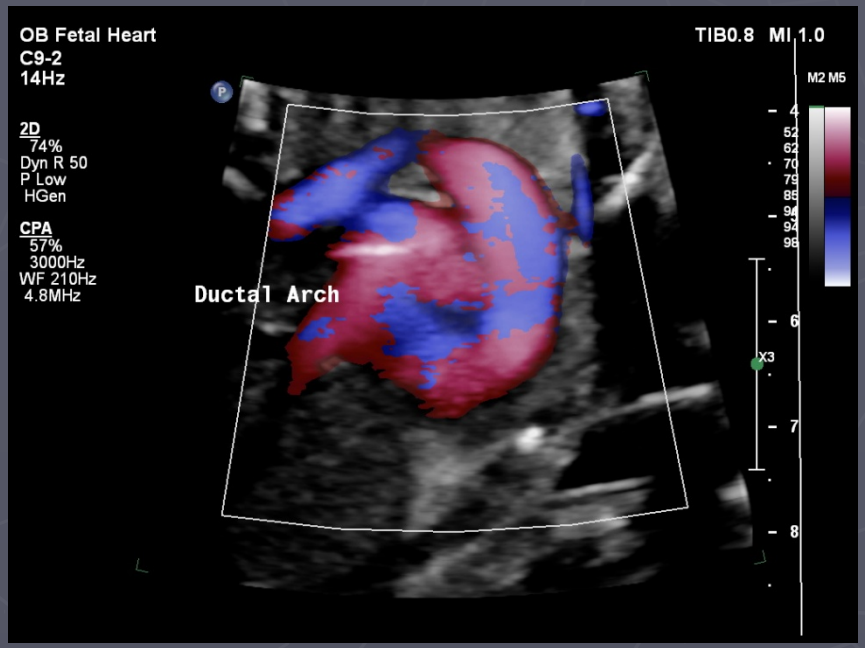


II TRIMESTAR

CPA : A. LUK+ 3 GRANE

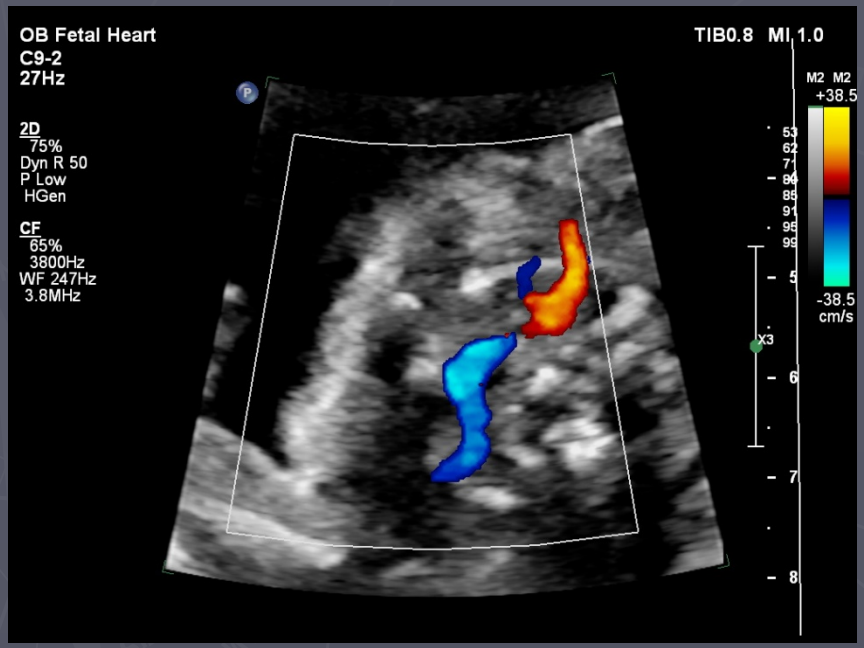


D. LUK BEZ PREKIDA

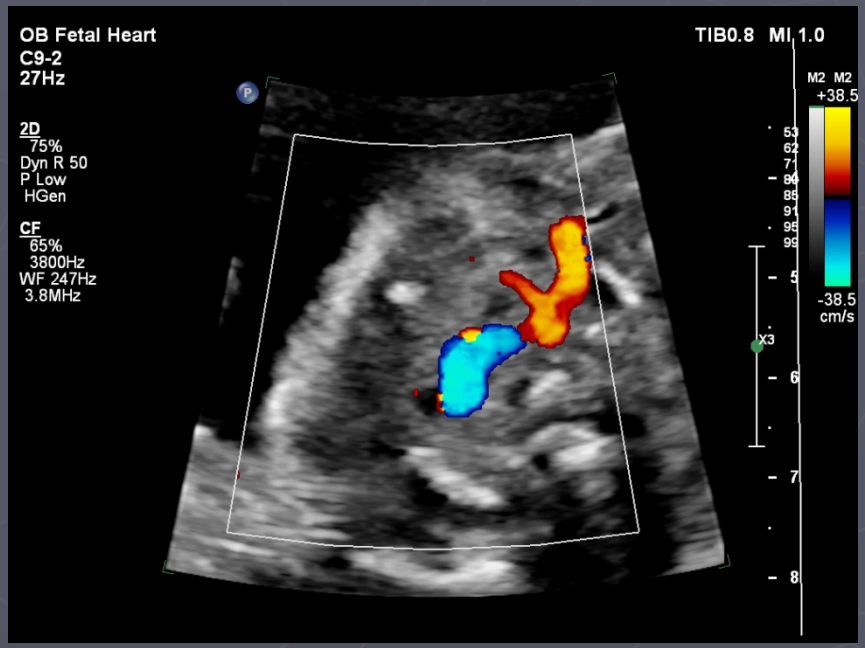


“Trizomija 21”: tok a.subklavije

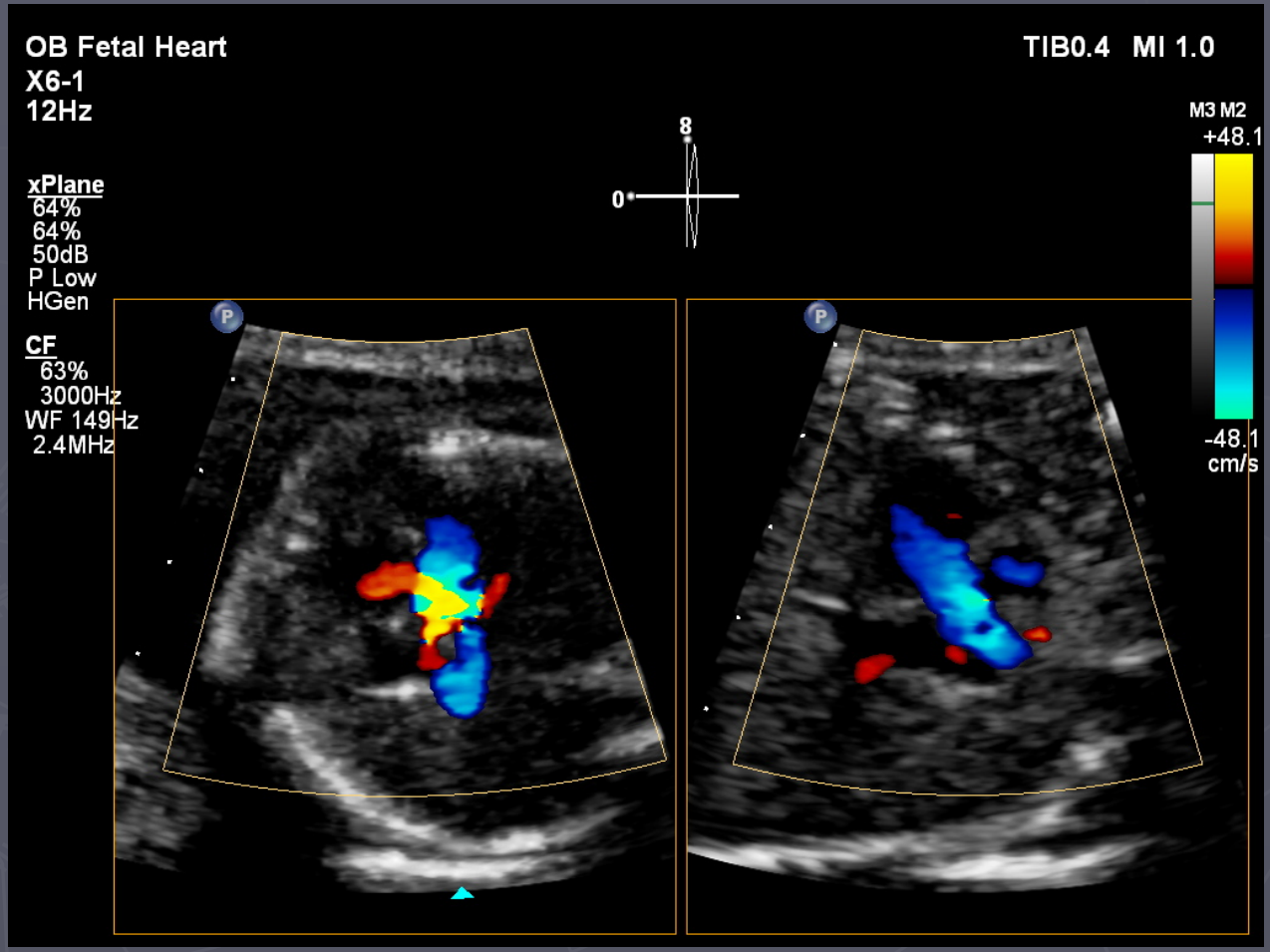
Leva i desna a. subc.



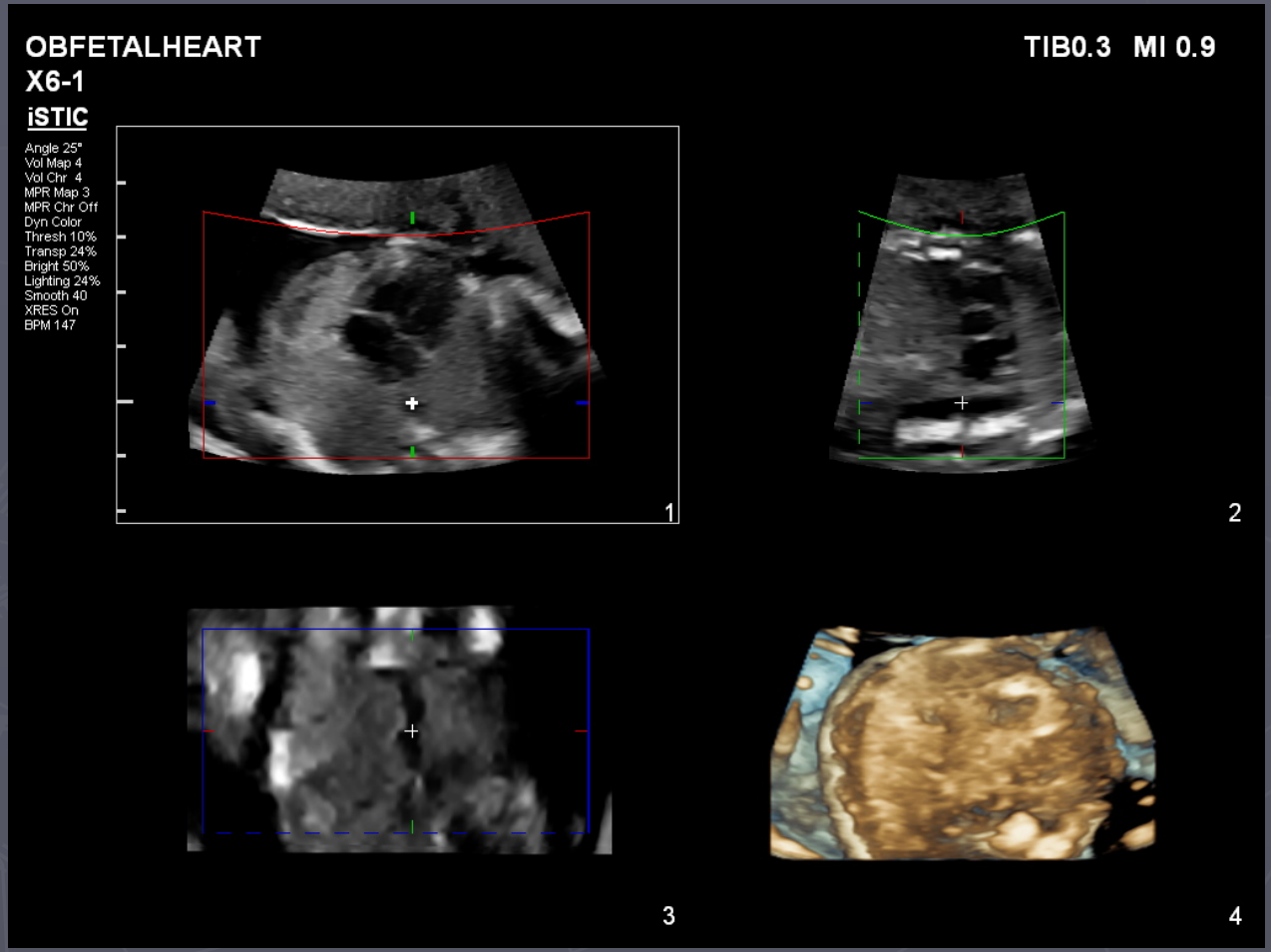
Tok desne a. subc.



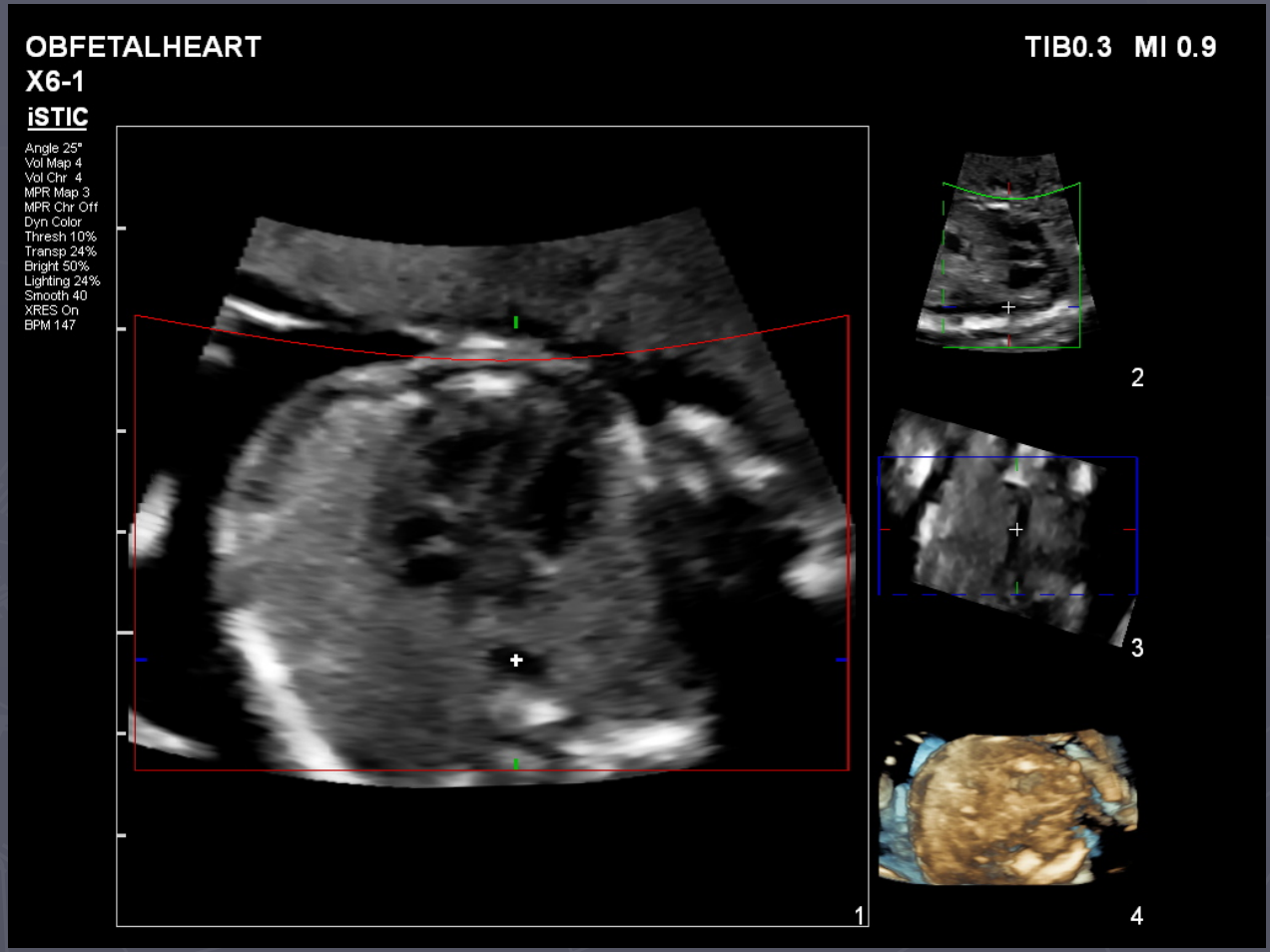
X-”Plane”=LVOT


OB Fetal Heart
X6-1
12Hz
TIB0.4 MI 1.0
M3 M2
+48.1
-48.1
cm/s
8
0
xPlane
64%
64%
50dB
P Low
HGen
CF
63%
3000Hz
WF 149Hz
2.4MHz

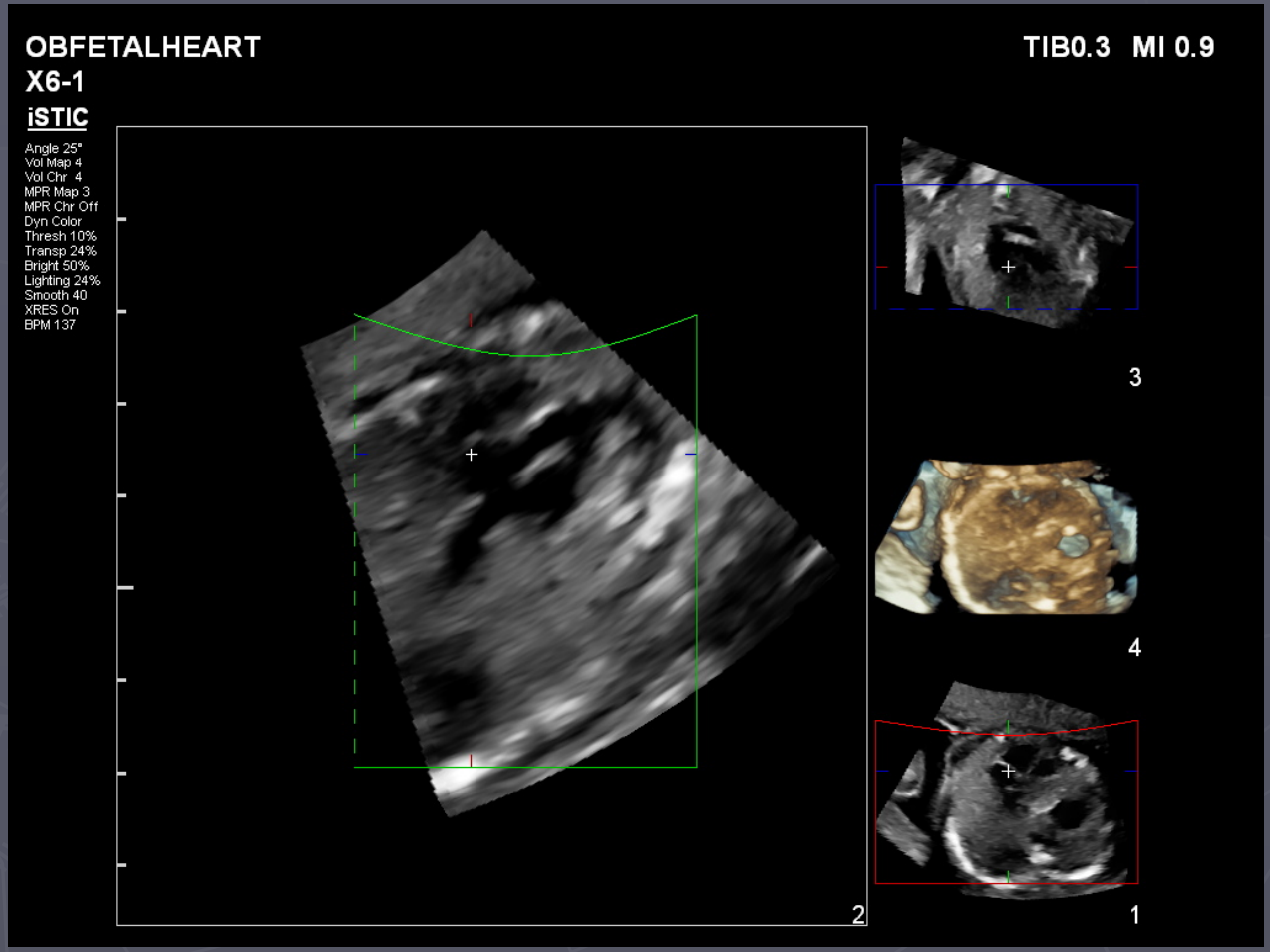
II TR: 4D STIC;A.= D.LUK



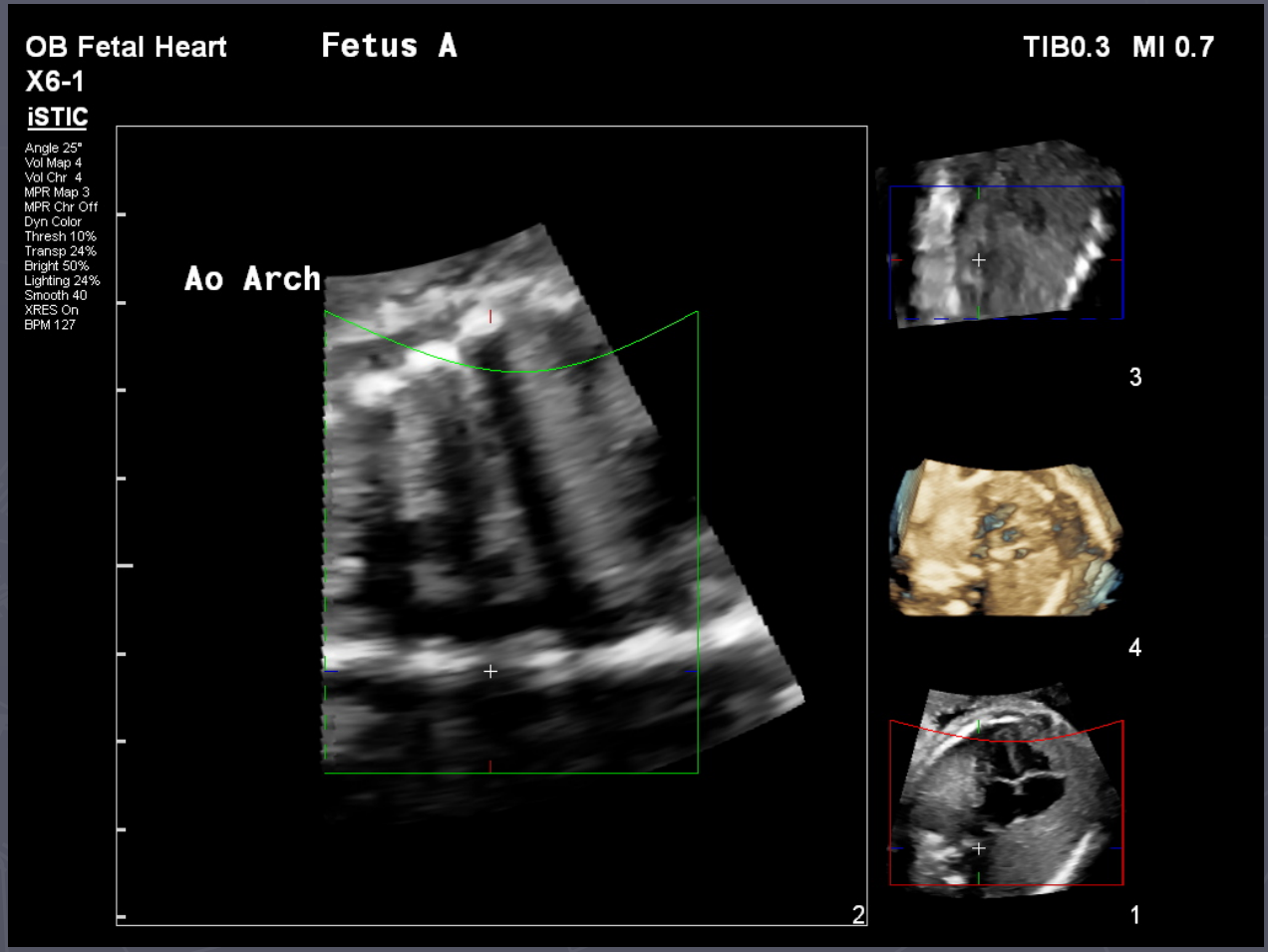
4D STIC : 5-7 h.


OBFETALHEART
X6-1
iSTIC
Angle 25°
Vol Map 4
Vol Chr 4
MPR Map 3
MPR Chr Off
Dyn Color
Thresh 10%
Transp 24%
Bright 50%
Lighting 24%
Smooth 40
XRES On
BPM 147
TIB0.3 MI 0.9
1
2
3
4

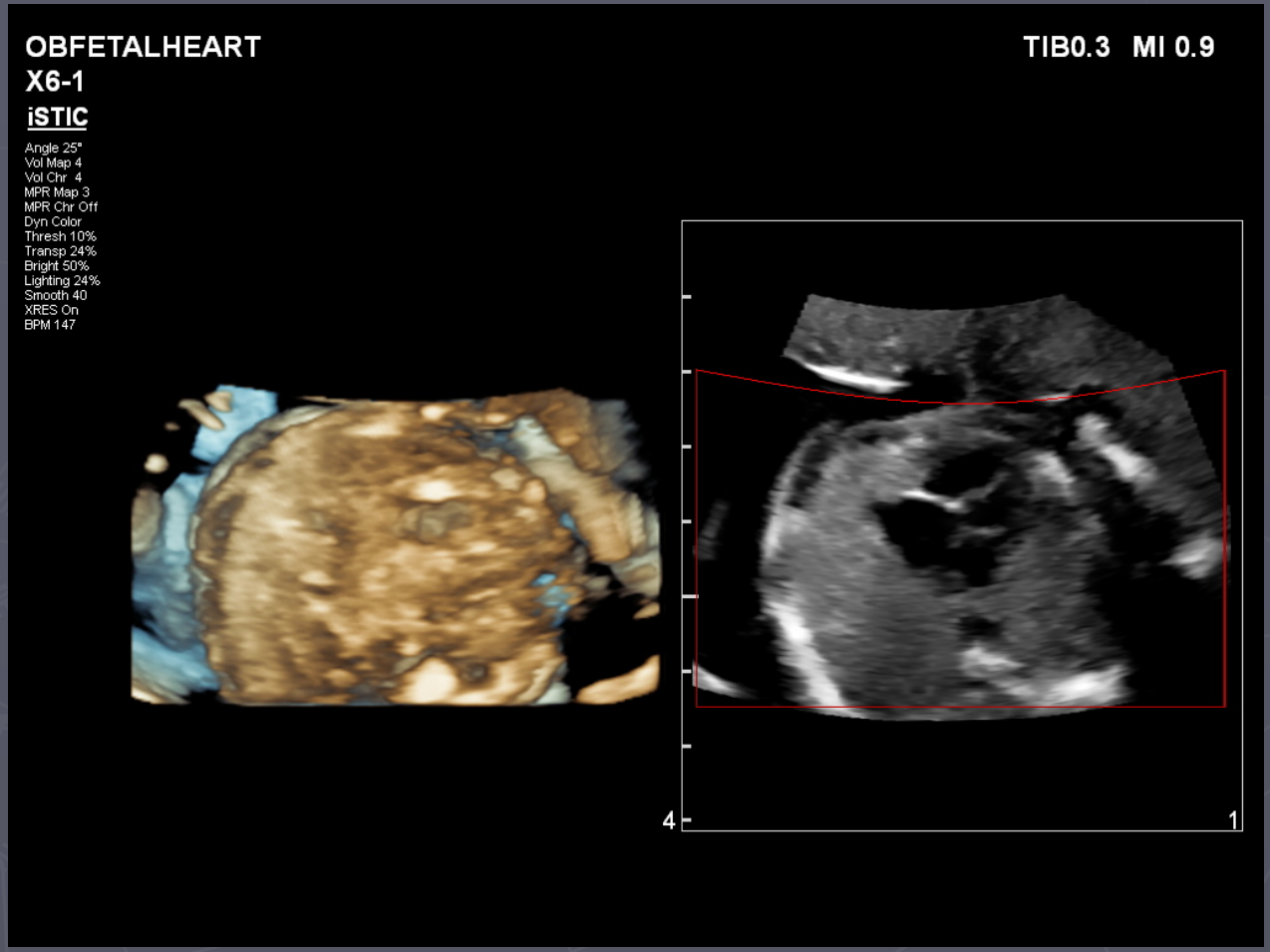
4D STIC : A. Luk


OBFETALHEART
X6-1
iSTIC
Angle 25°
Vol Map 4
Vol Chr 4
MPR Map 3
MPR Chr Off
Dyn Color
Thresh 10%
Transp 24%
Bright 50%
Lighting 24%
Smooth 40
XRES On
BPM 137
TIB0.3 MI 0.9
2
3
4
1

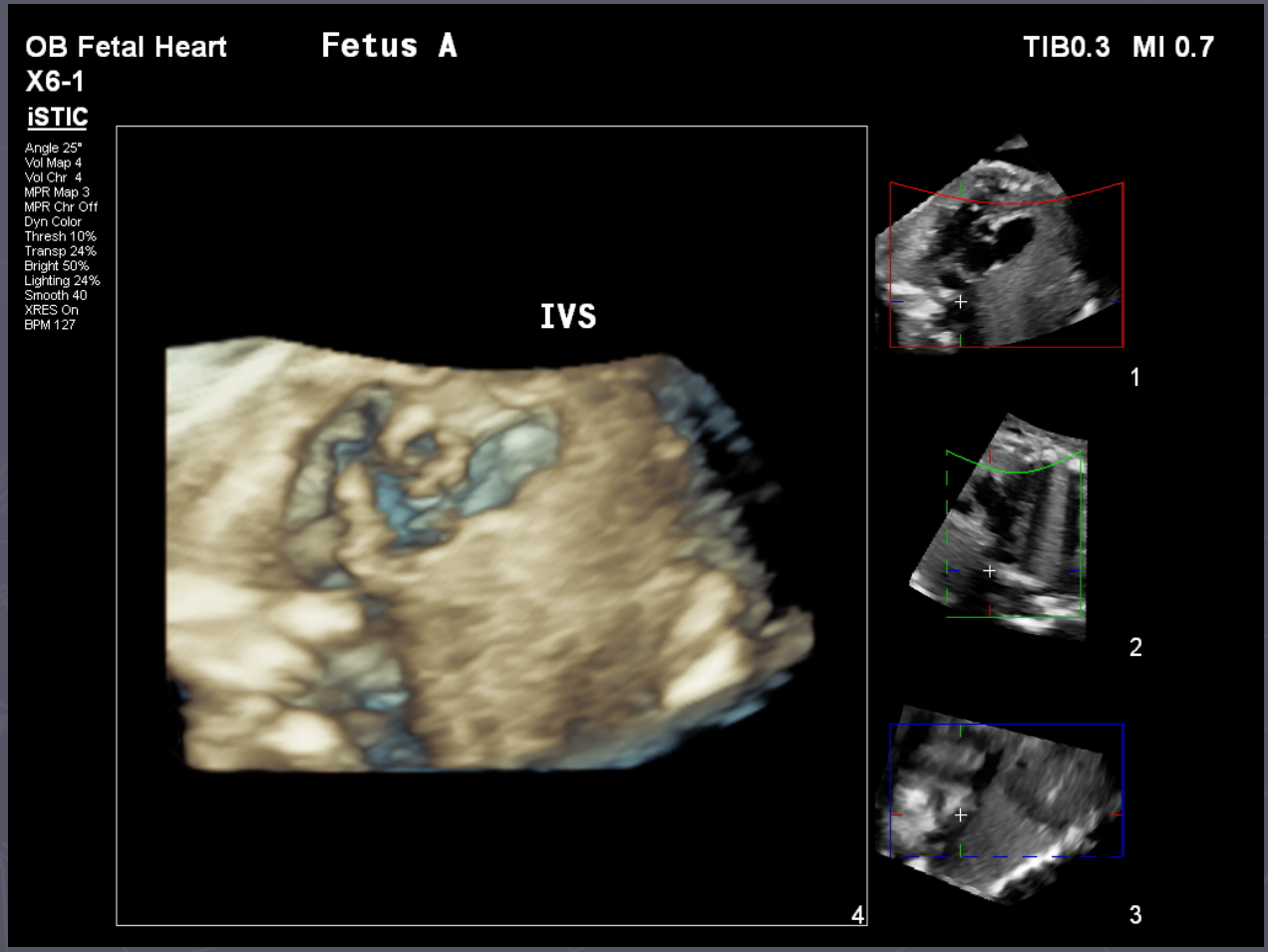
4D STIC: A. LUK


OB Fetal Heart
X6-1
iSTIC
Fetus A
TIB0.3 MI 0.7
Angle 25°
Vol Map 4
Vol Chr 4
MPR Map 3
MPR Chr Off
Dyn Color
Thresh 10%
Transp 24%
Bright 50%
Lighting 24%
Smooth 40
XRES On
BPM 127
Ao Arch
2
3
4
1

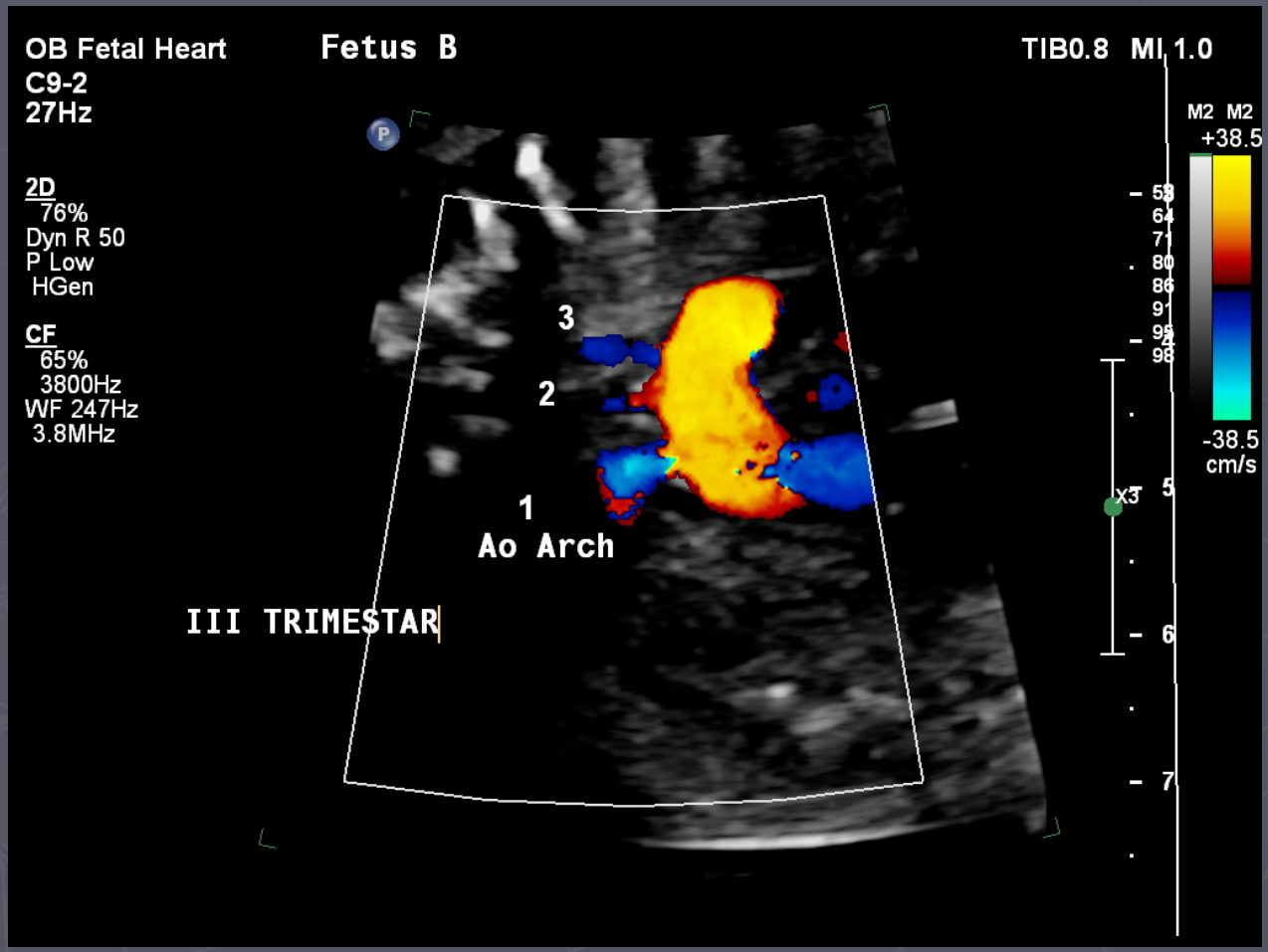
4D STIC: ATRIJALNI SEPTUM



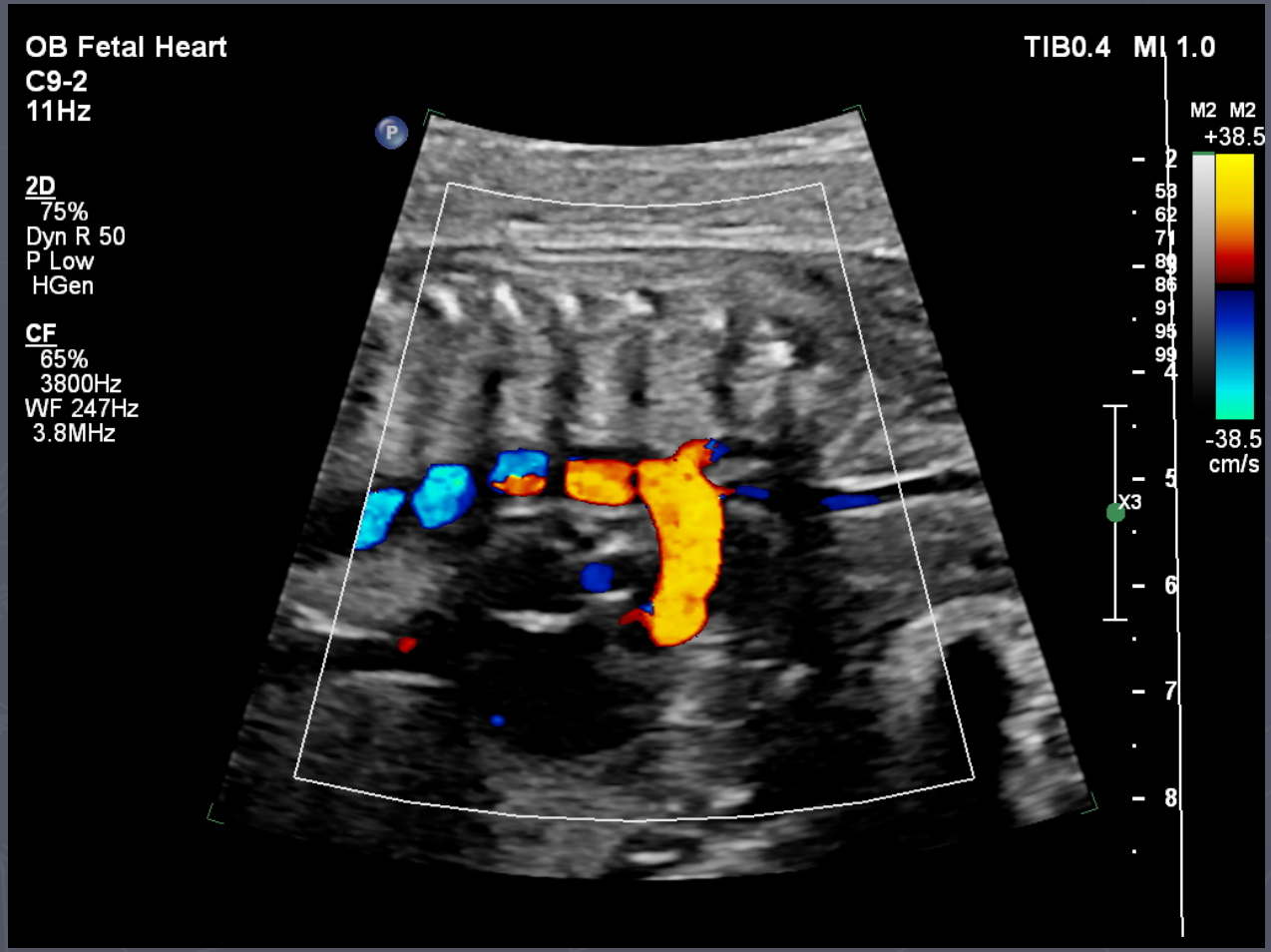
4D STIC: IVS


OB Fetal Heart
Fetus A
TIB0.3 MI 0.7
X6-1
iSTIC
Angle 25°
Vol Map 4
Vol Chr 4
MPR Map 3
MPR Chr Off
Dyn Color
Thresh 10%
Transp 24%
Bright 50%
Lighting 24%
Smooth 40
XRES On
BPM 127
IVS
1
2
3
4

III TRIMESTAR



III TRIMESTAR



ZAKLJUČAK

- Srce ploda je završilo razvoj u **12ng**.
- Plod sa srčanom manom može imati i hromozomsku anomaliju.
- Srčana mana je **6 puta** češća od hromozomske greške.
- **Trudnici mora biti objašnjena potreba i/ili obaveza pregleda srca ploda u I Tr**.

Zaključak: 10g. Postnatalne + 24g. Prenatalne dijagnostike USM

- U I i/ili II trimestru trudnoće, poslednja tehnologija (C 9-2MHz), omogućava pregled srca ploda u **97%**.
- **Najčešće srčane mane se po pravilu mogu otkriti u I trimestru.**
- Nakon pregleda srca 16-22 ng pregled srca u **III trimestru ne mora biti kompletan.**

Nedostaci pregleda srca u I TR:

- Skrining fetalanog srca može propustiti :

- VSD
- Totalnu anomalnu plućnu vensku konekciju
- Aortnu i plućnu stenozu
- **Koarktacija Aorte** može biti proglašena kao HLHS i dovesti do **nepotrebnog prekida trudnoće.**

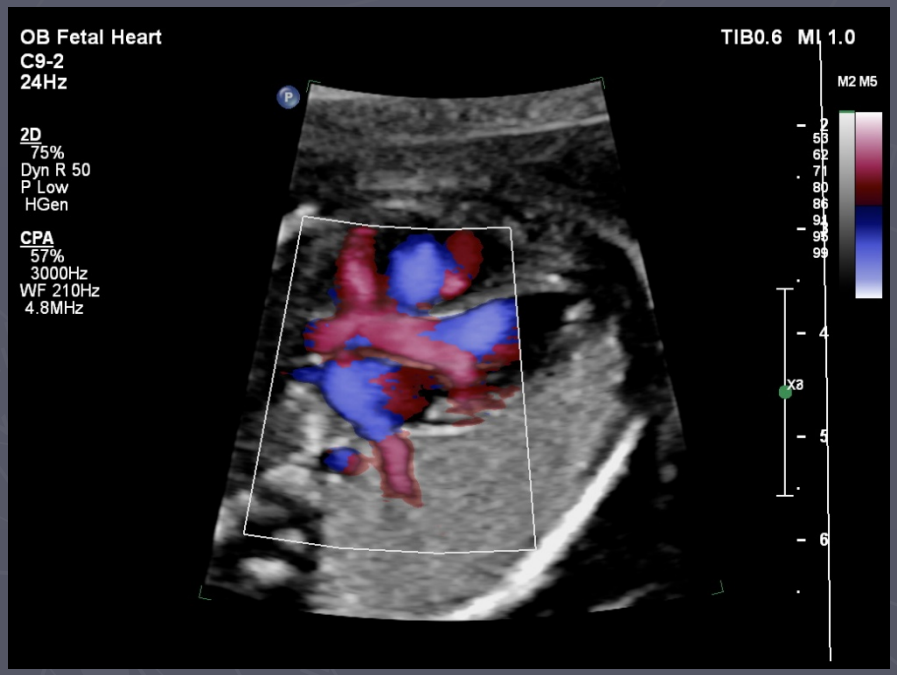
Šta su indikacije za pregled srca ploda ?

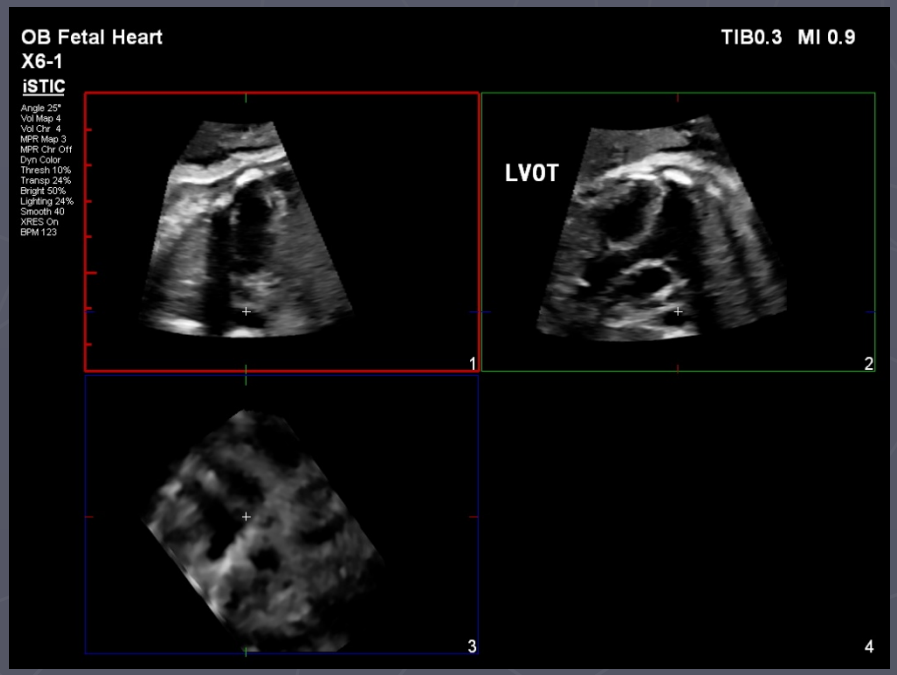
- GLAVNA INDIKACIJA za pregled srca ploda je činjenica da su **USM NAJČEŠĆE ANATOMSKE GREŠKE u trudnoći.**
- PREGLED SRCA PLODA JE MOGUĆ U **97%** u I i/ili ranom II trimestru.
- **ZLATNI STANDARD je 2D pregled srca ploda.**
- 4D STIC je nesenzitivna metoda i pri akviziciji od 3 sec. (EPIQ 7G).

2D i/ili 4D “STIC”

- Zlatan standard EF je 2D u I i ranom II trimestru.
- **4D ”STIC” je ograničen pozicijom kičme ploda i moguć je u oko 27%** (lično iskustvo).
- VREME AKVIZICIJE sondama sa motorom je **12sec.** a sa elektronskom sondom X-Matriks (Philips Epiq 7G) je **3sec.**
-

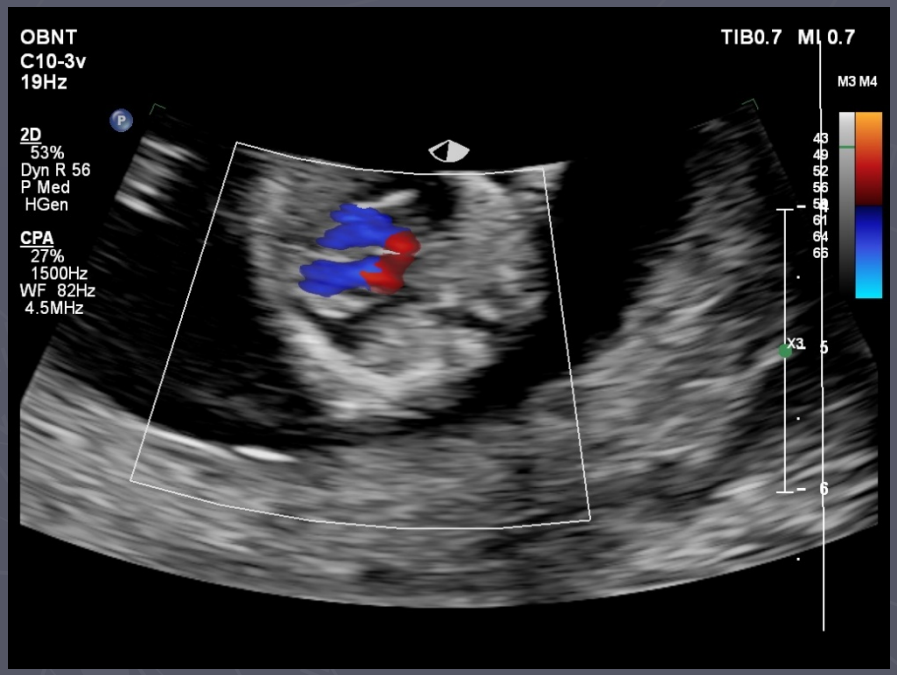
2D i/ili 4D –STIC, 5D ?

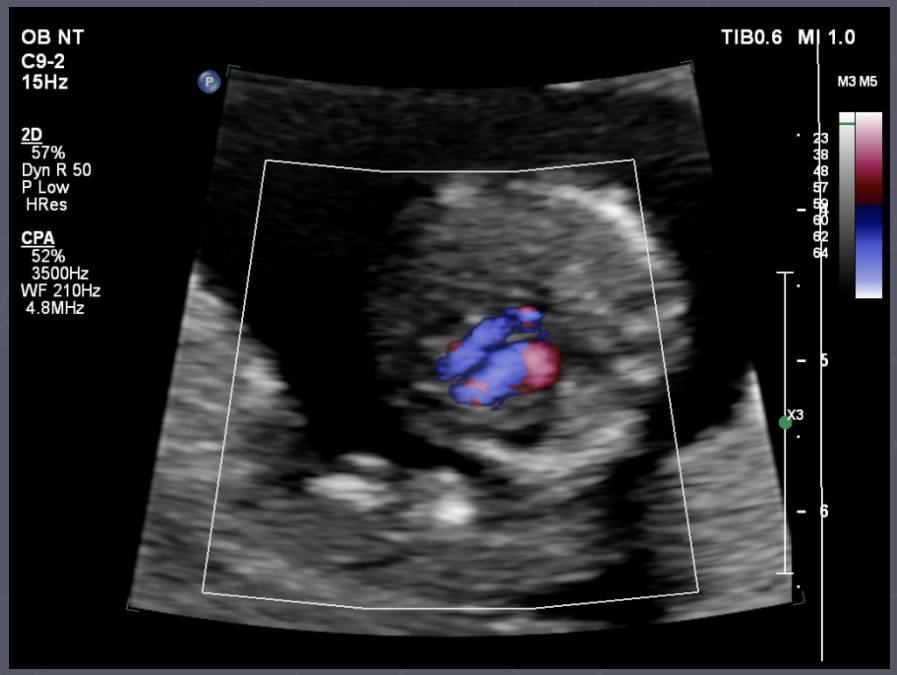




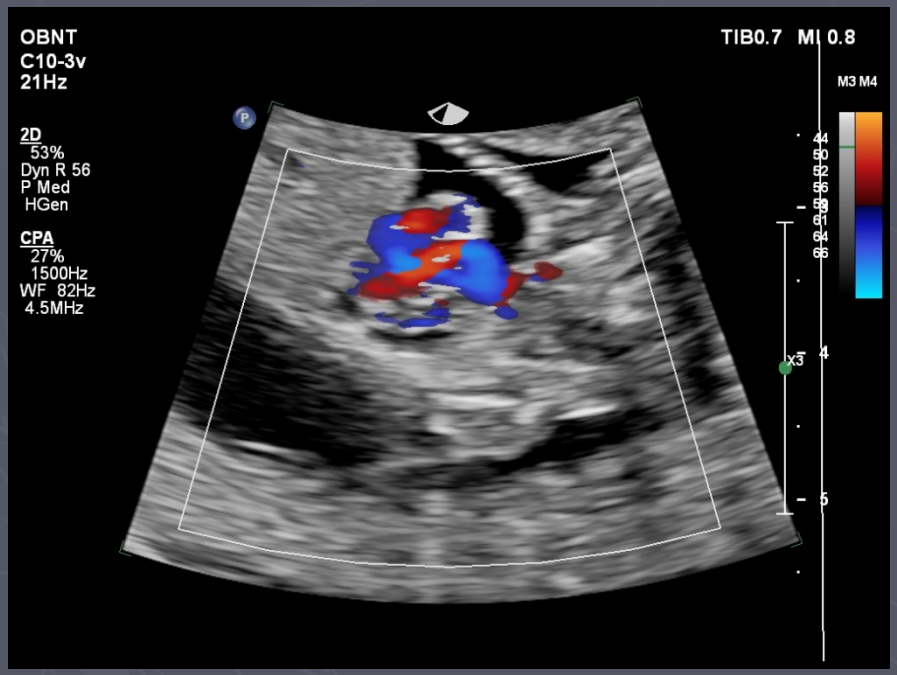
12 ng i 4 dana: USM?

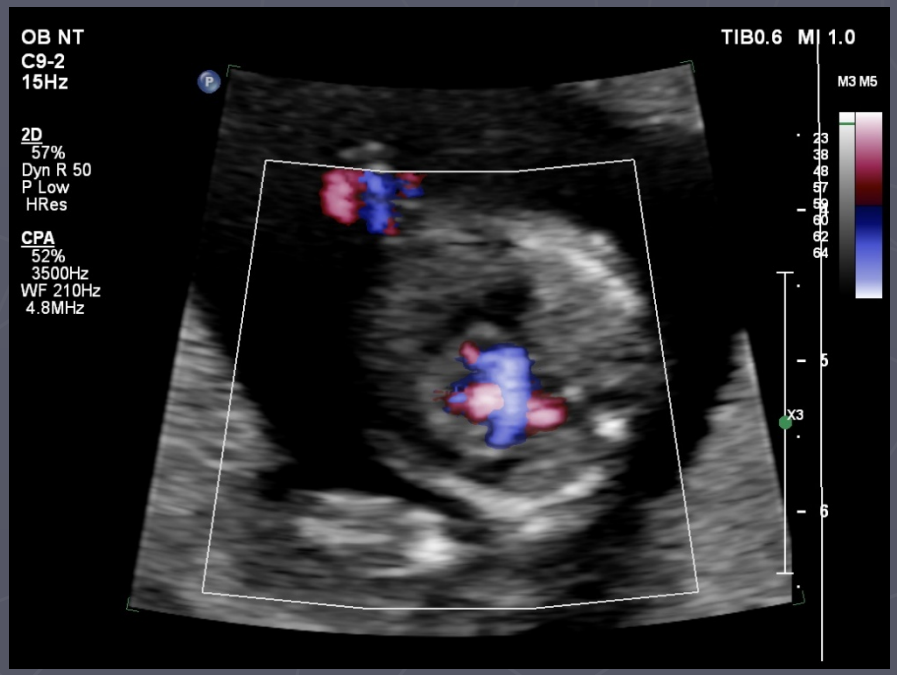
4CV: CD i CPA


OBNT
C10-3v
19Hz
2D
53%
Dyn R 56
P Med
HGen
CPA
27%
1500Hz
WF 82Hz
4.5MHz
TIB0.7 MI 0.7
M3 M4

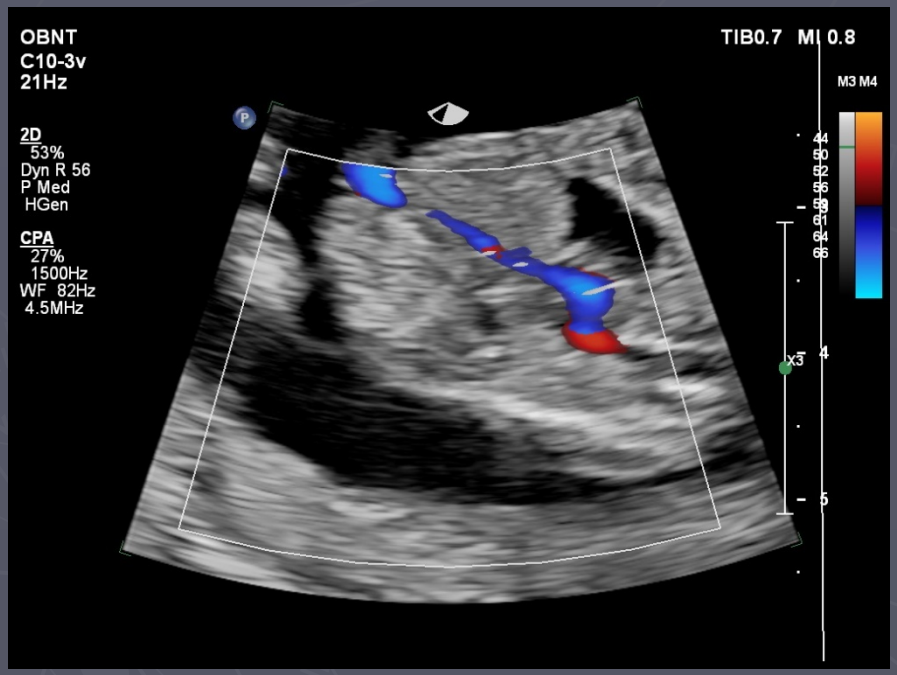

OB NT
C9-2
15Hz
2D
57%
Dyn R 50
P Low
HRes
CPA
52%
3500Hz
WF 210Hz
4.8MHz
TIB0.6 MI 1.0
M3 M5

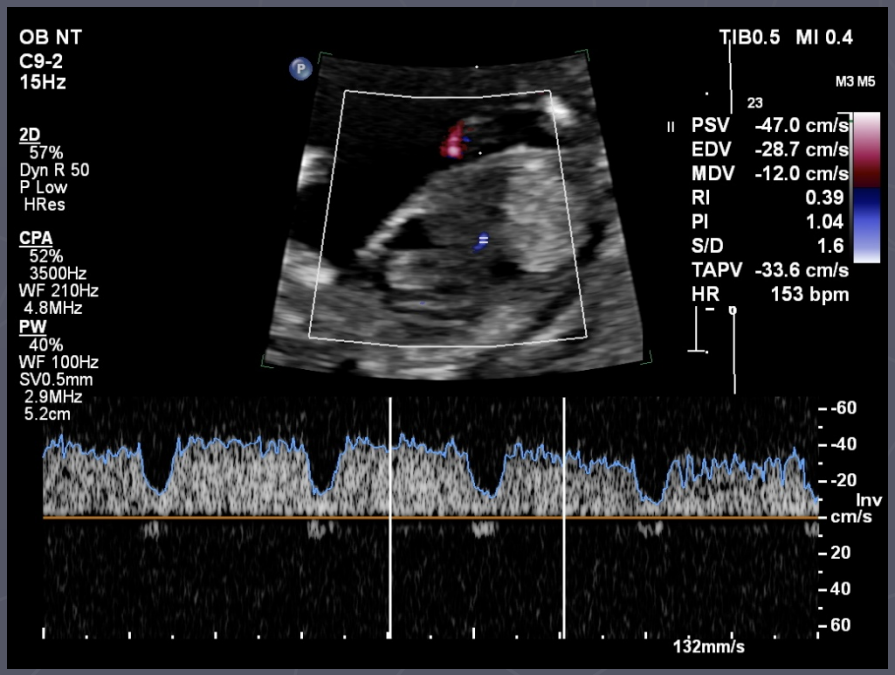
LVOT i “B” ,“X” i “V”, RVOT?



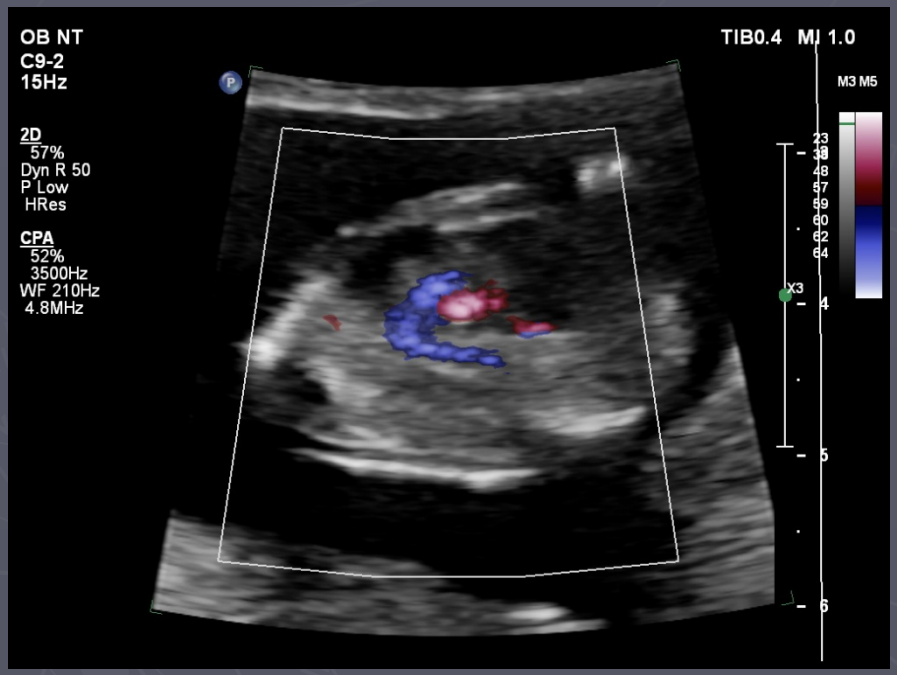


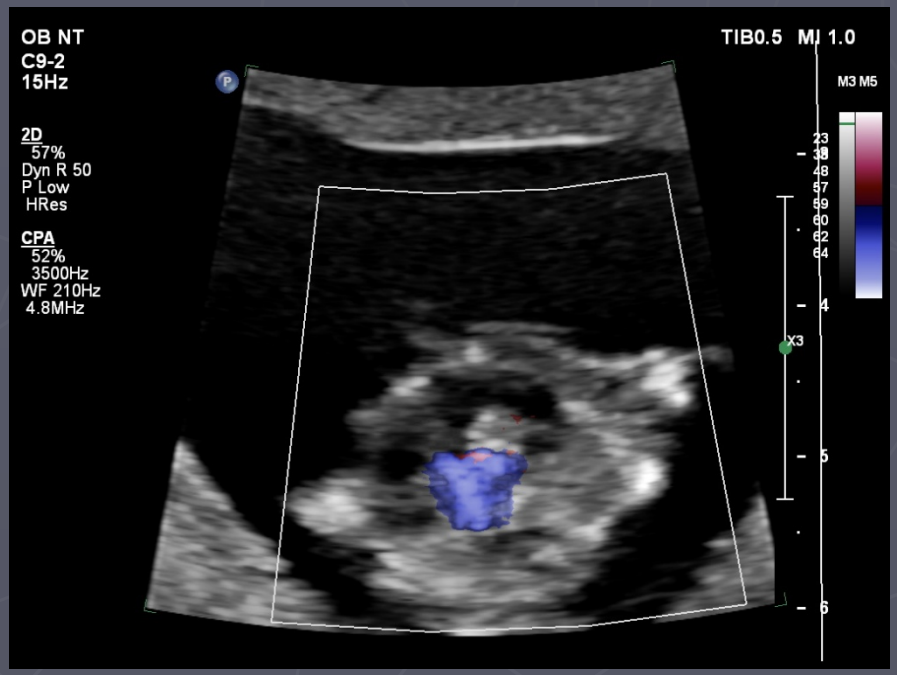
Venska drenaža “DP” i DV



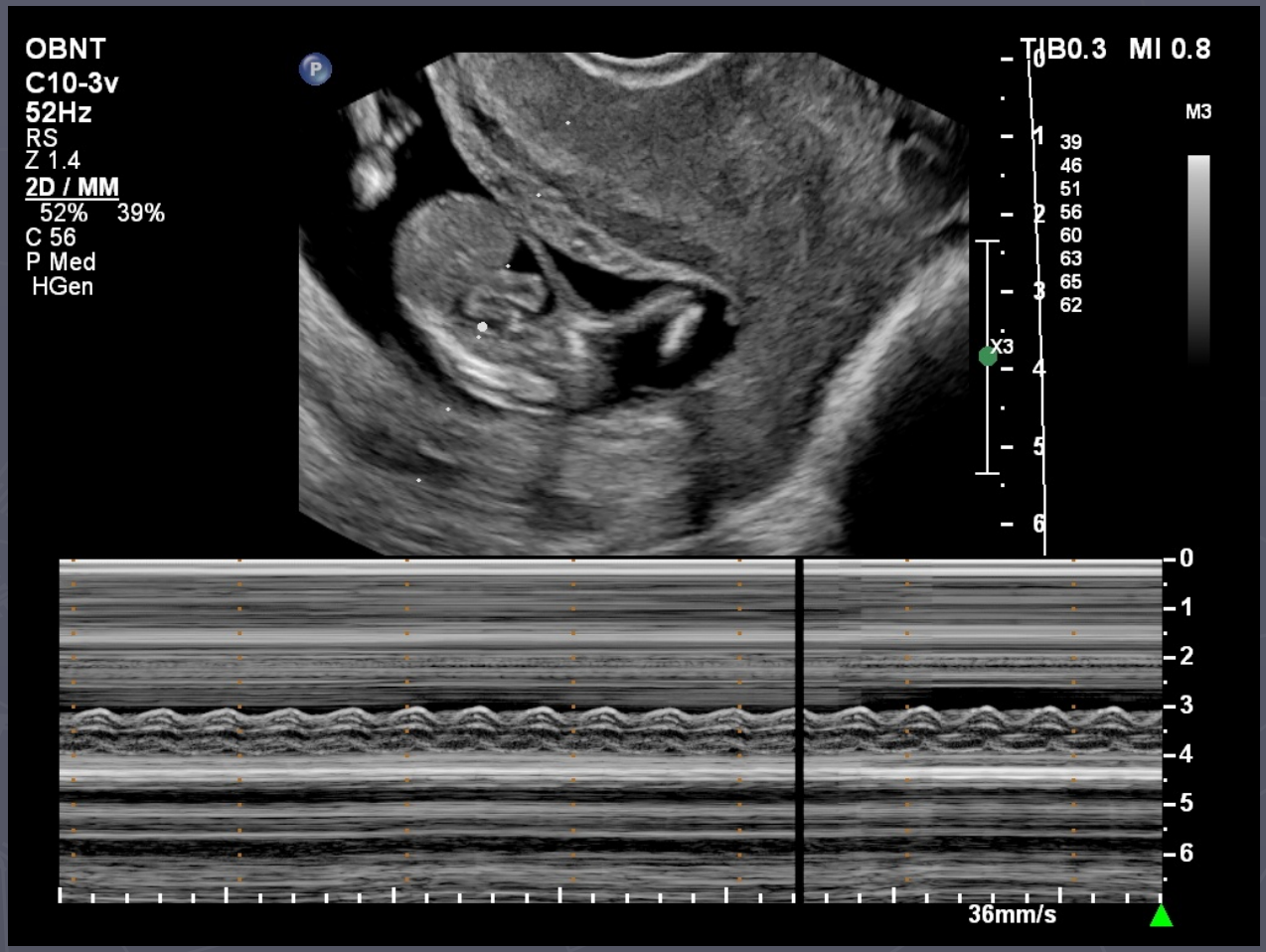


Duktalni luk, RVOT?

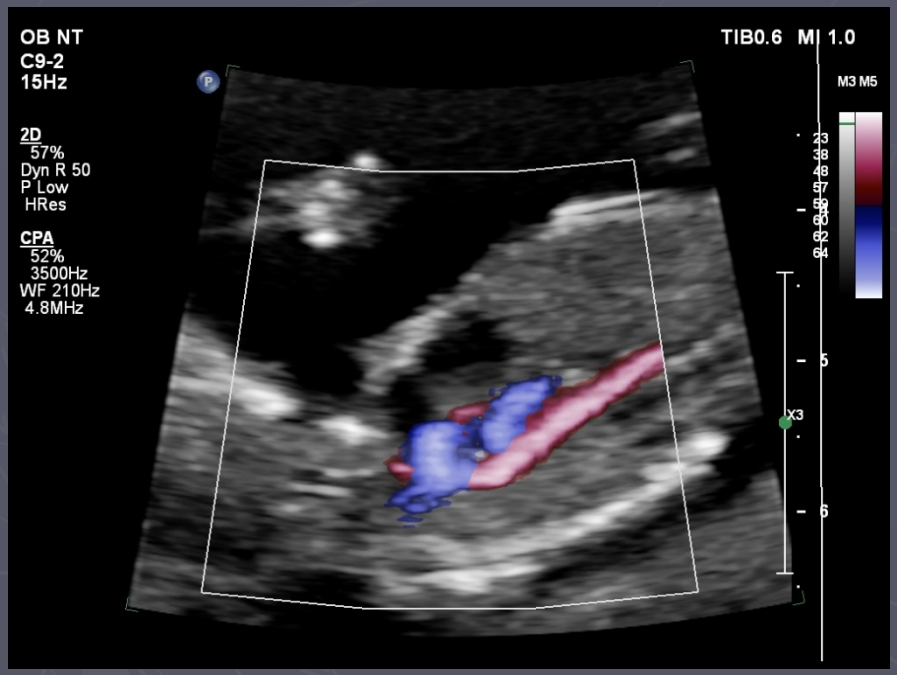


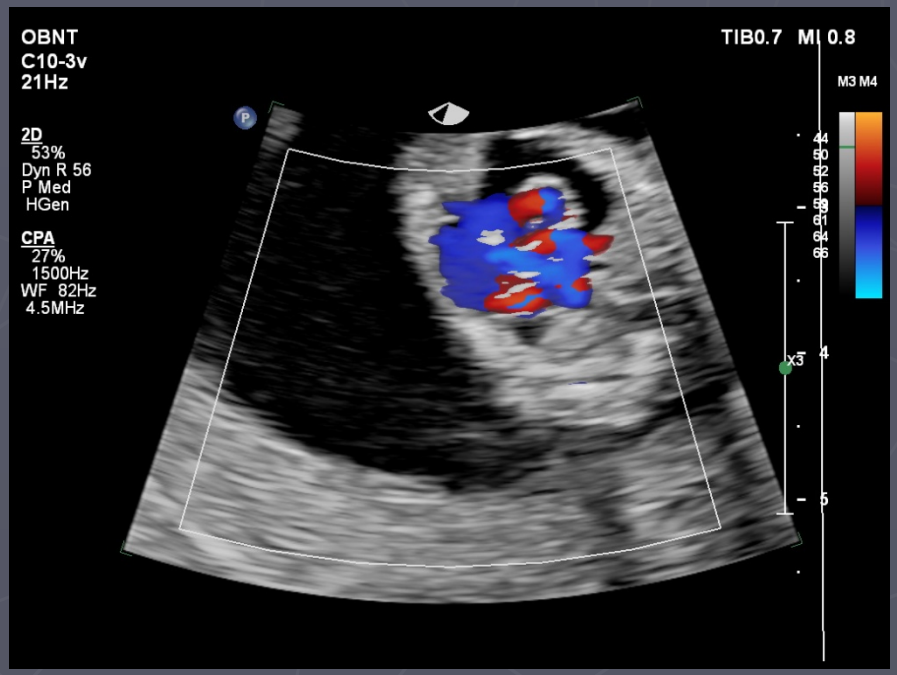


M-mod: perikardni izliv?!



Hidrotoraks, LP ?: Bilateralna agenezija pluća





ULTRAMEDIKA: Senzitivnost

Prošireni ultrazvučni pregled u I i u **II** Tr trudnoće sa i “Dabl i Tripl” testom je otkrio **99,87%** plodova sa HA za 15 god.

NIPT : **99,2%** za Trizomiju 21.

- Prošireni UZ skrining podrazumeva: **EF, NT, “Vomer”, Nosne kosti, ranu procenu Spine bifide, cevastih organa i urinarnog sistema kao i “Soft” i Doppler markere.**
- ***Nisu registrovane 2 minor USM*** .