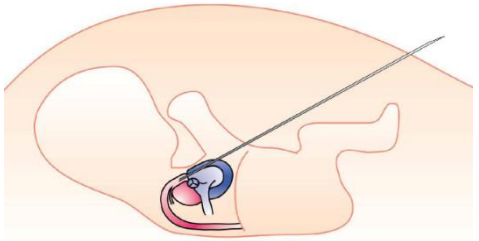
Fetal cardiac interventions



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Why Are Fetal Cardiac Interventions Performed?

- Anomalies that lead to stillbirth (PA, intact septum)
- Anomalies that lead to secondary diseases (AS, PS)
- To prevent ongoing postnatal operations

fetal cardiac interventions have been performed in:

- Aortic stenosis
- Hypoplastic left heart syndrome
- Pulmonary atresia intact septum
- Pulmonary stenosis

Outcome Data: UK & Eire study

Daubeney et al, Circulation, 1998

1 year survival 70.8%
5 year survival 63.8%

9 year follow up:

75/183 died – 15 untreated (36%), none > 55 months

49% BV circulation

6% 1.5 ventricle circulation

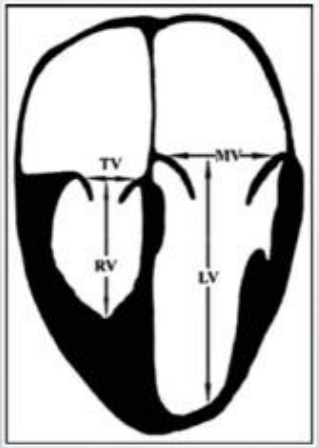
18% UV circulation & 28% remain mixed

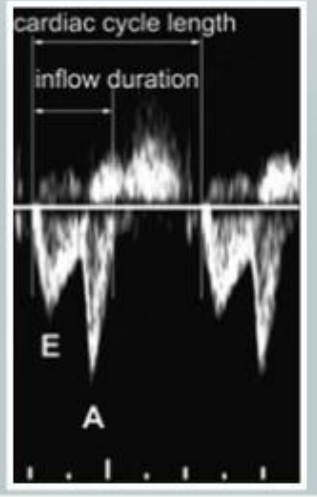
Intrauterine pulmonary valvuloplasty

Determinants of Outcome in Fetal Pulmonary Valve Stenosis or Atresia with Intact Ventricular Septum

Kevin, Fouron, Masaki, Smallhorn, Chaturvedi, Jaeggi - Toronto / Montreal

Am J Cardiol 2007;99:699-703





Prediction of a non - biventricular outcome:

- TV / MV ratio < 0.7
- RV / LV length ratio < 0.6
- TV infow duration < 31.5%
- Presence of sinusoids

If 3/4 were present:

Sensitivity: 100%

Specificity: 75%

Hemodynamic course

	PV vmax	*PV diam*	*TV TR*	*RV infl*	*TV diam*	*UV puls*	*DV rev*
2w	3.2 m/s	4mm	no	biph	7mm	yes	yes
6w	4.3 m/s		4m/s	biph		no	yes
12w		7mm		biph	11.3 mm	no	yes

1st visit

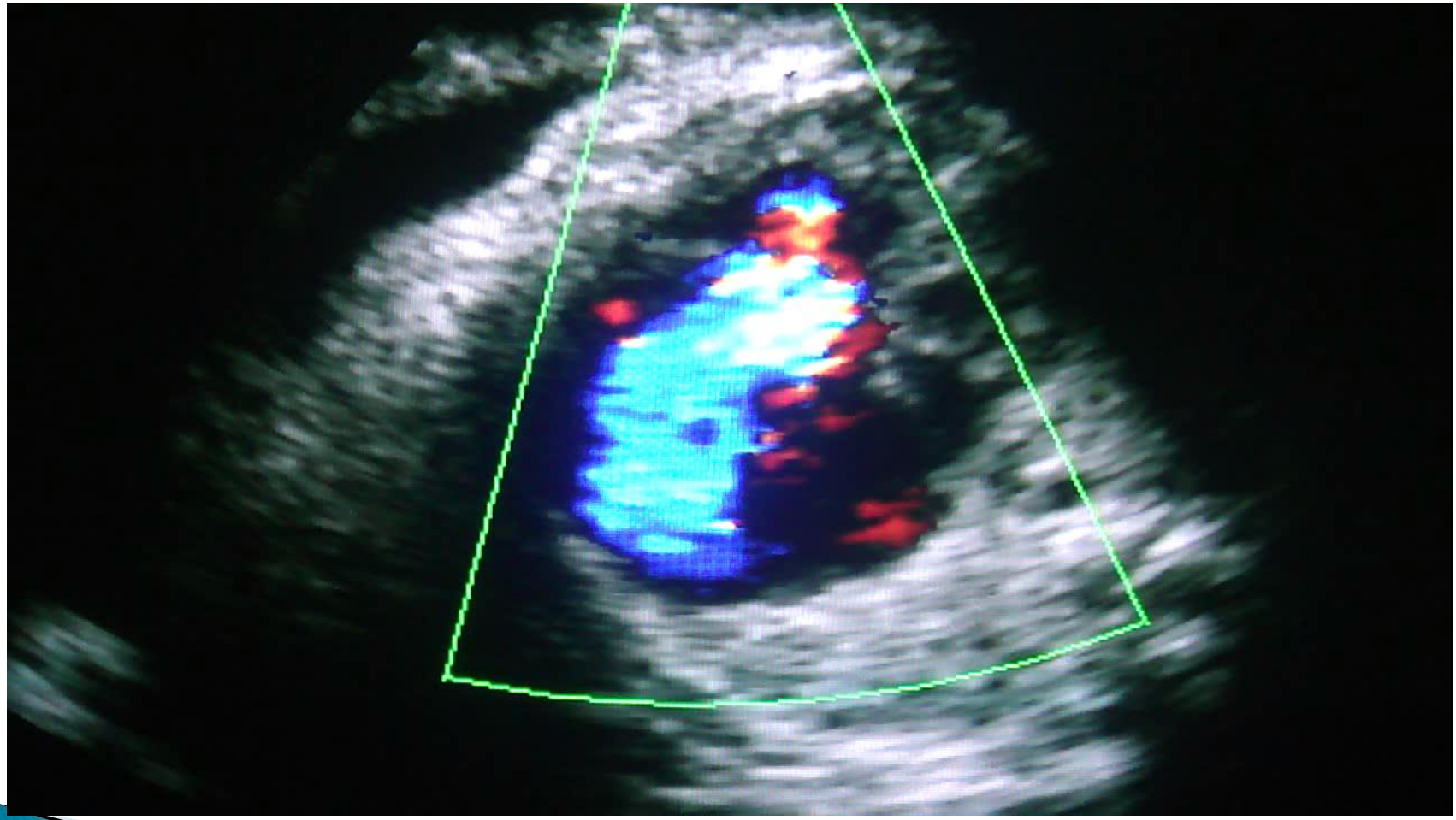
- A pregnant woman (G2P2A0L1) at gestational age 24 wk was referred for fetal cardiac evaluation due to cardiomegaly in her sonography
- The fetus had:
- Mild TR
- Dilated RA
- Hypertrophic RV
- PS=12mmHg
- Cardio/thorax=35%
- Plan : follow up

2nd visit

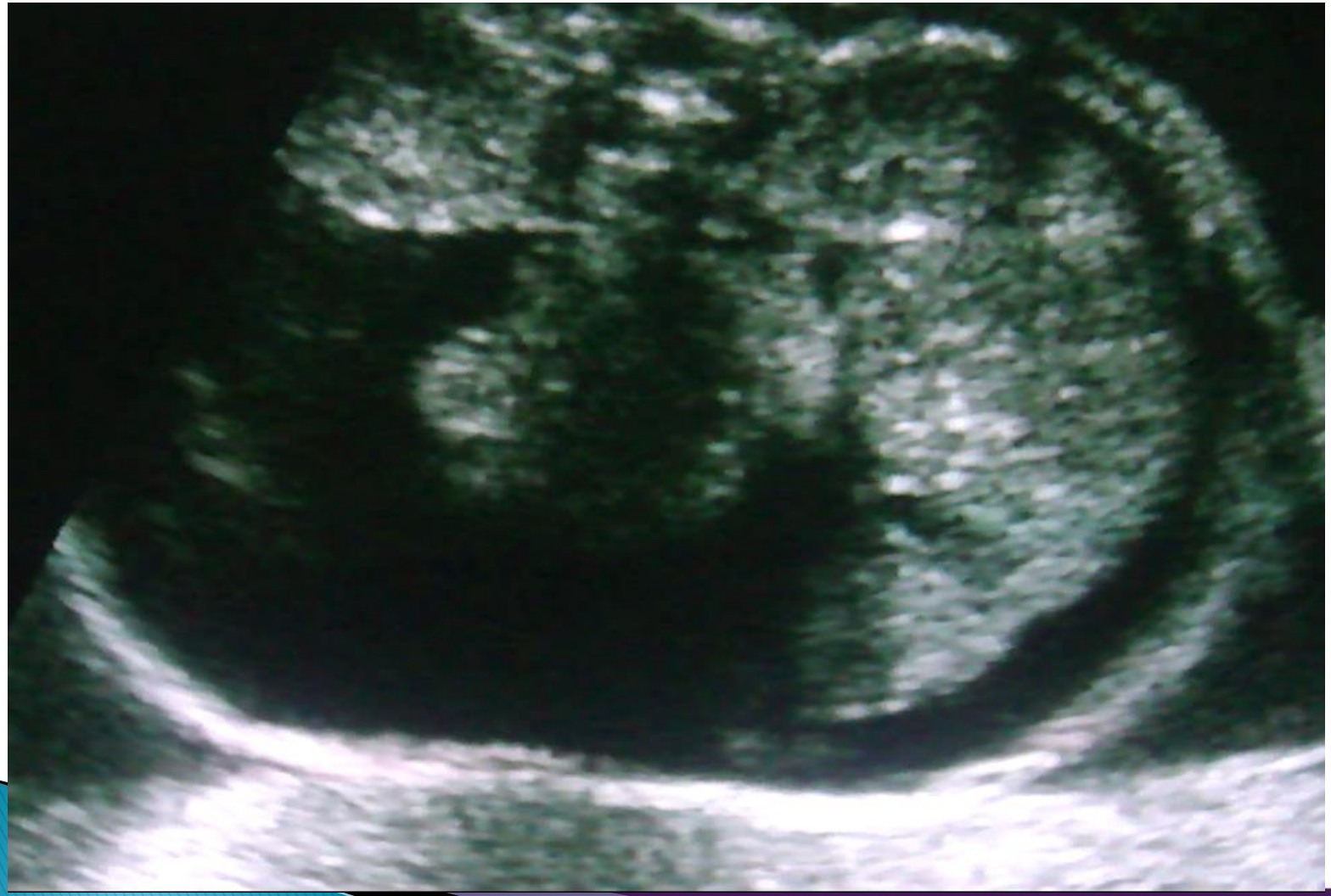
- GA: 28 wk
- SevereTR
- Dilated RA
- Hypertrophic RV
- PS=35 mmHg
- Cardio/thorax=45%
- Mild pericardial effusion
- Peritoneal effusion

4 chamber

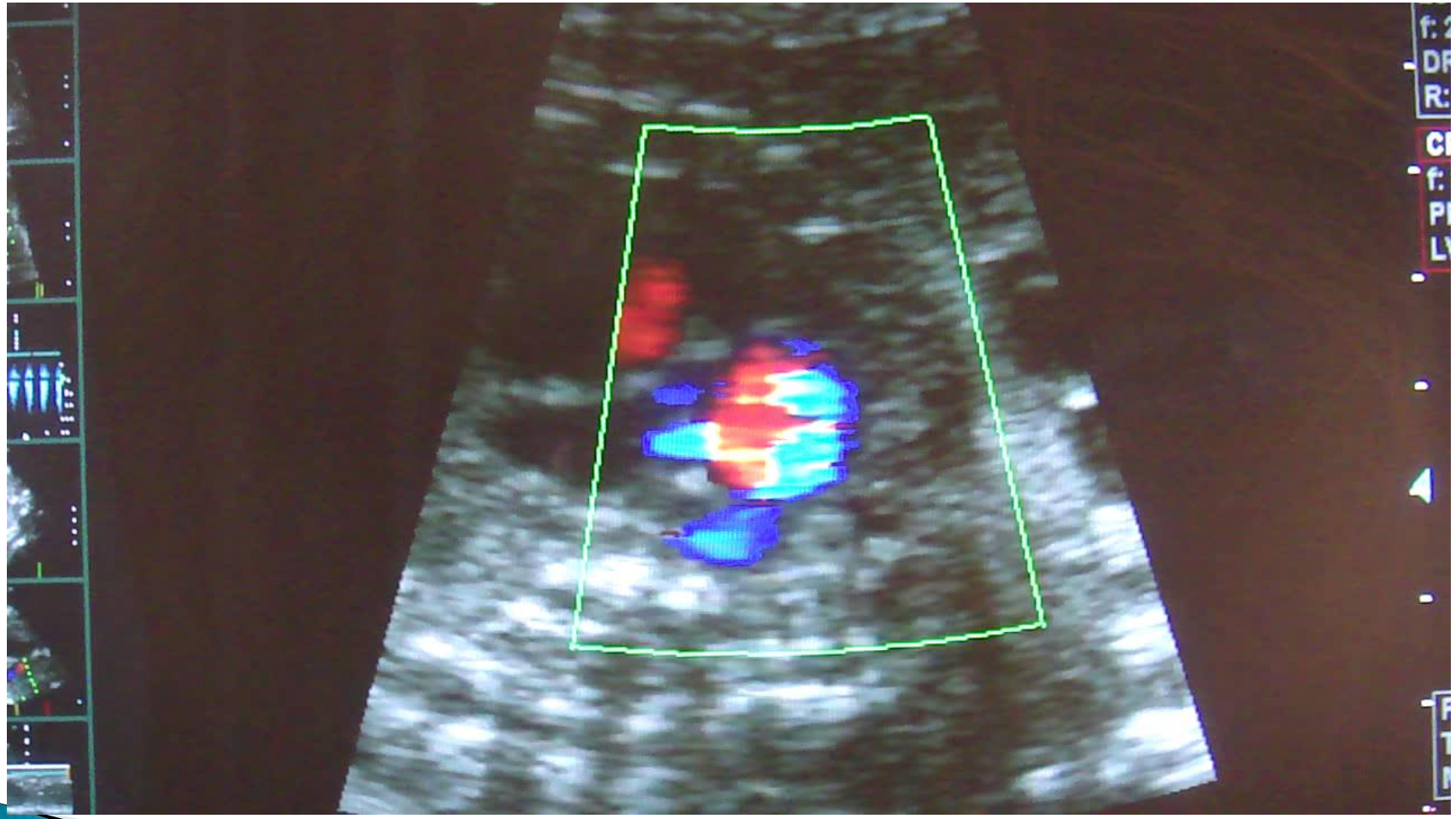
4 chamber



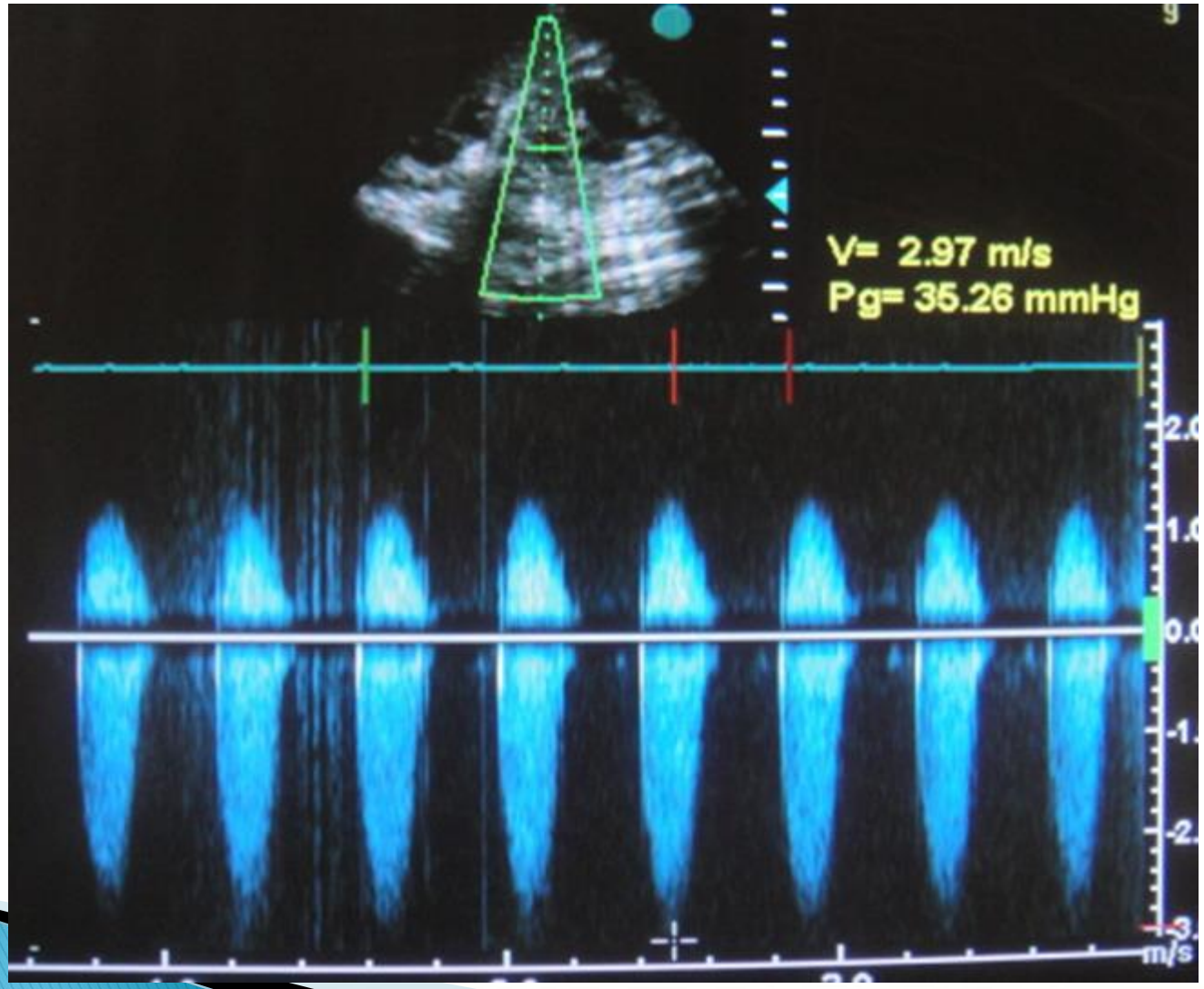
hydropse



Pulmonary stenosis

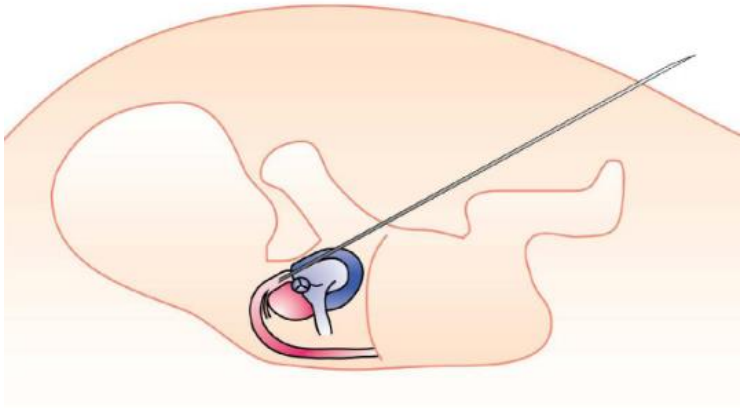


Pulmonary stenosis



Intervention

- For fetus **percutaneous** balloon dilation of pulmonary valve was performed in **Mother and child hospital of Ghadir, Shiraz, Iran**

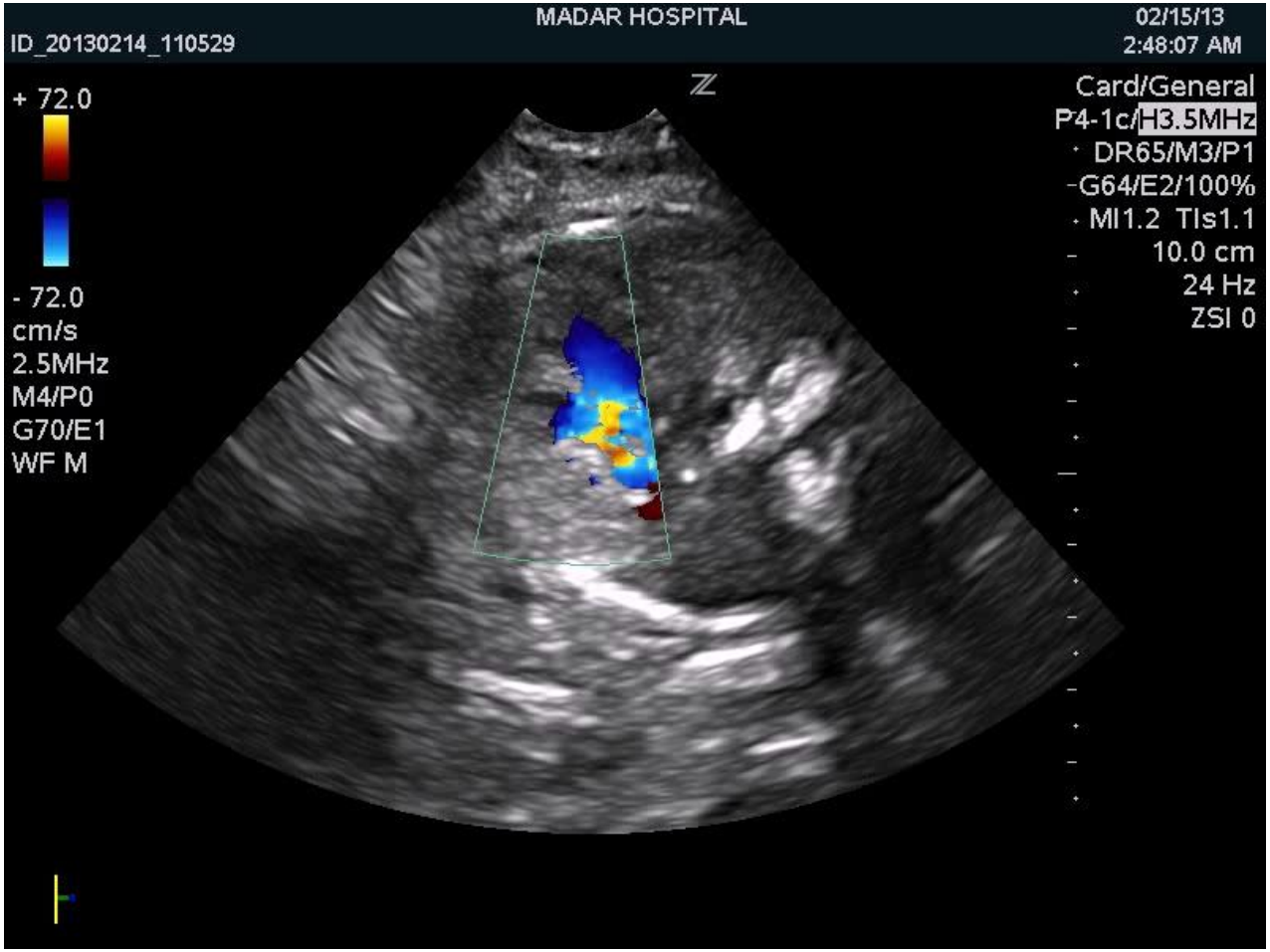


The film will be present after slides

Next day

- PS=18
- Mild PI
- Moderate TR
- No pericardial effusion
- Cardio/thorax=45%


MADAR HOSPITAL
ID_20130214_110529
02/15/13
2:35:01 AM
Card/General
P4-1c/H3.5MHz
DR65/M3/P1
G62/E2/100%
MI1.5 TIs0.4
10.0 cm
45 Hz
ZSI 0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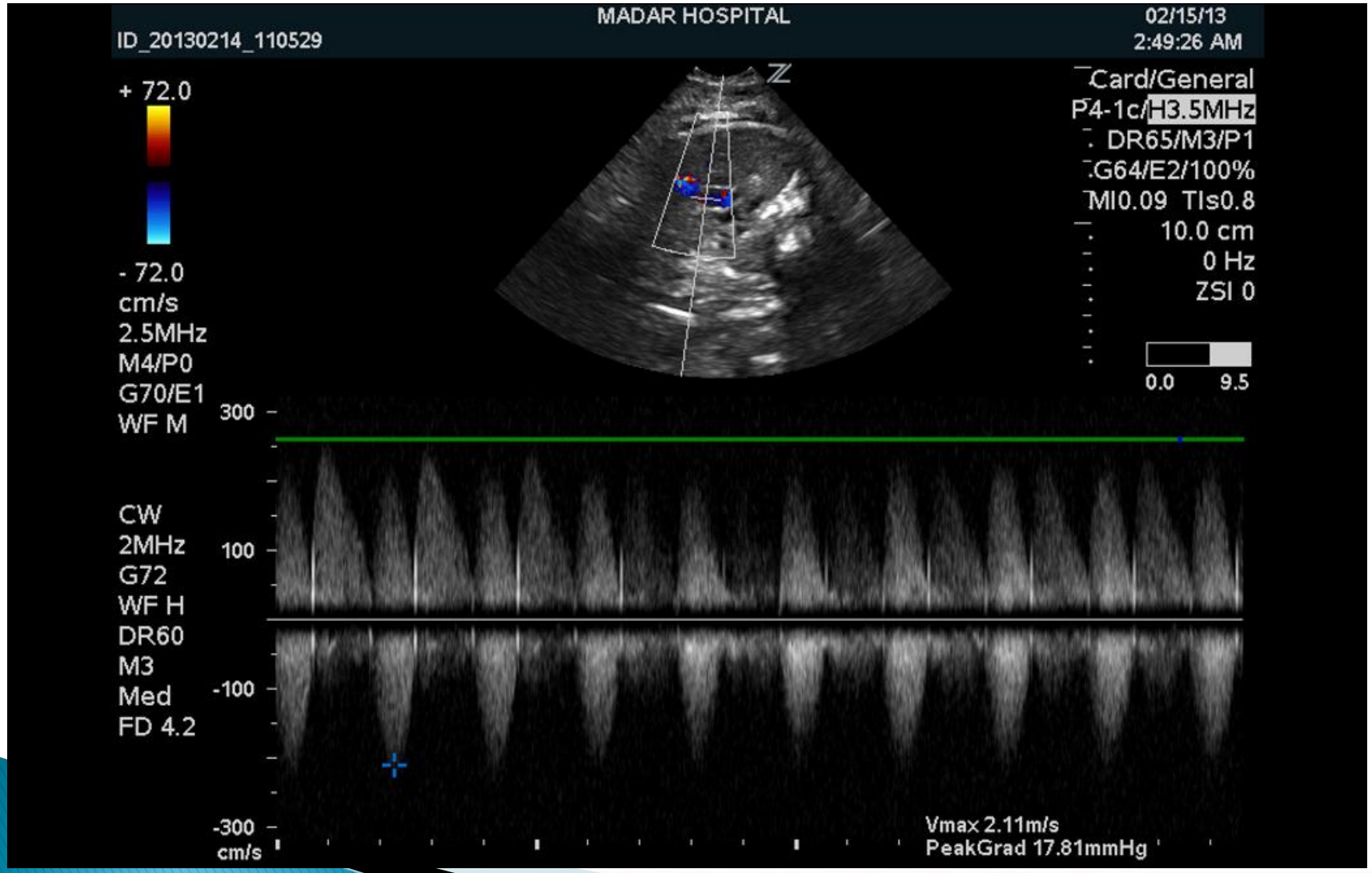
ID_20130214_110529
02/15/13
2:48:07 AM
+ 72.0
- 72.0
cm/s
2.5MHz
M4/P0
G70/E1
WF M
Card/General
P4-1c/H3.5MHz
DR65/M3/P1
G64/E2/100%
MI1.2 TIs1.1
10.0 cm
24 Hz
ZSI 0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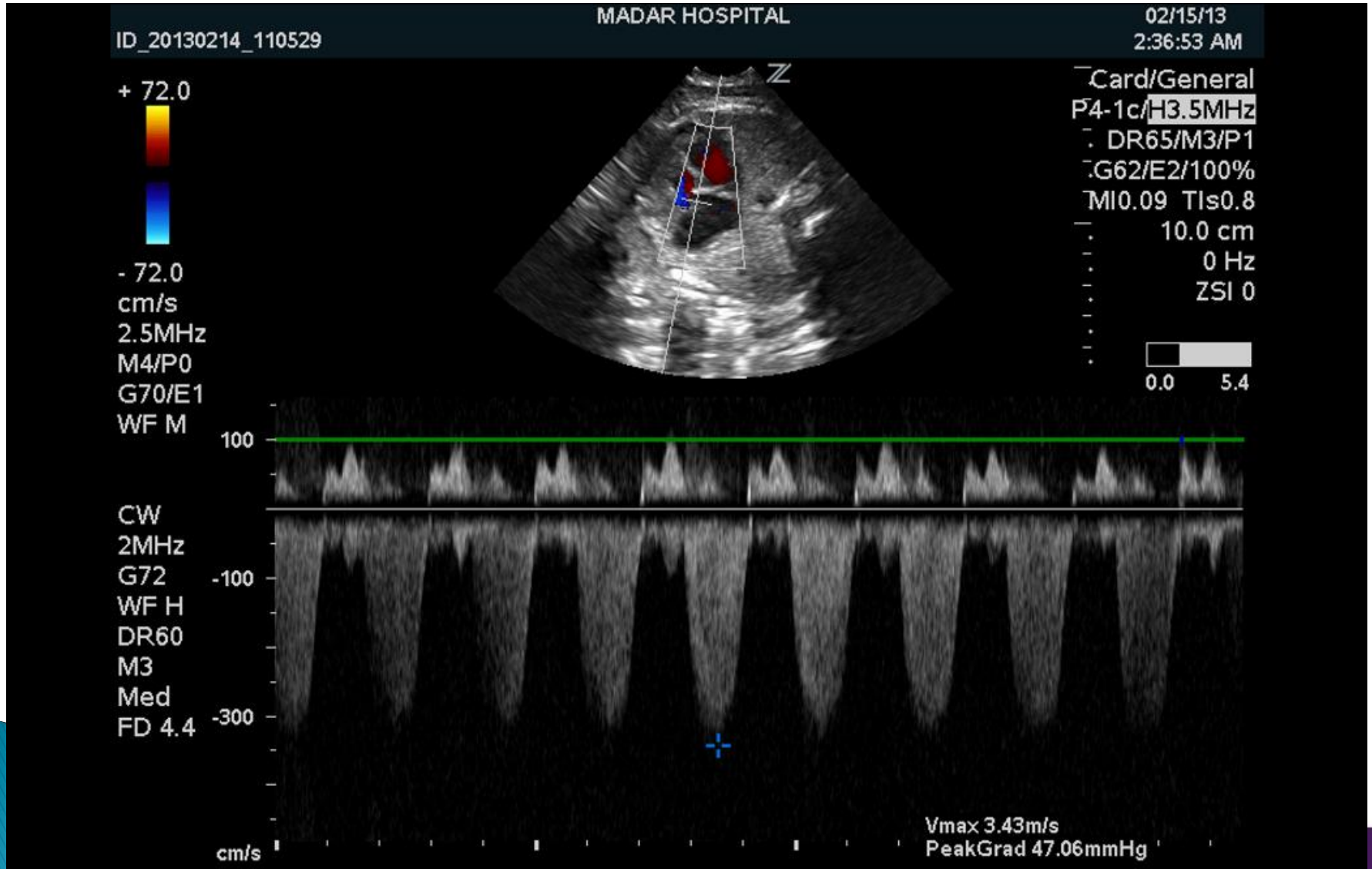
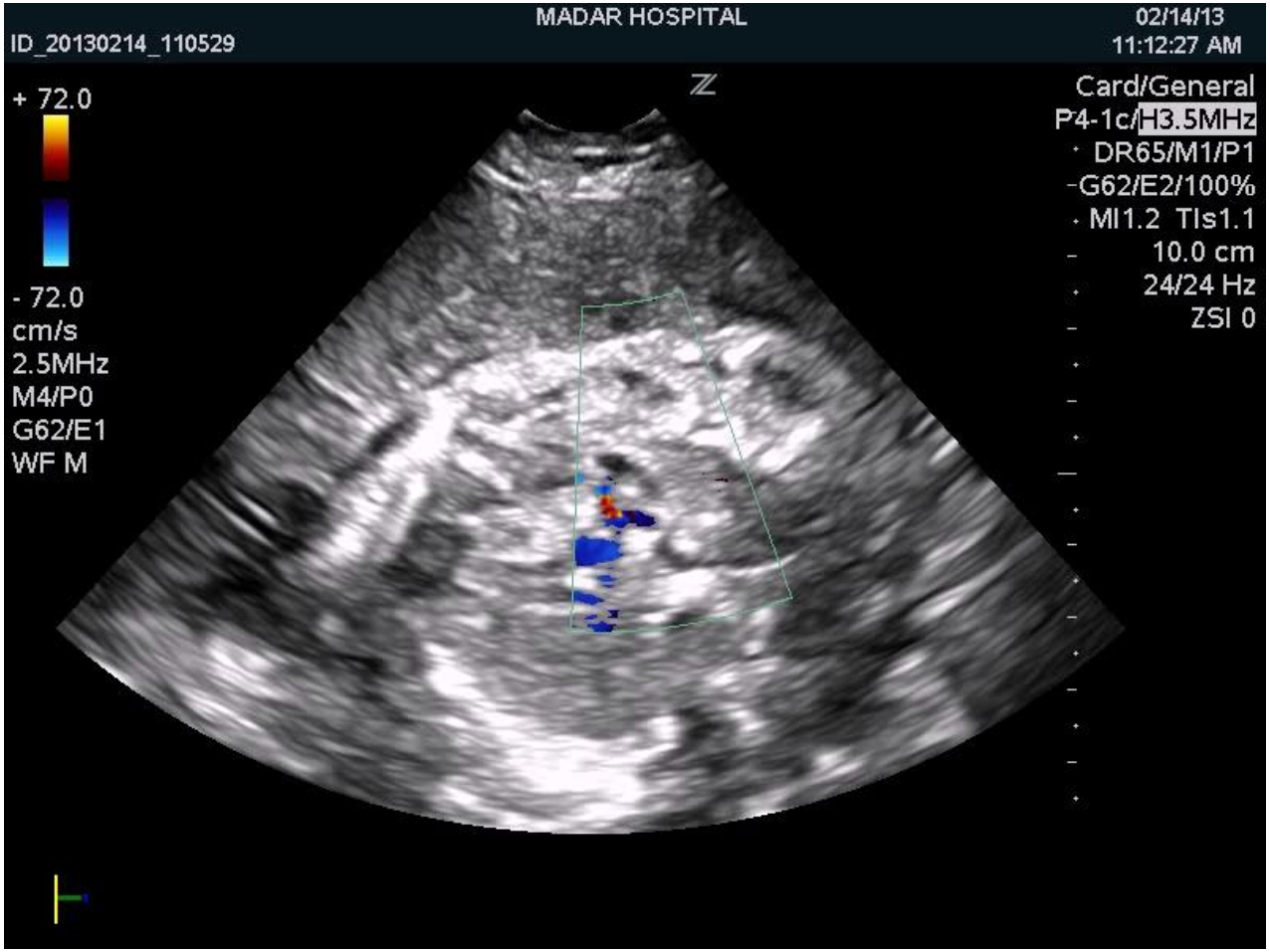
02/15/13
2:49:26 AM
+ 72.0
- 72.0
cm/s
2.5MHz
M4/P0
G70/E1
WF M
Card/General
P4-1c/H3.5MHz
DR65/M3/P1
G64/E2/100%
MI0.09 TIs0.8
10.0 cm
0 Hz
ZSI 0
0.0
9.5
300
100
-100
-300
cm/s
CW
2MHz
G72
WF H
DR60
M3
Med
FD 4.2
Vmax 2.11m/s
PeakGrad 17.81mmHg

Tricuspid regurgitation

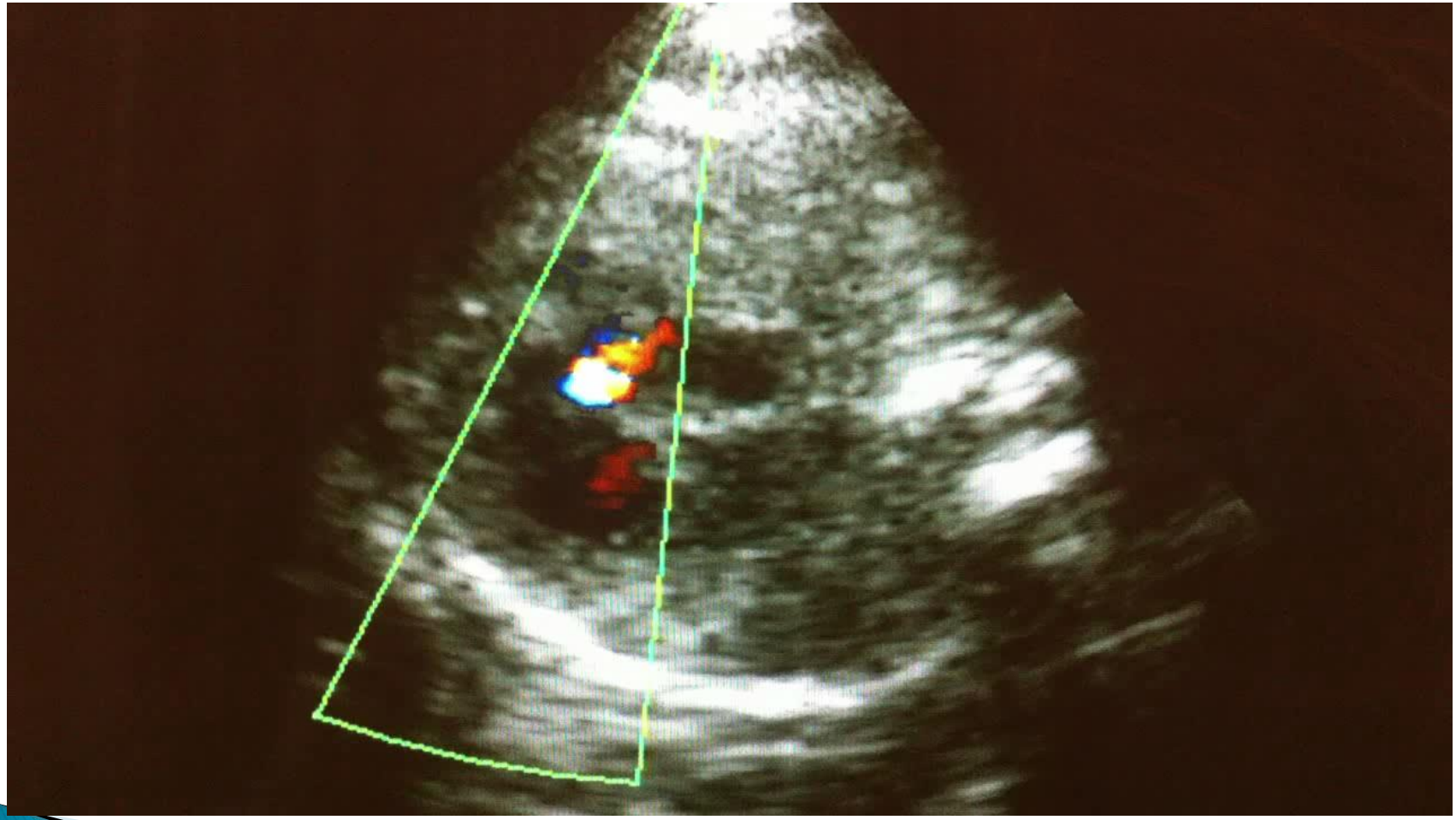


4 days latter

- PS=18
- Mild PI
- Moderate TR
- No pericardial effusion
- Cardio /thorax=40
- Increased RV cavity


MADAR HOSPITAL
ID_20130214_110529
02/14/13
11:12:27 AM
+ 72.0
- 72.0
cm/s
2.5MHz
M4/P0
G62/E1
WF M
Card/General
P4-1c/H3.5MHz
DR65/M1/P1
G62/E2/100%
MI1.2 TIs1.1
10.0 cm
24/24 Hz
ZSI 0

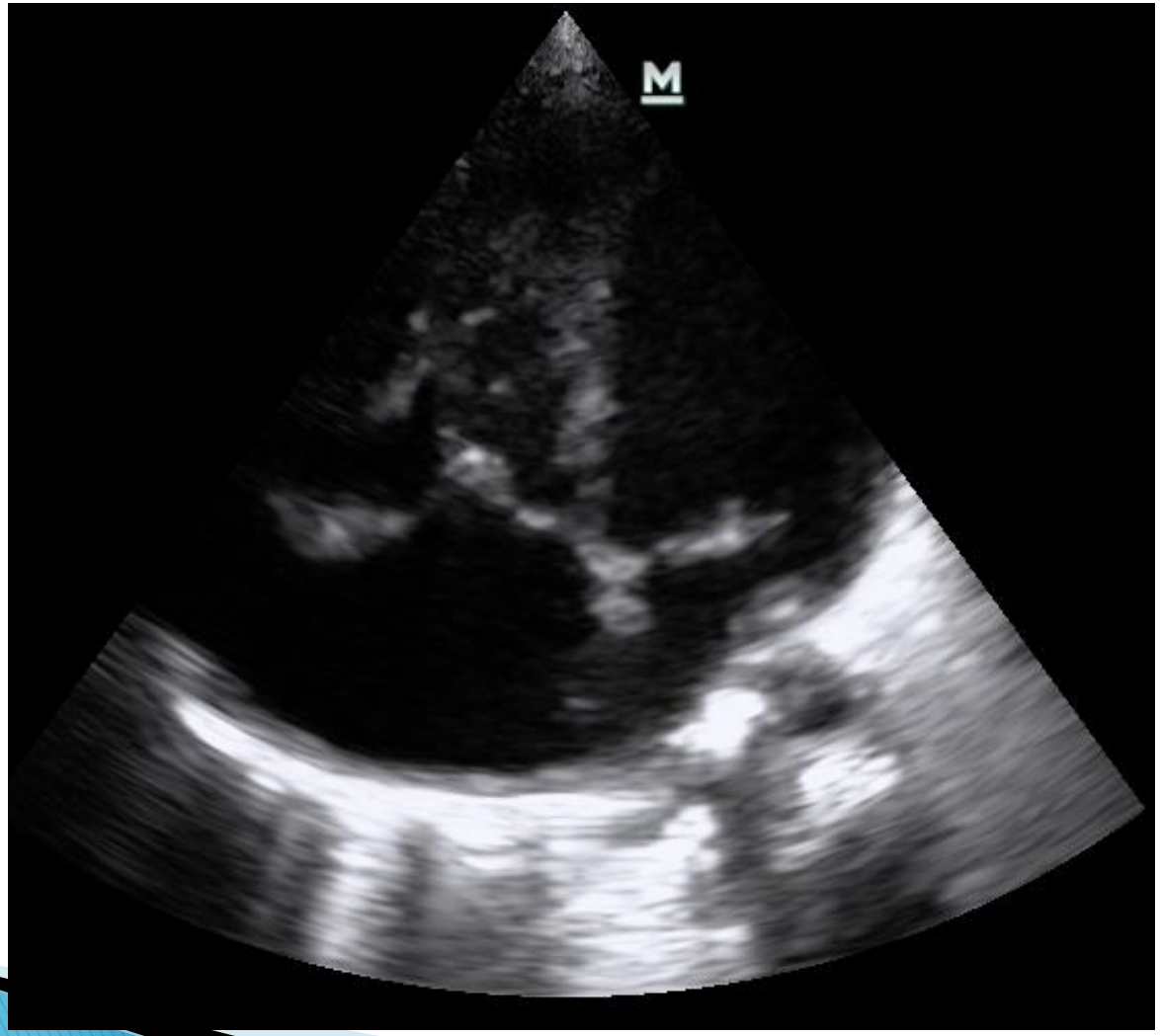
6 week after (34 week GA)



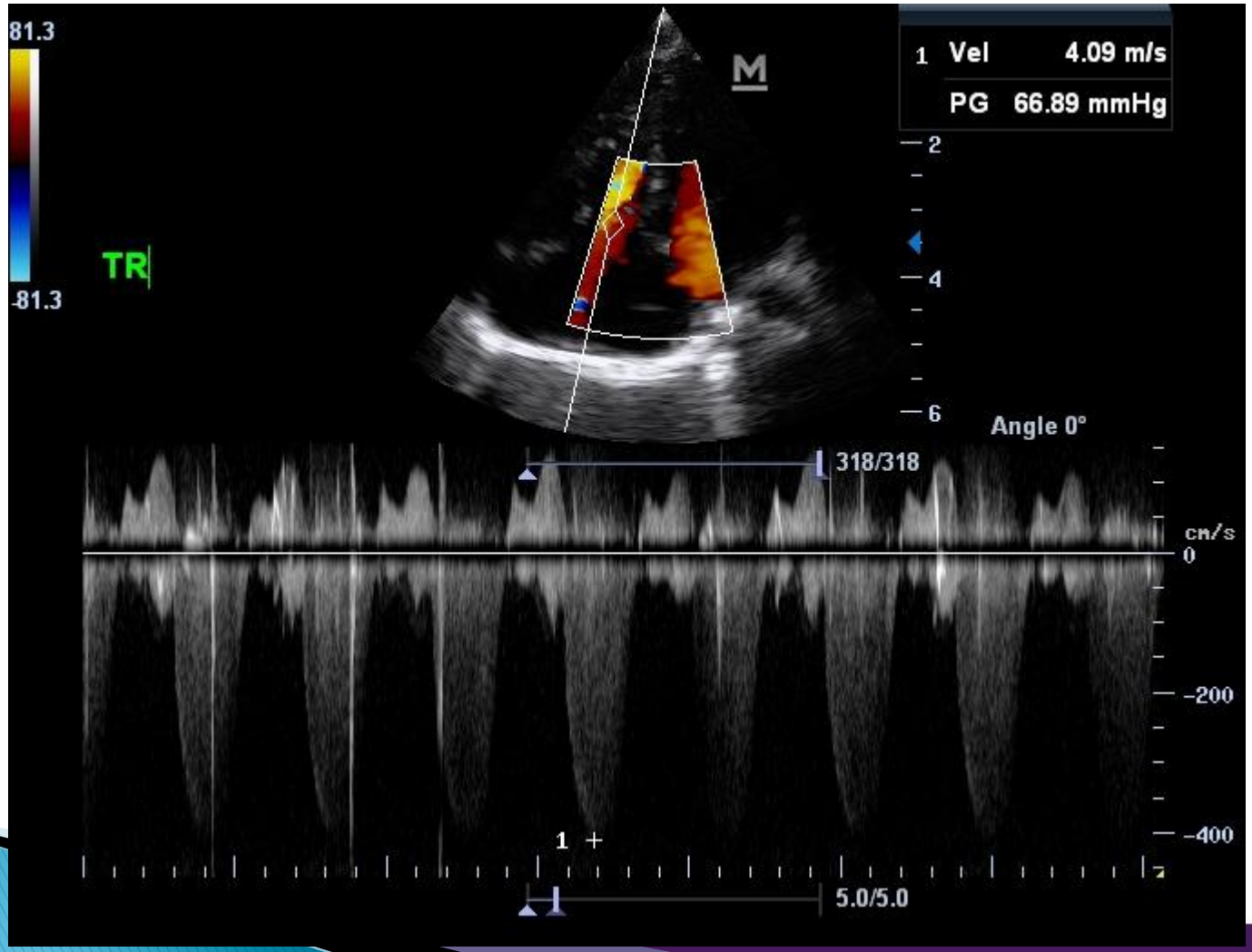
34 week old

- PS=18
- Mild PI
- mild TR
- No pericardial effusion
- Cardio /thorax=35
- Increased RV cavity

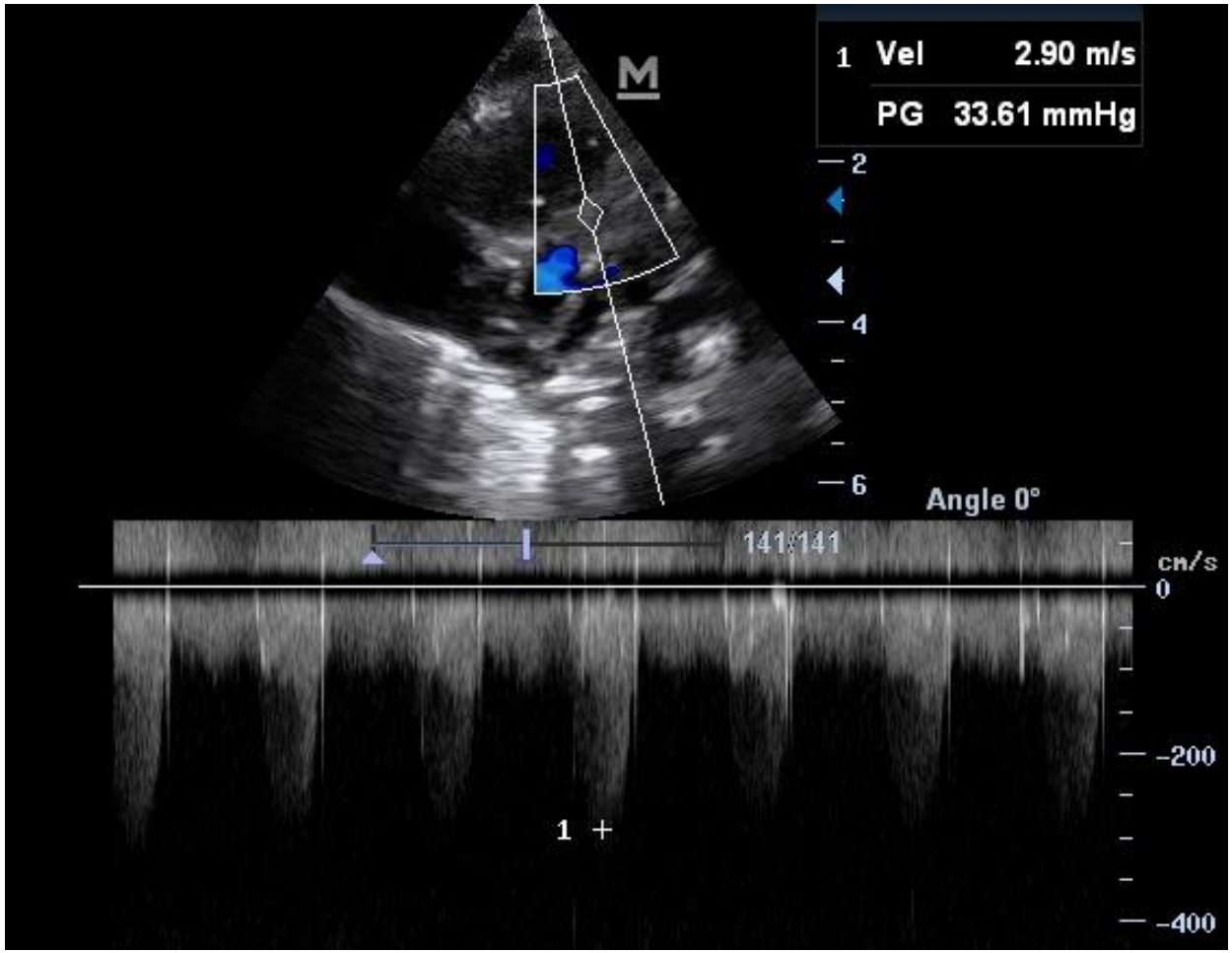
2 days After birth

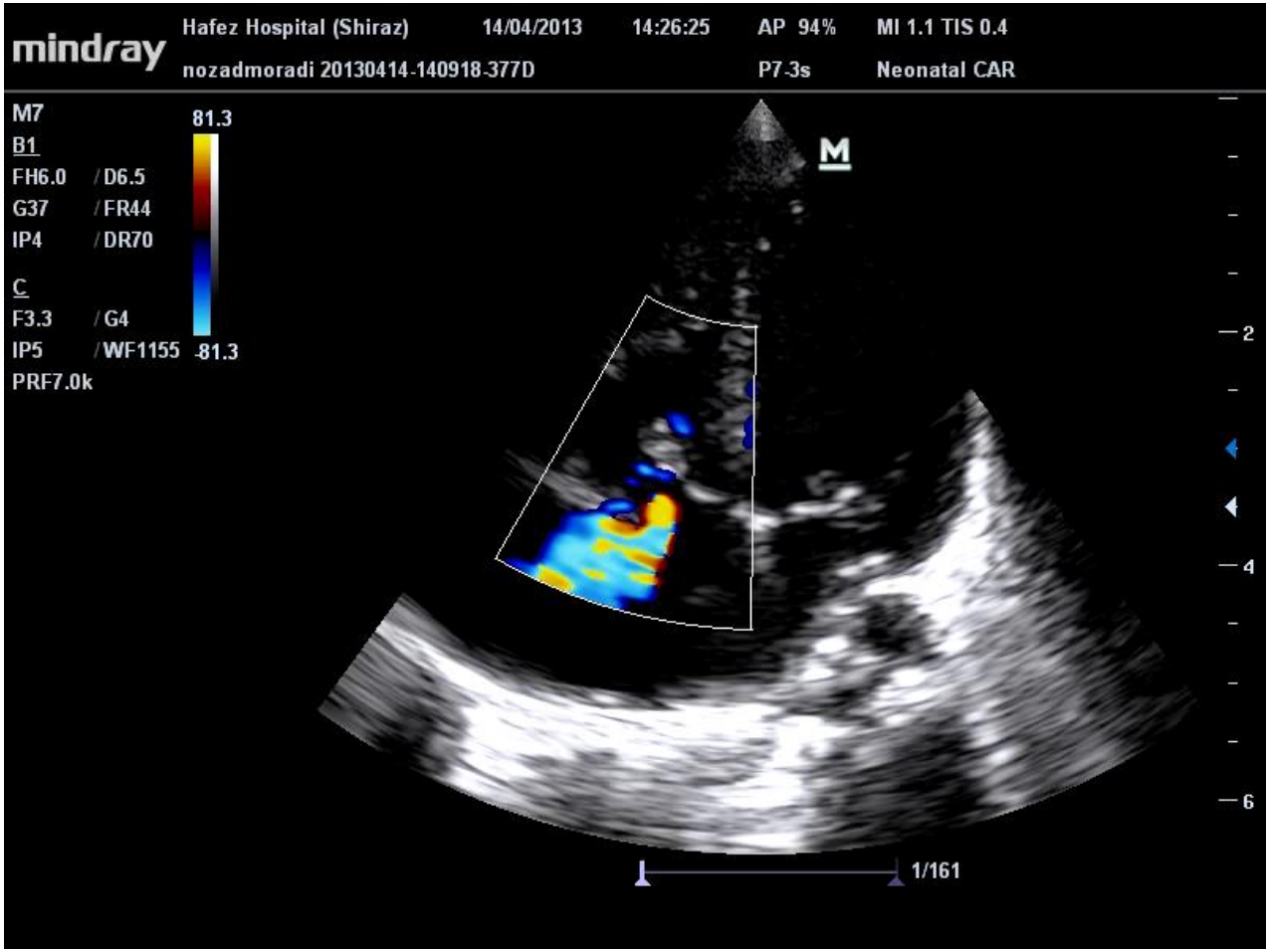


TR Gradient

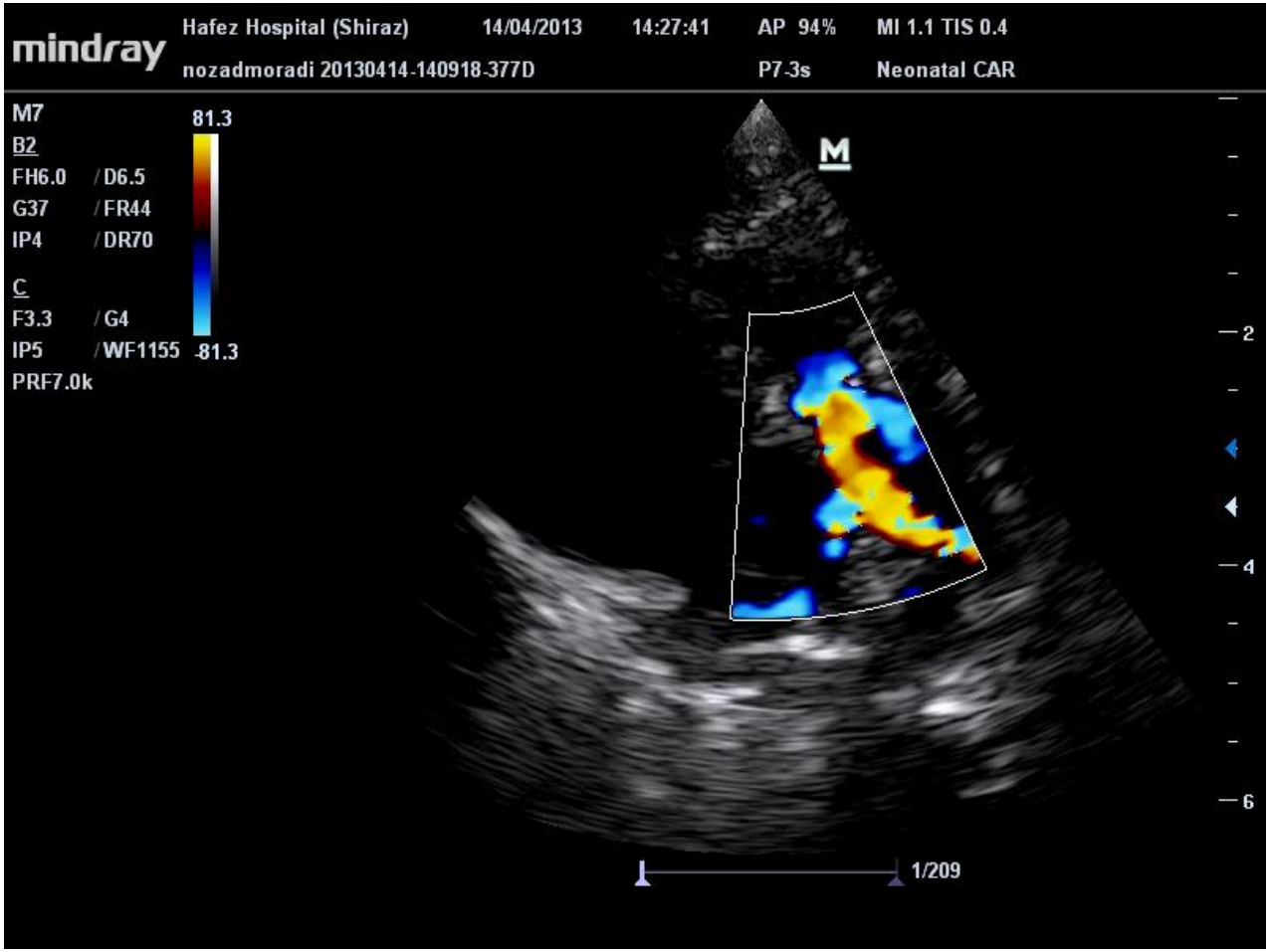

81.3
-81.3
TR
M
1 Vel 4.09 m/s
PG 66.89 mmHg
2
4
6
Angle 0°
318/318
cm/s
0
-200
-400
1 +
5.0/5.0

Ps




mindray
Hafez Hospital (Shiraz)
14/04/2013
14:26:25
AP 94%
MI 1.1 TIS 0.4
nozadmoradi 20130414-140918-377D
P7.3s
Neonatal CAR
M7
B1
FH6.0 / D6.5
G37 / FR44
IP4 / DR70
C
F3.3 / G4
IP5 / WF1155
PRF7.0k
81.3
-81.3
M
2
4
6
1/161

PS, PI, PDA


mindray
Hafez Hospital (Shiraz)
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14:27:41
AP 94%
MI 1.1 TIS 0.4
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P7.3s
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M7
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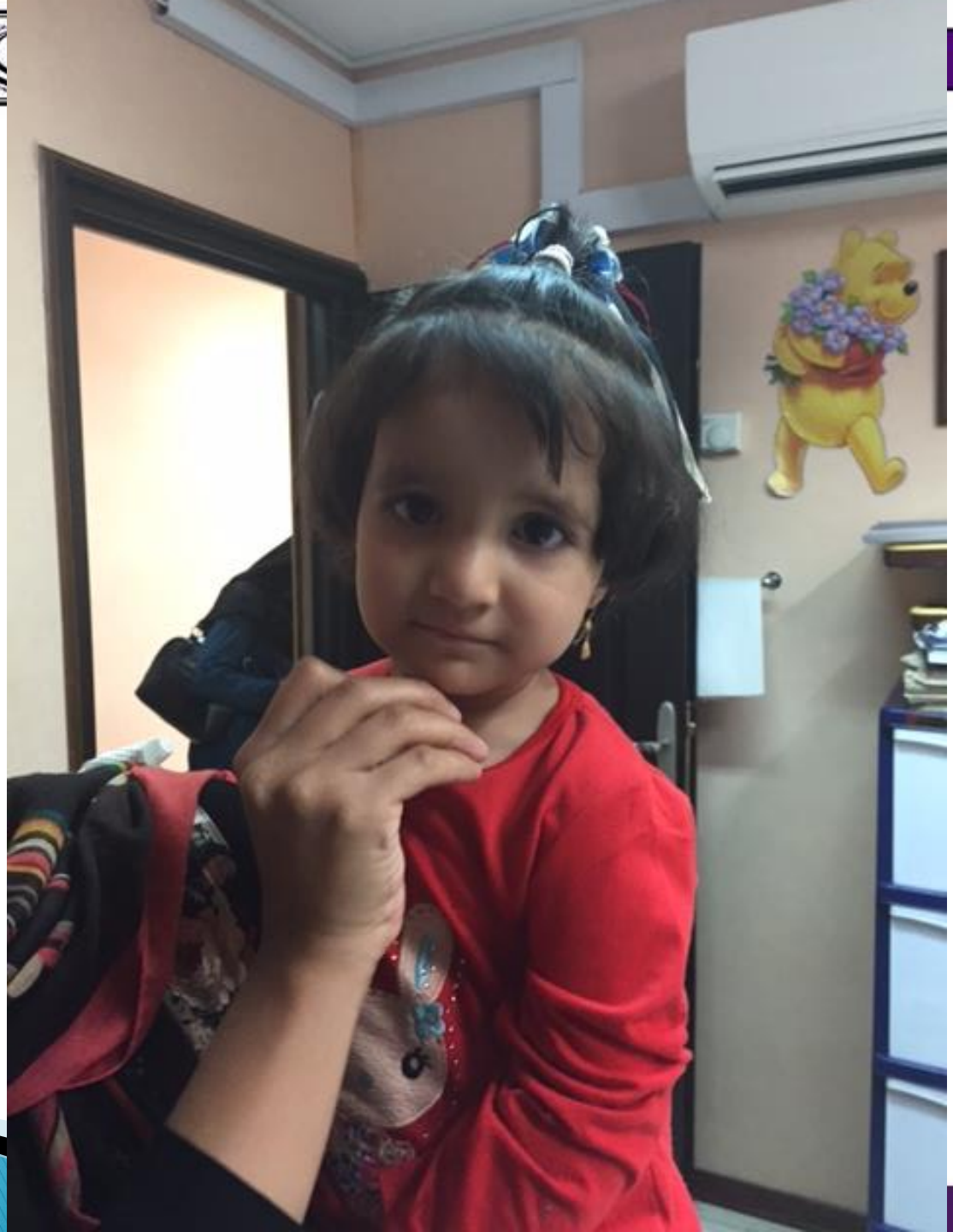
G37 / FR44
IP4 / DR70
C
F3.3 / G4
IP5 / WF1155
PRF7.0k
81.3
-81.3
M
2
4
6
1/209

Balloon angioplasty of PS

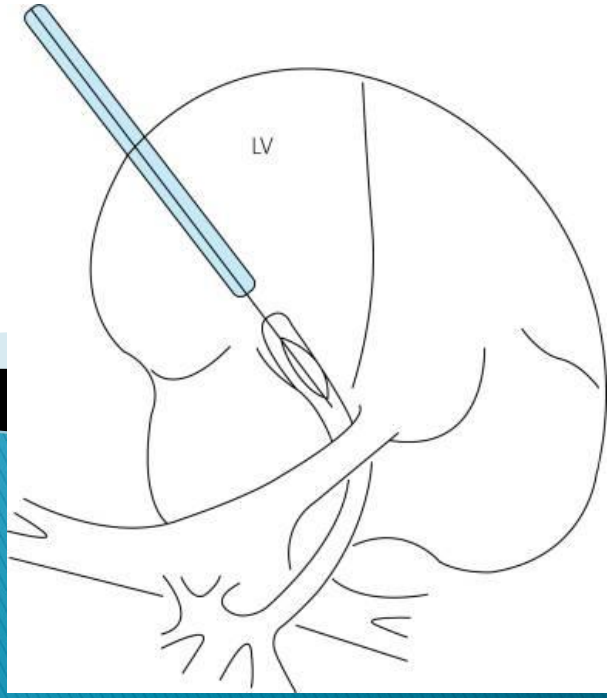
- Balloon angioplast of PS was done for the neonate on 7 days post delivery
- PS gradient decresed from 36 to 18

Post delivry

9 mo after delivery



Intrauterine balloon aortic valvuloplasty



Fetus 29 wk GA

Prenatal intervention on the atrial septum

- mean pulmonary vein forward/reverse time-velocity integral ratio of ≤ 5

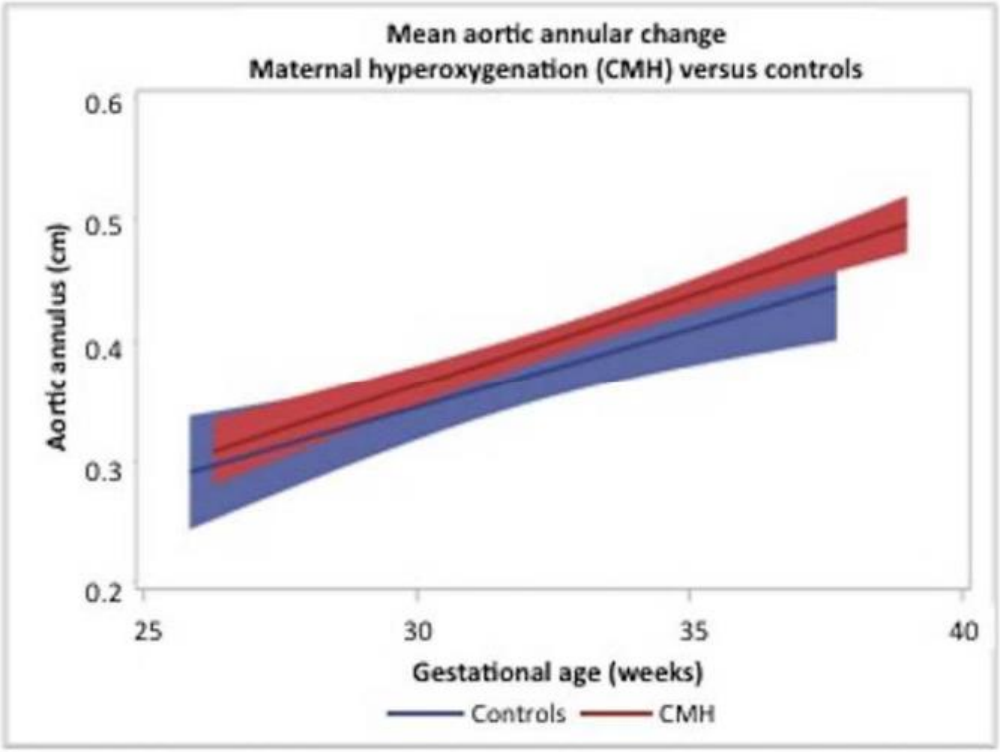
chronic maternal hyperoxygenation and effect on aortic and mitral valve annular dimensions

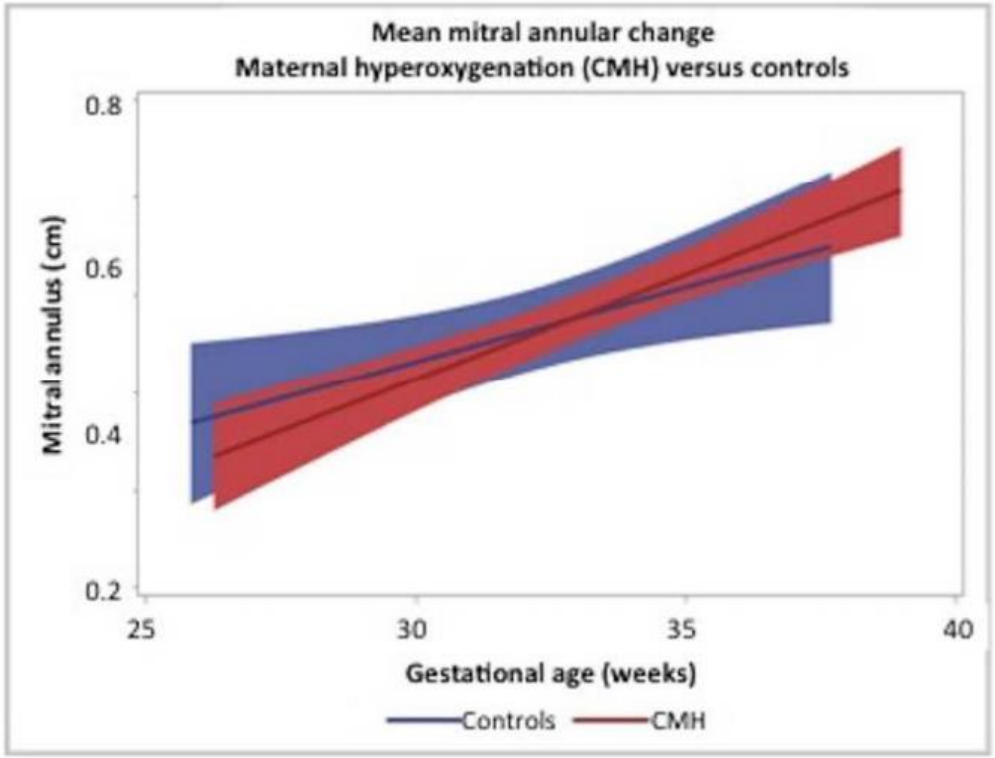
- borderline left ventricle, hypoplastic left heart complex, or Shone complex variant

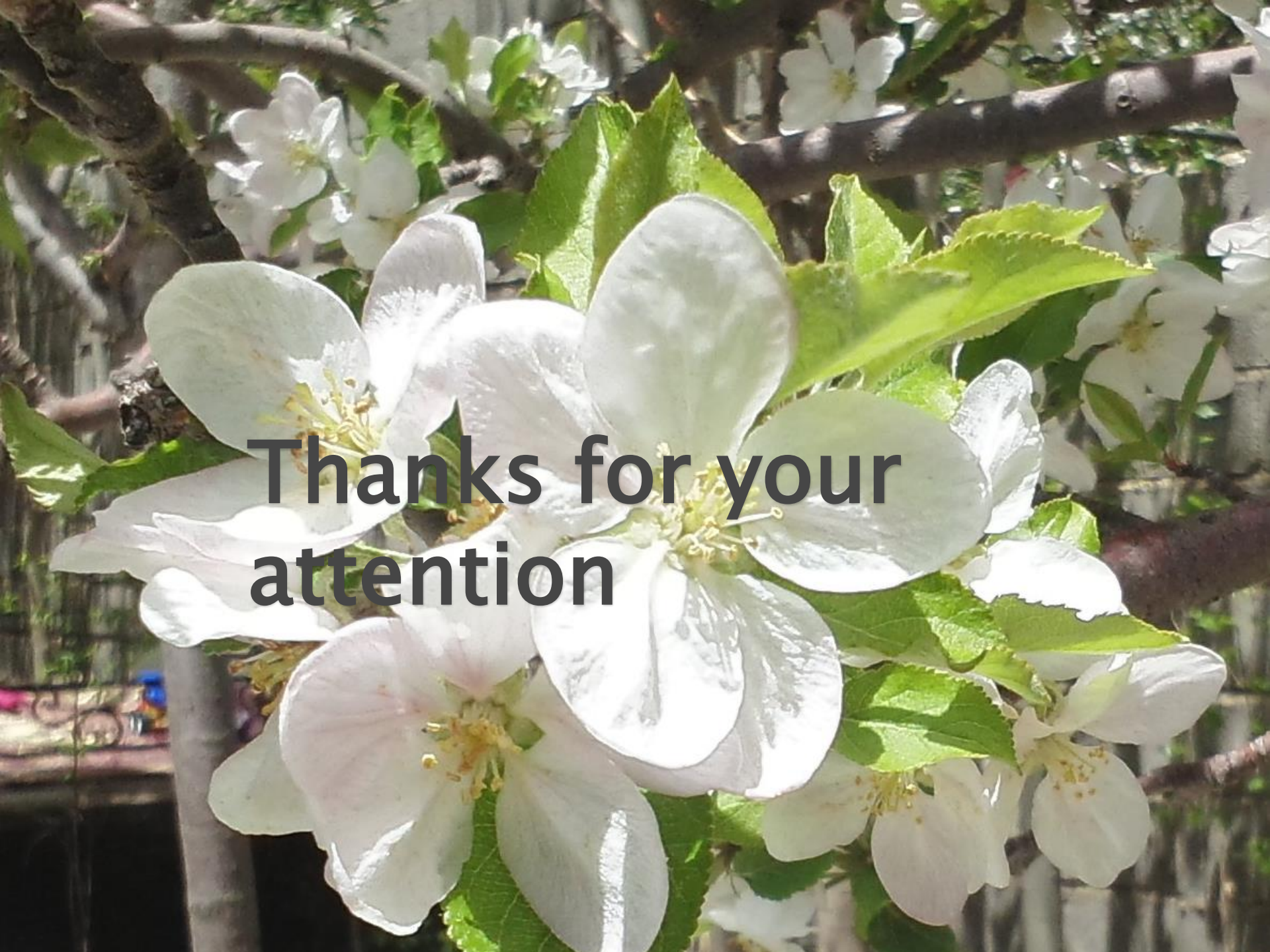
Acute maternal hyperoxygenation

- It has been shown that when supplemental oxygen is provided to gravid women, termed maternal hyperoxygenation, there is an increase in fetal pulmonary blood flow resulting in greater venous return to the left heart, and this response increases with gestational age.

- Prior to enrollment, prospective intervention gravidae were evaluated by an oxygen challenge to determine if the fetus would respond to AMH.
- This was followed by an oxygen challenge with repeated assessment of aortic and pulmonary artery flow after 10 minutes of AMH at 8 liters per minute (LPM) 100% FiO2 via nonrebreather face mask.
- Responders were defined as fetuses with a greater than 10% increase in percent aortic output with AMH
- therapy consisting of goal >8 hours daily of oxygen at 8-9 LPM 100% FiO2 for the remainder of gestation.
- For mothers with a PaO2 of <250mmHg, the flow was increased to 9 LPM.


Mean aortic annular change
Maternal hyperoxygenation (CMH) versus controls
Aortic annulus (cm)
0.6
0.5
0.4
0.3
0.2
25
30
35
40
Gestational age (weeks)
Controls
CMH


Mean mitral annular change
Maternal hyperoxygenation (CMH) versus controls
Mitral annulus (cm)
0.8
0.6
0.4
0.2
25
30
35
40
Gestational age (weeks)
Controls
CMH


Thanks for your
attention