

# Prenatal diagnosis Imaging

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Training Course in Sexual and Reproductive Health Research  
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# **PRENATAL DIAGNOSIS IMAGING**

**ULTRASOUND**

**EMBRYOSCOPY**

# **FETAL MEDICINE ULTRASOUND IMAGING**

**DATING**

**MULTIPLE PREGNANCY**

**ANOMALY SCREENING**

**FETAL GROWTH**

**AMNIOTIC FLUID VOLUME**

**PLACENTAL LOCALISATION**

**DOPPLER STUDIES**

**FETAL WELL-BEING**

**GUIDANCE OF INVASIVE PROCEDURES**

**PSYCHOLOGICAL ASPECTS**

# **FETAL MEDICINE ULTRASOUND IMAGING**

## **ULTRASOUND SCREENING DURING PREGNANCY**

**I : 11 - 14 WKS**

**II : 19 – 21 WKS**

**III: 32 - 36 WKS**

# **ULTRASOUND SCREENING DURING PREGNANCY**

## **FIRST EXAMINATION (11-14 WKS)**

**UTERUS, ADNEXAE**

**GESTATIONAL AGE**

**CHORIONICITY IN MULTIPLE PREGNANCIES**

**NUCHAL TRANSLUCENCY (NT)**

**EARLY MORPHOLOGY**

# ASSESSMENT OF GESTATIONAL AGE

MEAN GESTATIONAL SAC DIAMETER                      +/- 7d

CROWN RUMP LENGTH (CRL)                              +/- 5d

BIPARIETAL DIAMETER (BPD)	± 7 d	≤ 20 wks
	± 10d	20-26 wks
	± 2 wks	27-29 wks
	± 2.5 wks	30-32 wks
	+/- 3 wks	≥ 33 wks

FEMUR LENGTH (FL)

OTHER PARAMETERS (CEPHALIC CIRCUMFERENCE, HUMERUS LENGTH, CEREBELLUM, FOOT LENGTH)



# ASSESSMENT OF GESTATIONAL AGE

MEAN GESTATIONAL SAC DIAMETER  $\pm 7d$

CROWN RUMP LENGTH (CRL)  $\pm 5d$

BIPARIETAL DIAMETER (BPD)

$\pm 7d$	$\leq 20$ wks
$\pm 10d$	20-26 wks
$\pm 2$ wks	27-29 wks
$\pm 2.5$ wks	30-32 wks
$\pm 3$ wks	$\geq 33$ wks

FEMUR LENGTH (FL)

OTHER PARAMETERS (CEPHALIC CIRCUMFERENCE, HUMERUS LENGTH, CEREBELLUM, FOOT LENGTH)



# **ULTRASOUND SCREENING DURING PREGNANCY**

## **FIRST EXAMINATION (11-14 WKS)**

**UTERUS, ADNEXAE**

**GESTATIONAL AGE**

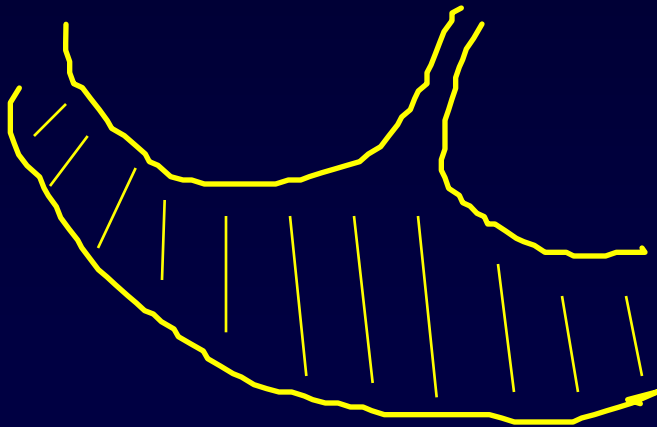
**CHORIONICITY IN MULTIPLE PREGNANCIES**

**NUCHAL TRANSLUCENCY (NT)**

**EARLY MORPHOLOGY**

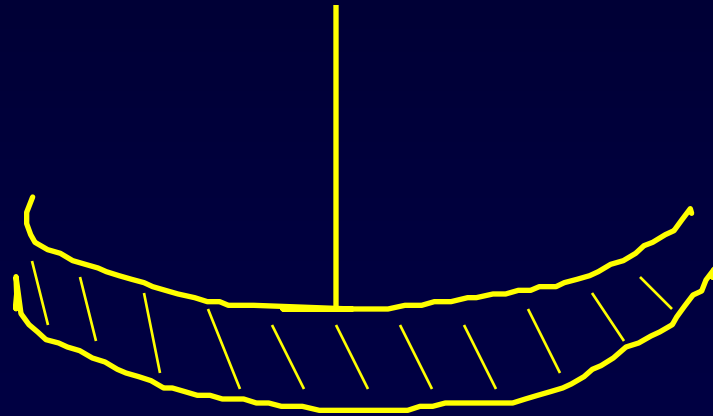
# MULTIPLE PREGNANCIES

"LAMBDA"



BICHORIONIC

"T"



MONOCHORIONIC







# **ULTRASOUND SCREENING DURING PREGNANCY**

## **FIRST EXAMINATION (11-14 WKS)**

**UTERUS, ADNEXAE**

**GESTATIONAL AGE**

**CHORIONICITY IN MULTIPLE PREGNANCIES**

**NUCHAL TRANSLUCENCY (NT)**

**EARLY MORPHOLOGY**

# FIRST-TRIMESTER SCREENING FOR FETAL ANEUPLOIDIES

## NUCHAL TRANSLUCENCY MEASUREMENT:

1. CRL 41 - 80 mm
2. MEDIAN SAGITTAL SECTION OF THE FETUS IN NEUTRAL POSITION
3. DISTINCTION BETWEEN FETAL SKIN AND AMNION
4. THE FETUS SHOULD OCCUPY AT LEAST 75% OF THE IMAGE
5. MAXIMUM THICKNESS OF NT SHOULD BE MEASURED
6. CALLIPERS SHOULD BE PLACED ON THE LINES

Snijders RJM et al. Lancet 1998; 352: 343-6.





General

85dB S1/+1/2/4

Gain= -2dB  $\Delta=$

Store in progress



1 Dist = 6.81 cm

2 Dist = 0.14 cm



# FIRST-TRIMESTER SCREENING FOR FETAL ANEUPLOIDIES

## SECONDARY BENEFITS OF NT MEASUREMENT:

WHEN THE FETAL KARYOTYPE IS NORMAL, A NT  $\geq$  95th CENTILE MAY BE ASSOCIATED WITH:

1. CONGENITAL CARDIOPATHIES
2. OTHER FETAL ANOMALIES (ORGANIC / SYNDROMIC)

# **ULTRASOUND SCREENING DURING PREGNANCY**

## **SECOND EXAMINATION (19-21 WKS)**

**GESTATIONAL AGE**

**MARKERS OF ANOMALY / ANEUPLOIDY**

**FETAL MORPHOLOGY I**

**PLACENTAL LOCALISATION**

# **FETAL MORPHOLOGY SCAN**

## **FETAL ANOMALY SCREENING**

# FETAL MORPHOLOGY SCAN

**HEAD**

**SPINE**

**THORAX (HEART)**

**DIAPHRAGMA**

**ABDOMEN**

**EXTREMITIES**

**UMBILICAL CORD**

**FETAL GENDER (?)**

# FETAL MORPHOLOGY SCAN

## HEAD

**CRANIUM**

**CEREBRAL STRUCTURES**

**VENTRICLES, POSTERIOR FOSSA**

**ADDITIONAL STRUCTURES ?**

**BIPARIETAL DIAMETER**

**OTHER MEASUREMENTS WHEN NEEDED**

**FACIAL STRUCTURES, PROFILE**









0 ◆

T

5 ◆





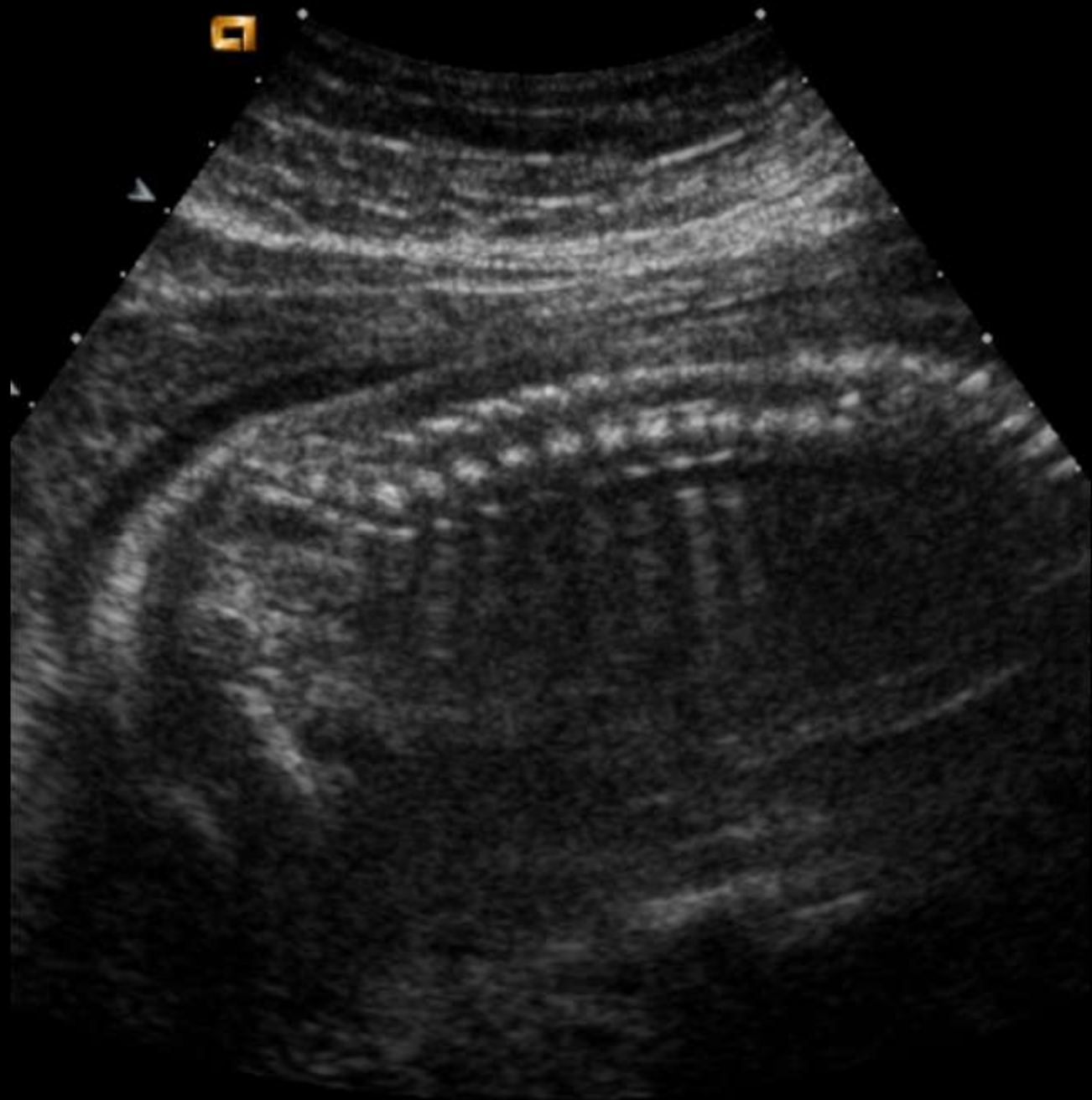




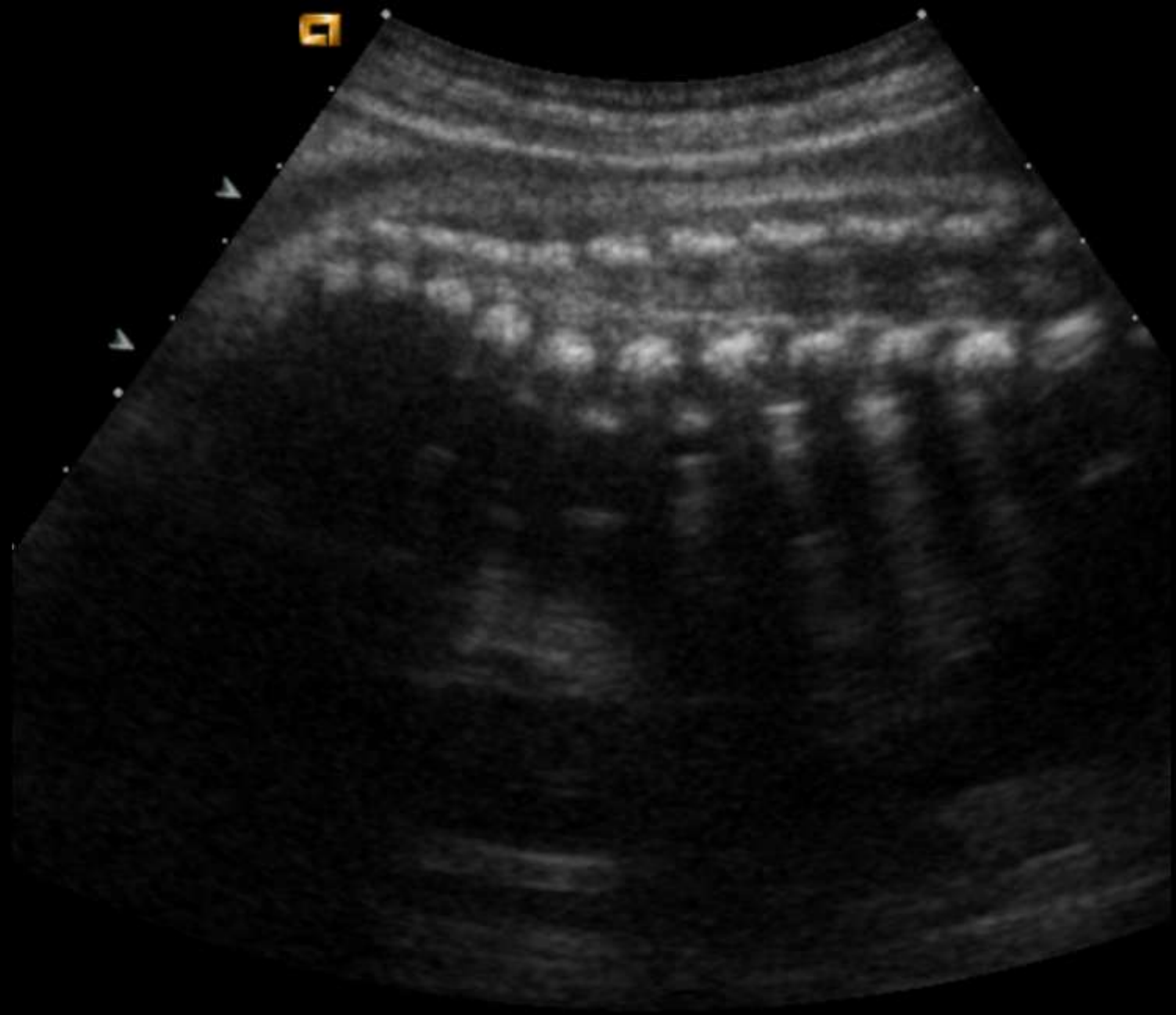
# **FETAL MORPHOLOGY SCAN**

**RACHIS**

**LONGITUDINAL, TRANSVERSE  
AND FRONTAL VIEWS**









# FETAL MORPHOLOGY SCAN

## THORAX

**HEART: POSITION / AXIS, DIMENSIONS, RHYTHM,  
4 CHAMBERS, OUTFLOW TRACTS**

**THORACIC WALL, RIBS**

**THORACIC CIRCUMFERENCE IF NEEDED**

**ADDITIONAL STRUCTURES ?**



[http://www.gfmer.ch/Video/Fetal\\_thorax1.wmv](http://www.gfmer.ch/Video/Fetal_thorax1.wmv)

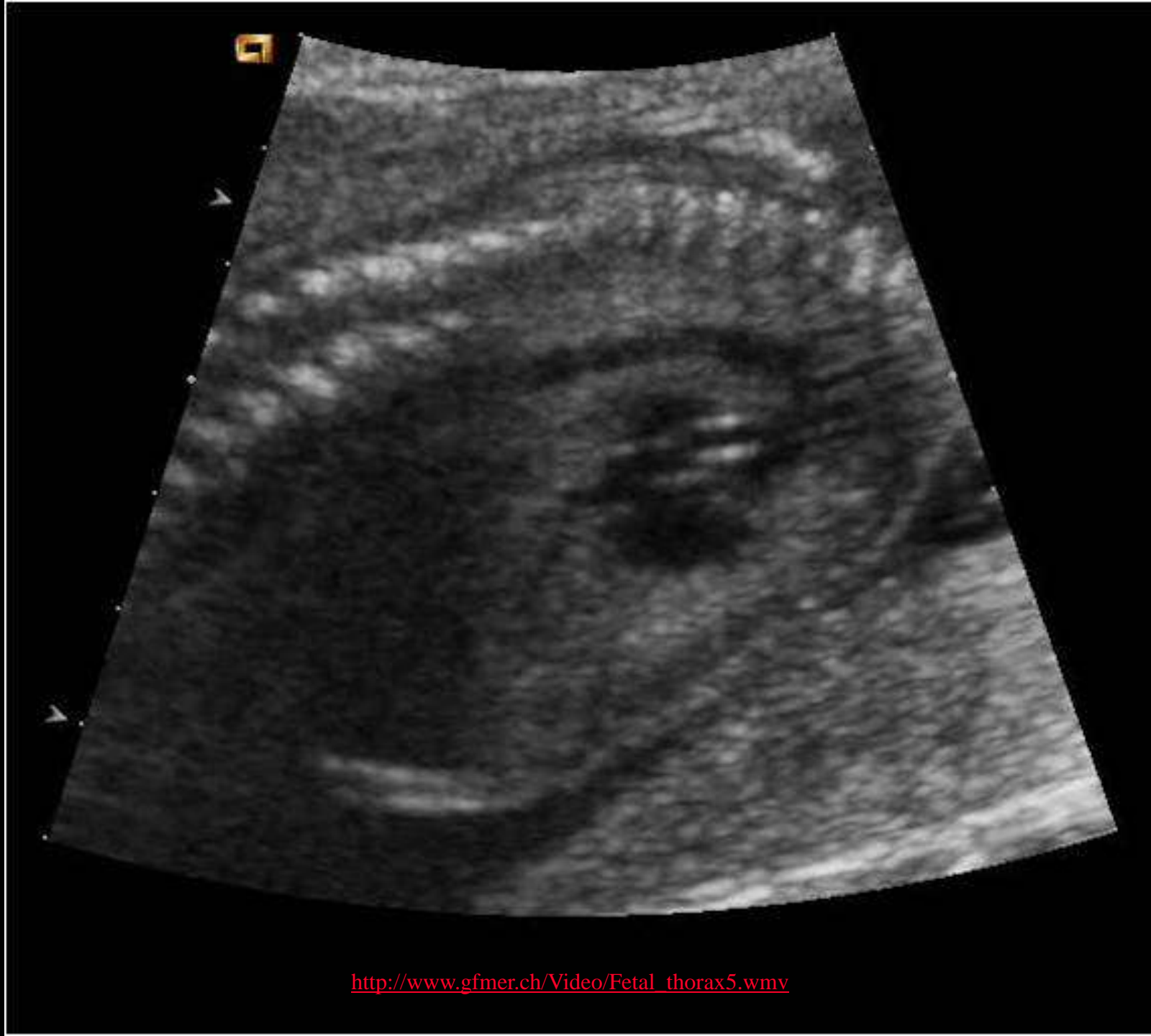




[http://www.gfmer.ch/Video/Fetal\\_thorax3.wmv](http://www.gfmer.ch/Video/Fetal_thorax3.wmv)



[http://www.gfmer.ch/Video/Fetal\\_thorax4.wmv](http://www.gfmer.ch/Video/Fetal_thorax4.wmv)



[http://www.gfmer.ch/Video/Fetal\\_thorax5.wmv](http://www.gfmer.ch/Video/Fetal_thorax5.wmv)





[http://www.gfmer.ch/Video/Fetal\\_thorax6.wmv](http://www.gfmer.ch/Video/Fetal_thorax6.wmv)





[http://www.gfmer.ch/Video/Fetal\\_thorax8.wmv](http://www.gfmer.ch/Video/Fetal_thorax8.wmv)



0

2

4

6

8



0

2

4

6

8





[http://www.gfmer.ch/Video/Fetal\\_thorax12.wmv](http://www.gfmer.ch/Video/Fetal_thorax12.wmv)

# FETAL MORPHOLOGY SCAN

DIAPHRAGM





[http://www.gfmer.ch/Video/Fetal\\_diaphragm.wmv](http://www.gfmer.ch/Video/Fetal_diaphragm.wmv)

# FETAL MORPHOLOGY SCAN

## ABDOMEN

**DIAMETERS AND/OR CIRCUMFERENCE**

**CORD INSERTION**

**STOMACH, LIVER, GALLBLADDER, UMBILICAL  
VEIN**

**KIDNEYS: DIMENSIONS, STRUCTURES**

**BLADDER: PRESENCE (DYNAMIC EVALUATION)**

**ADDITIONAL IMAGES ?**



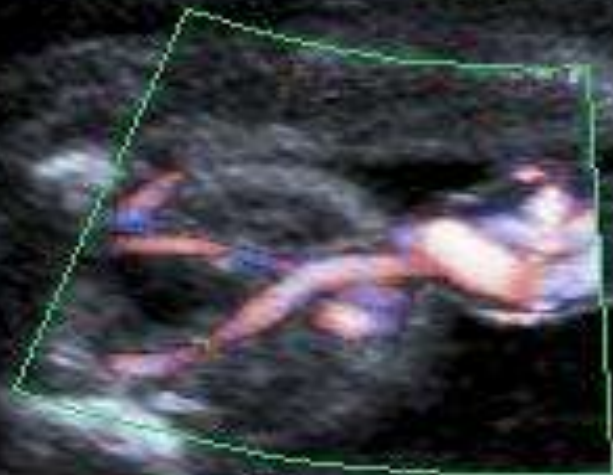
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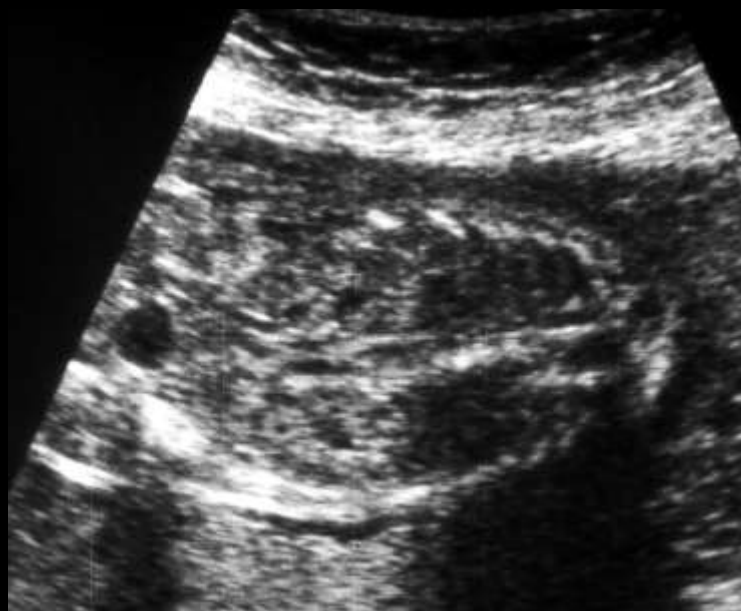


0

T

5







T

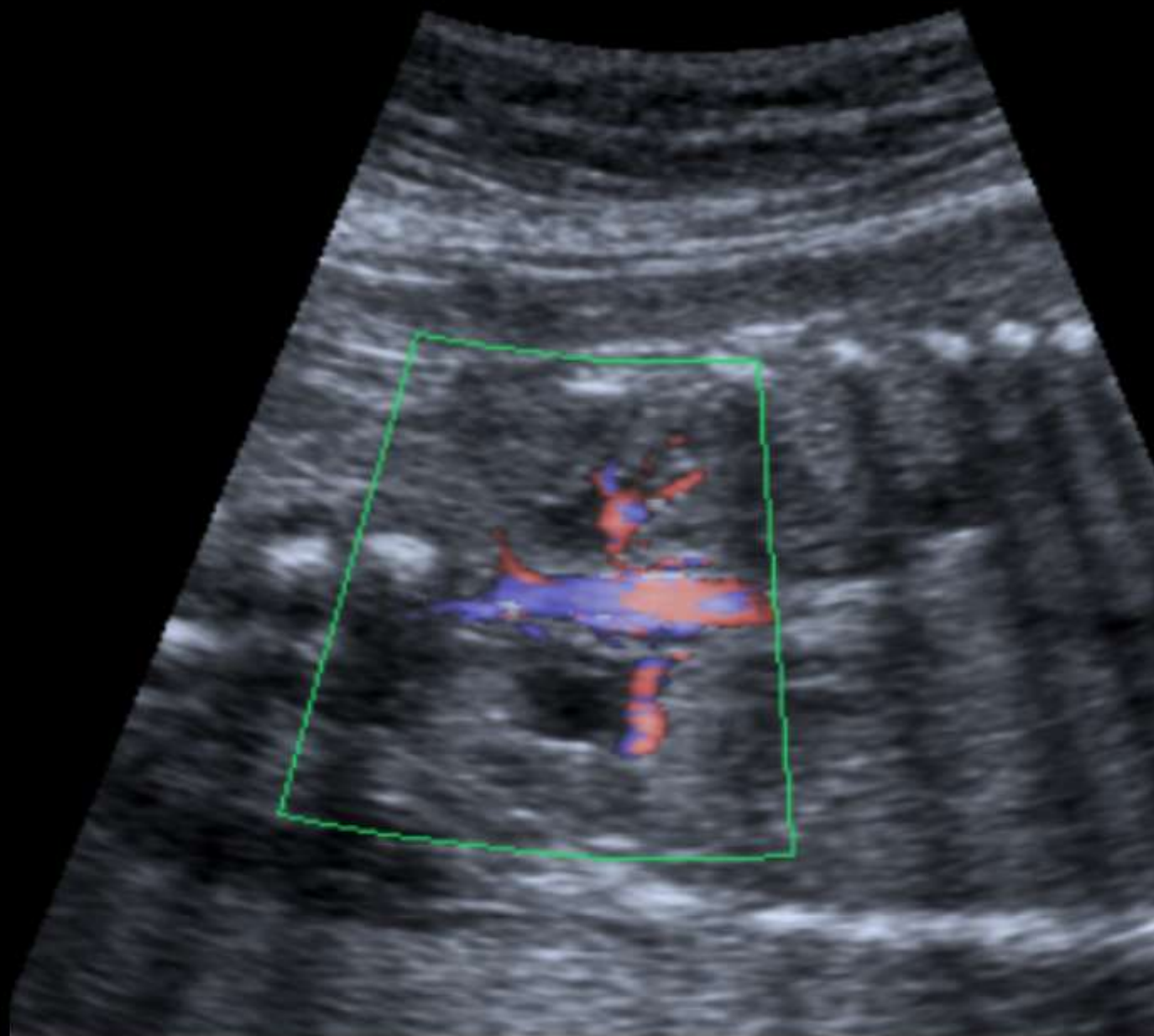
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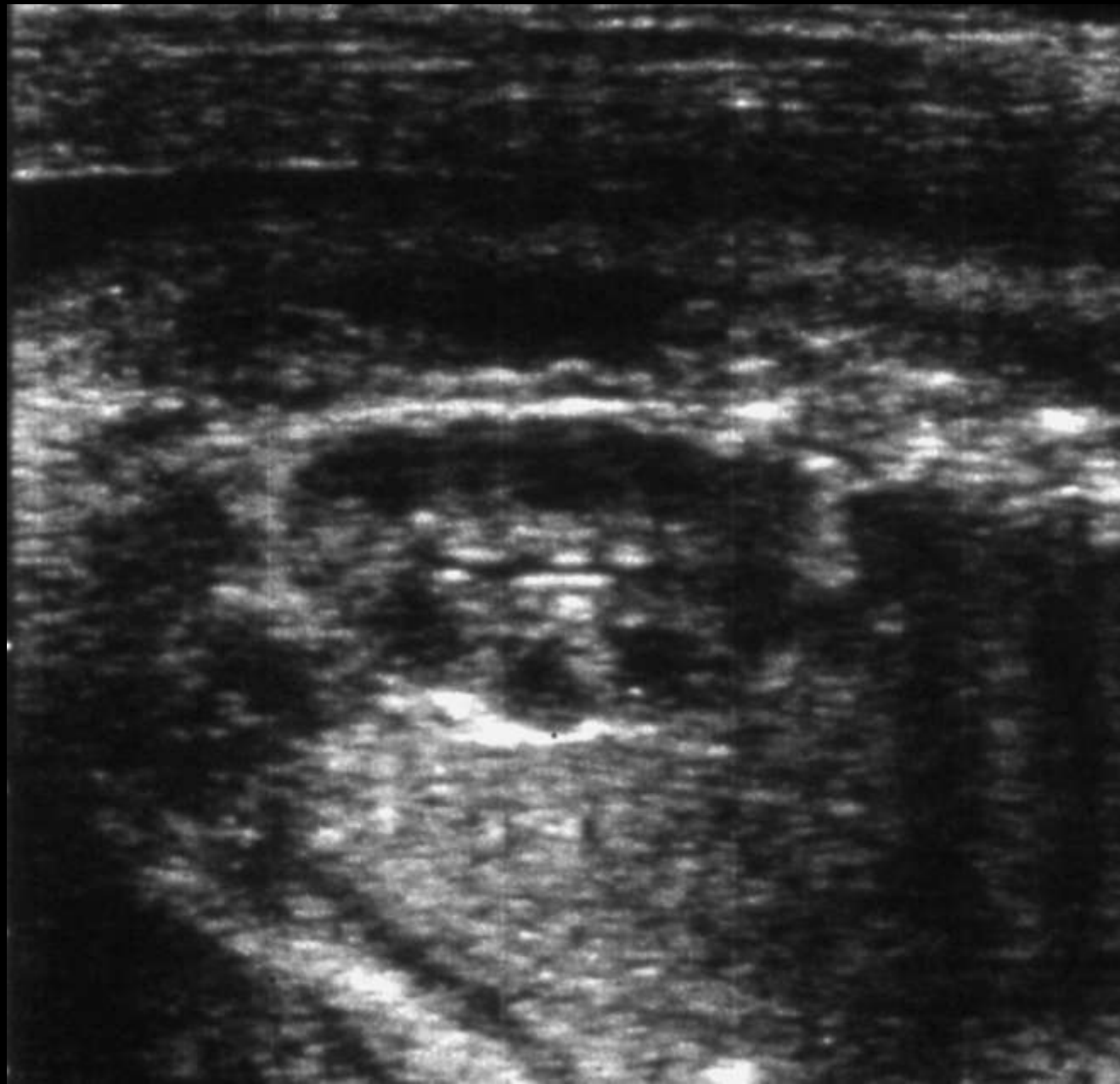
5

10









# FETAL MORPHOLOGY SCAN

## EXTREMITIES

**FEMORAL LENGTH**

**MEASUREMENTS OF OTHER LONG BONES WHEN NEEDED**

**PRESENCE OF ALL 4 EXTREMITIES AND THEIR SEGMENTS**

**MOBILITY**

**ATTITUDE**

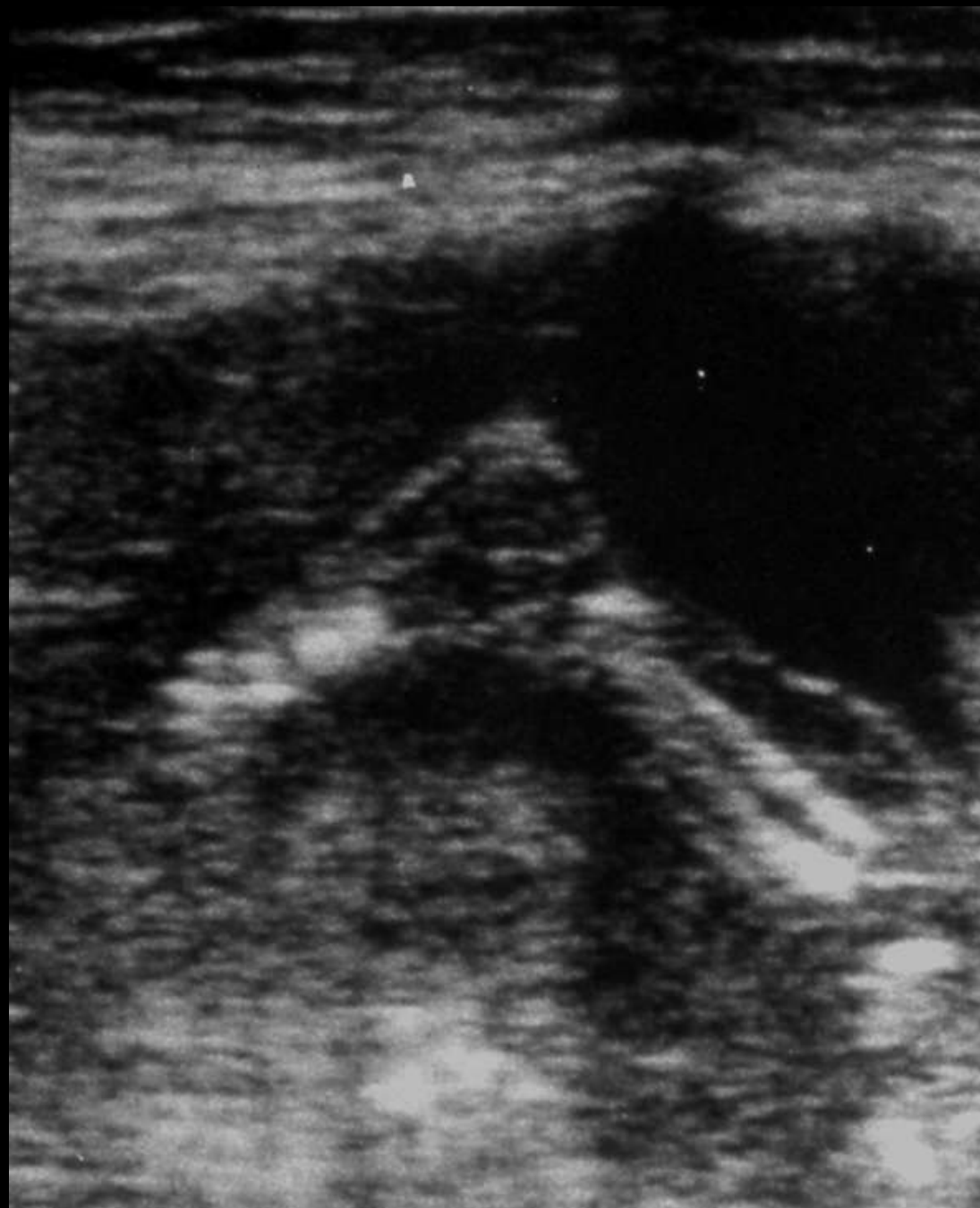
**POLYDACTILY ?**

0

T

5







# **FETAL MORPHOLOGY SCAN**

**UMBILICAL CORD**

**NUMBER OF VESSELS**









# FETAL MORPHOLOGY SCAN

FETAL SEX (?)

# **FETAL MORPHOLOGY SCAN CRITICAL POINTS**

- 1. TIMING**
- 2. COMPREHENSIVE AND SYSTEMATIC EXAMINATION**
- 3. EXPERIENCE OF NORMAL FETAL IMAGES**
- 4. ONLY ADEQUATELY VISUALISED STRUCTURES  
SHOULD BE EVALUATED**
- 5. IMAGING CONDITIONS**

# **US MARKERS OF FETAL ANOMALIES**

**OLIGOHYDRAMNIOS**

**POLYHYDRAMNIOS**

**EARLY GROWTH RETARDATION**

**DISHARMONIOUS FETAL GROWTH**

**ABNORMAL MOTOR ACTIVITY**

**CARDIAC ARRHYTHMIAS**

# **US MARKERS OF FETAL ANEUPLOIDY**

**2ND-TRIMESTER OLIGOHYDRAMNIOS  
POLYHYDRAMNIOS  
EARLY GROWTH RETARDATION  
DISHARMONIOUS GROWTH  
NON-IMMUNOLOGIC HYDROPS  
ABNORMAL PROFILE  
STRUCTURAL ANOMALIES  
SINGLE UMBILICAL ARTERY  
ABNORMAL MOTOR ACTIVITY**

# **ULTRASOUND SCREENING DURING PREGNANCY**

## **THIRD EXAMINATION (32-36 WKS)**

**FETAL GROWTH**

**FETAL MORPHOLOGY II (CNS, HEART,  
URINARY AND DIGESTIVE TRACTS,  
DIAPHRAGM)**

**AMNIOTIC FLUID**

**PLACENTAL LOCALISATION**

# **ULTRASOUND IN OBSTETRICS**

## **DOPPLER EVALUATION OF FETAL AND UTERO-PLACENTAL CIRCULATIONS**



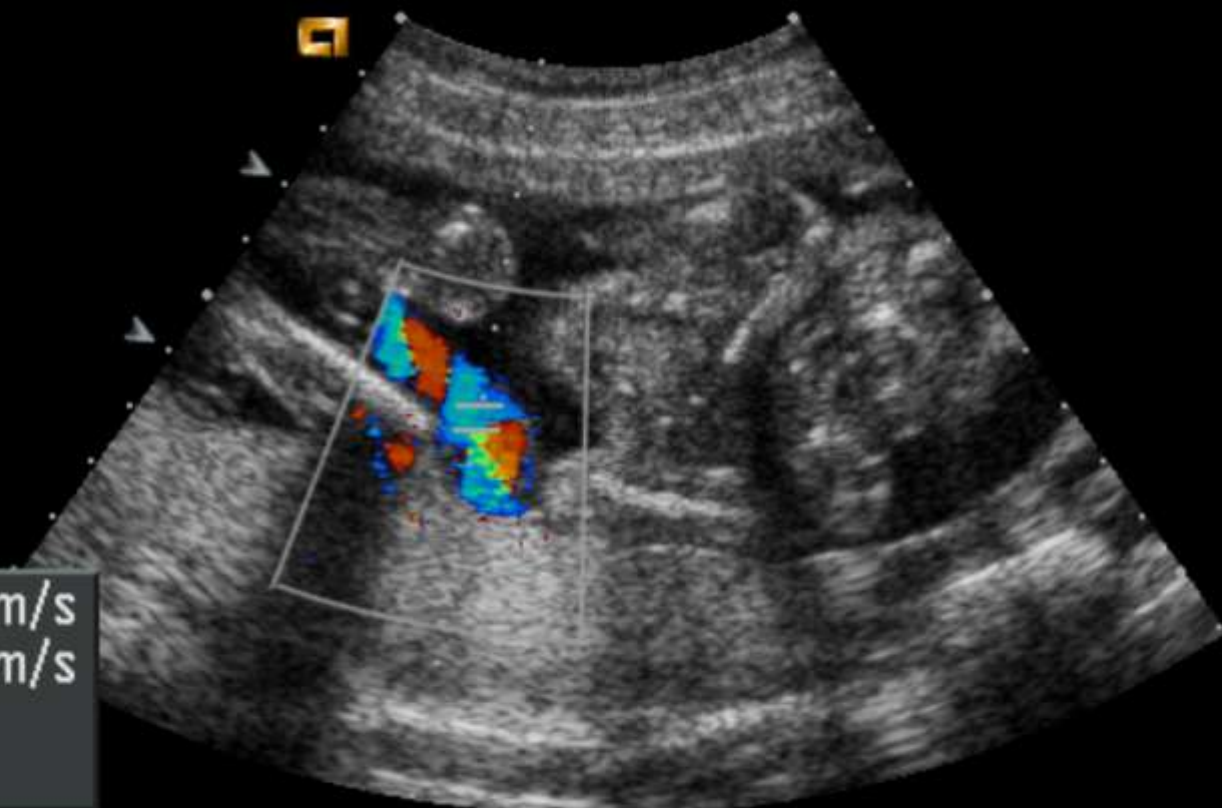
10:02:39

6C2-S  
H4.0MHz 110mm  
OB 6C2  
General /V

40dB 2 +/ +1/2/ 5  
PW Depth= 54mm  
PW Gate= 4.0mm  
PW Gain= -8dB

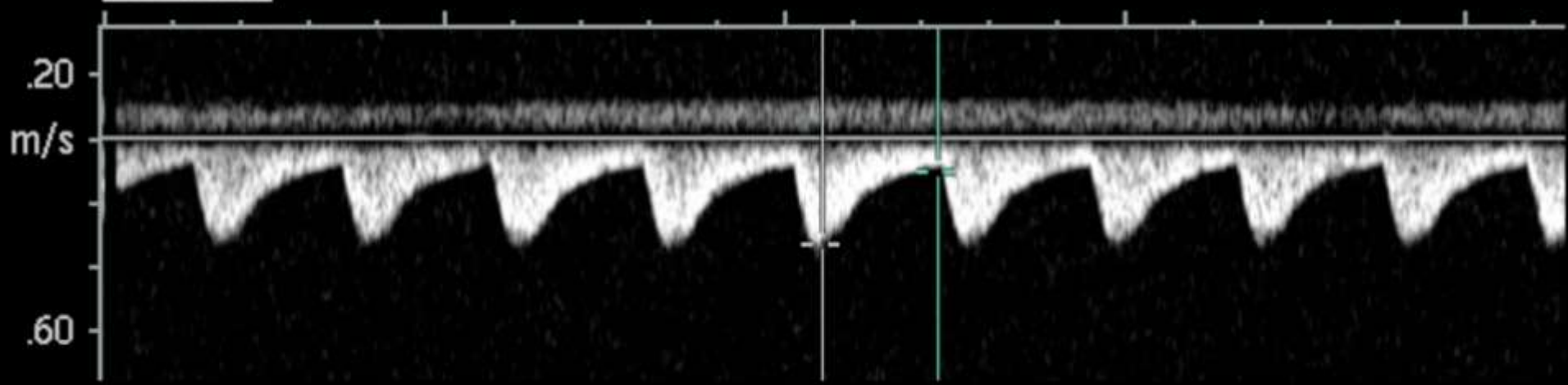
Store in progress  
Sweep=50mm/s

.18  
18



V1 = -0.326m/s  
V2 = -0.099m/s  
RI = 0.70  
S/D = 3.29

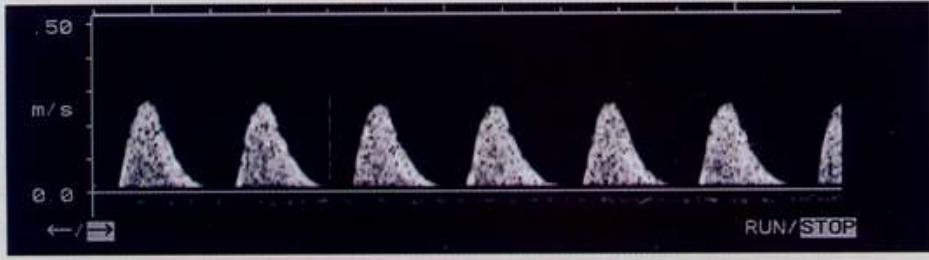
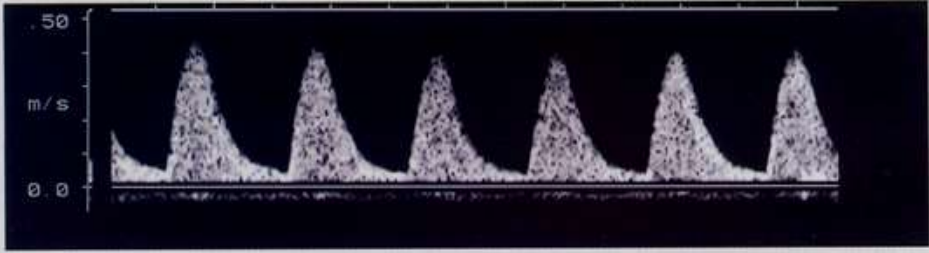
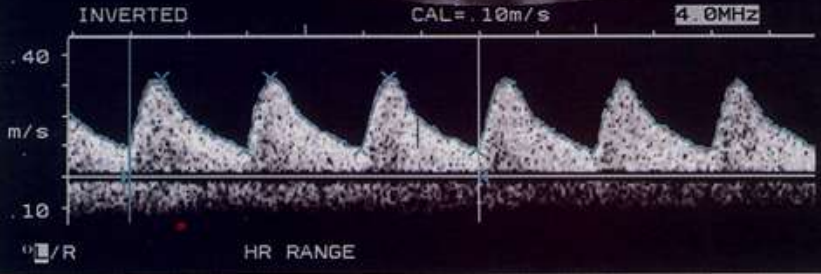
PW:2.5MHz



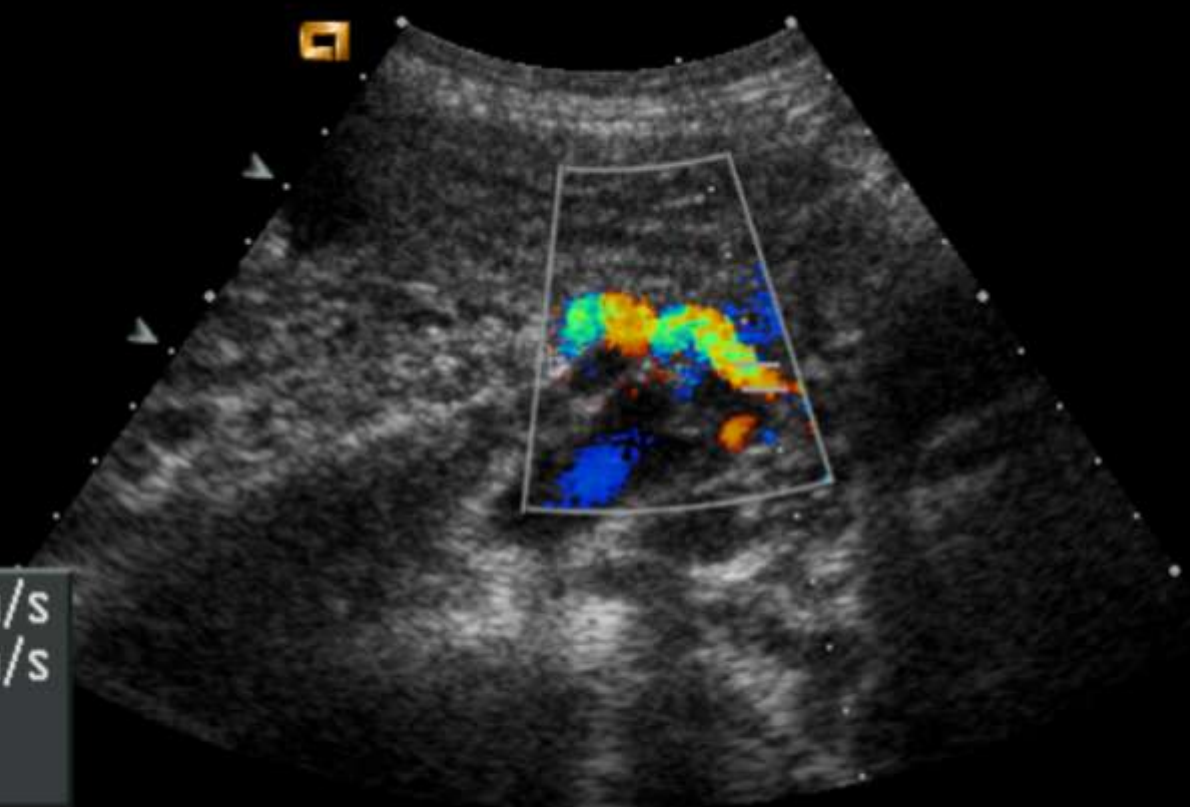
OB/GYN  
HR RANGE 80-160  
MAX = 0.32 m/s  
MIN = 0.09 m/s  
ANGLE = 0°  
TAMX = 0.19 m/s  
HR = 150 bpm  
ACCEL = 2.57 m/s<sup>2</sup>  
PI = 1.22  
RI = 0.73



C7 248  
7.0 MHz R31  
OB/GYN  
1:0 100%



.18  
18



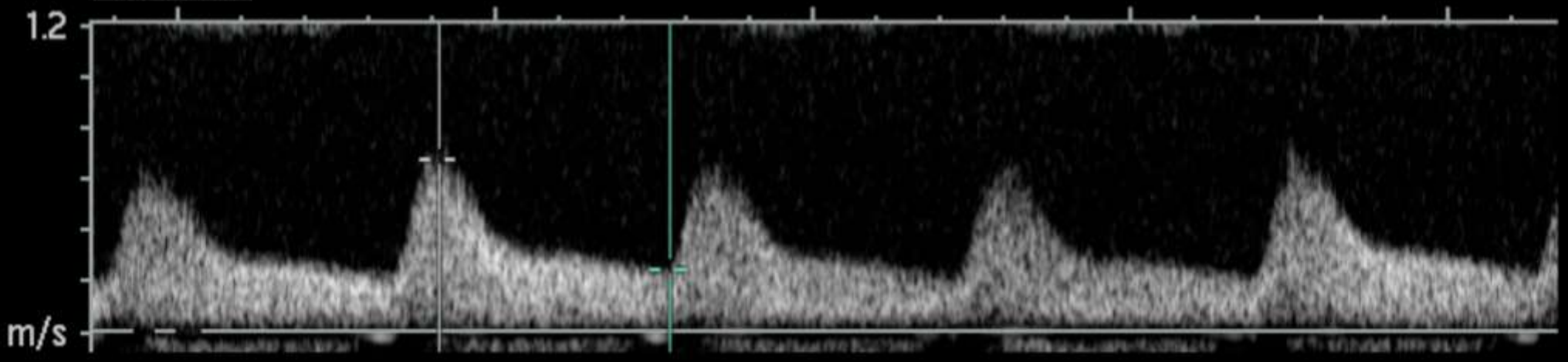
10:00:22  
6C2-S 5sec  
H4.0MHz 110mm  
OB 6C2  
General /V

40dB 2 · /+1/2/ 5  
PW Depth= 49mm  
PW Gate= 4.0mm  
PW Gain= -8dB

Store in progress  
Sweep=50mm/s

V1 = 0.679m/s  
V2 = 0.248m/s  
RI = 0.63  
S/D = 2.73

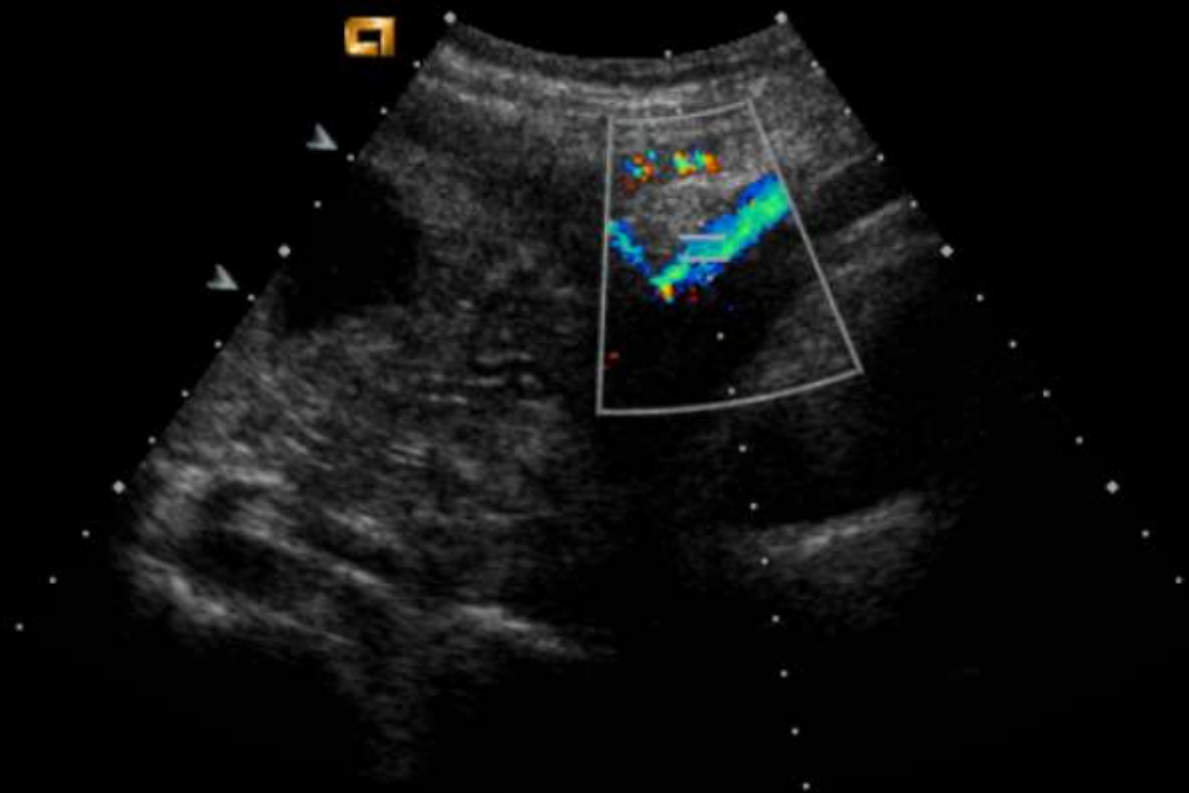
PW:2.5MHz



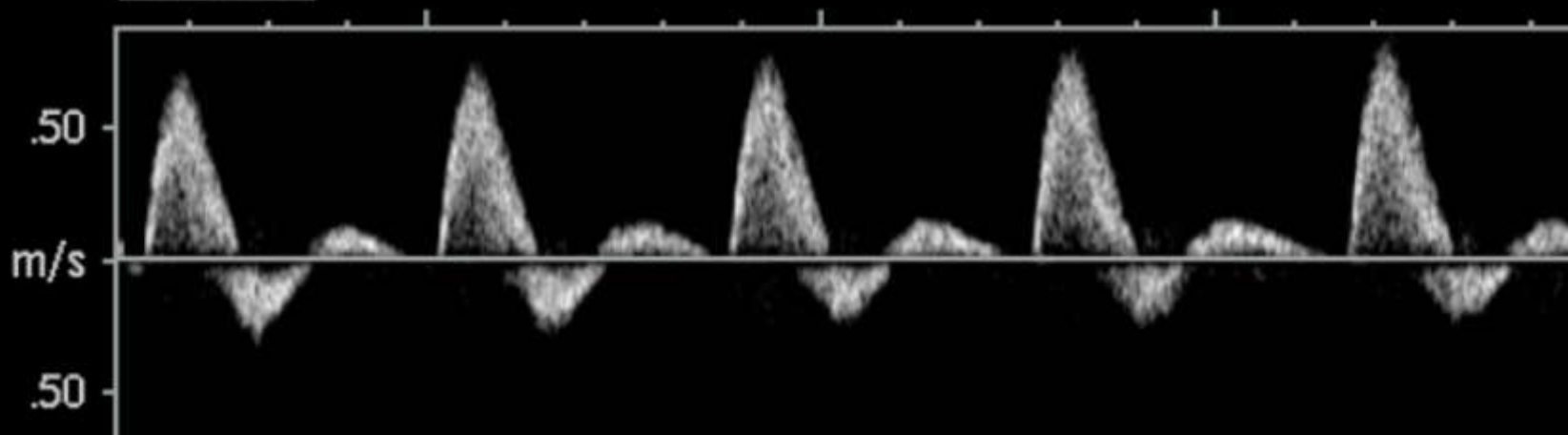
.18

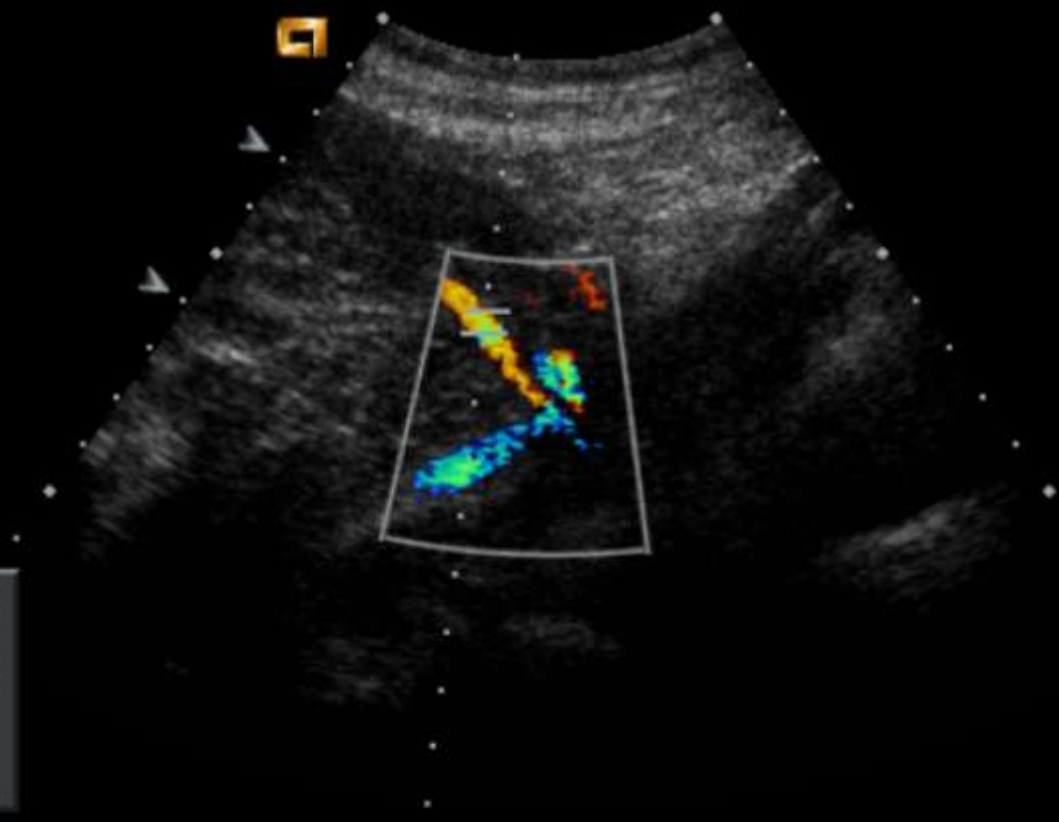


.18



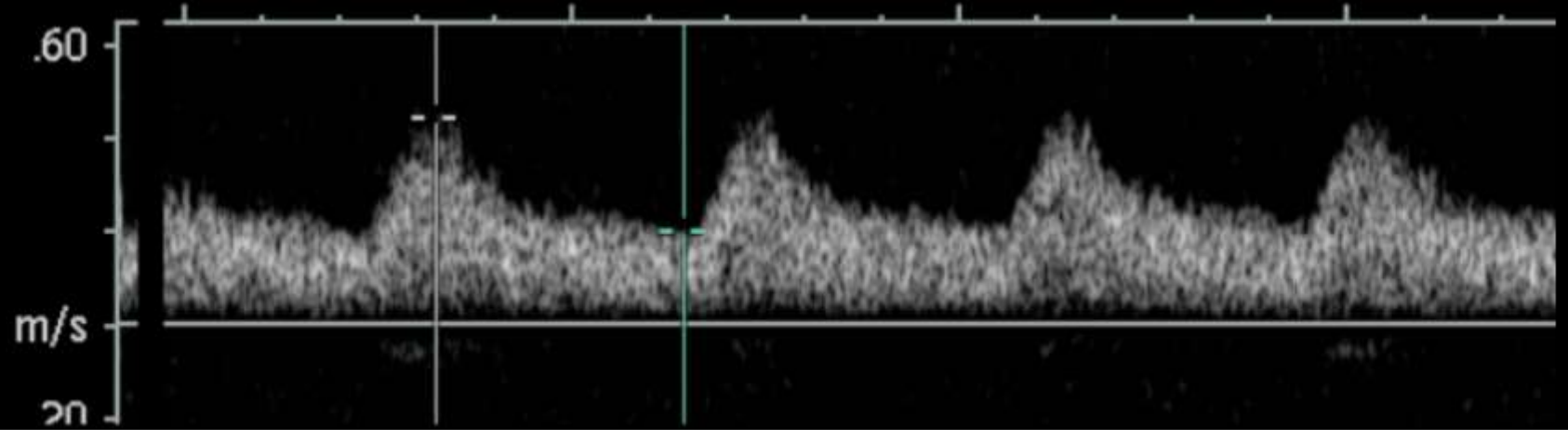
PW:2.5MHz

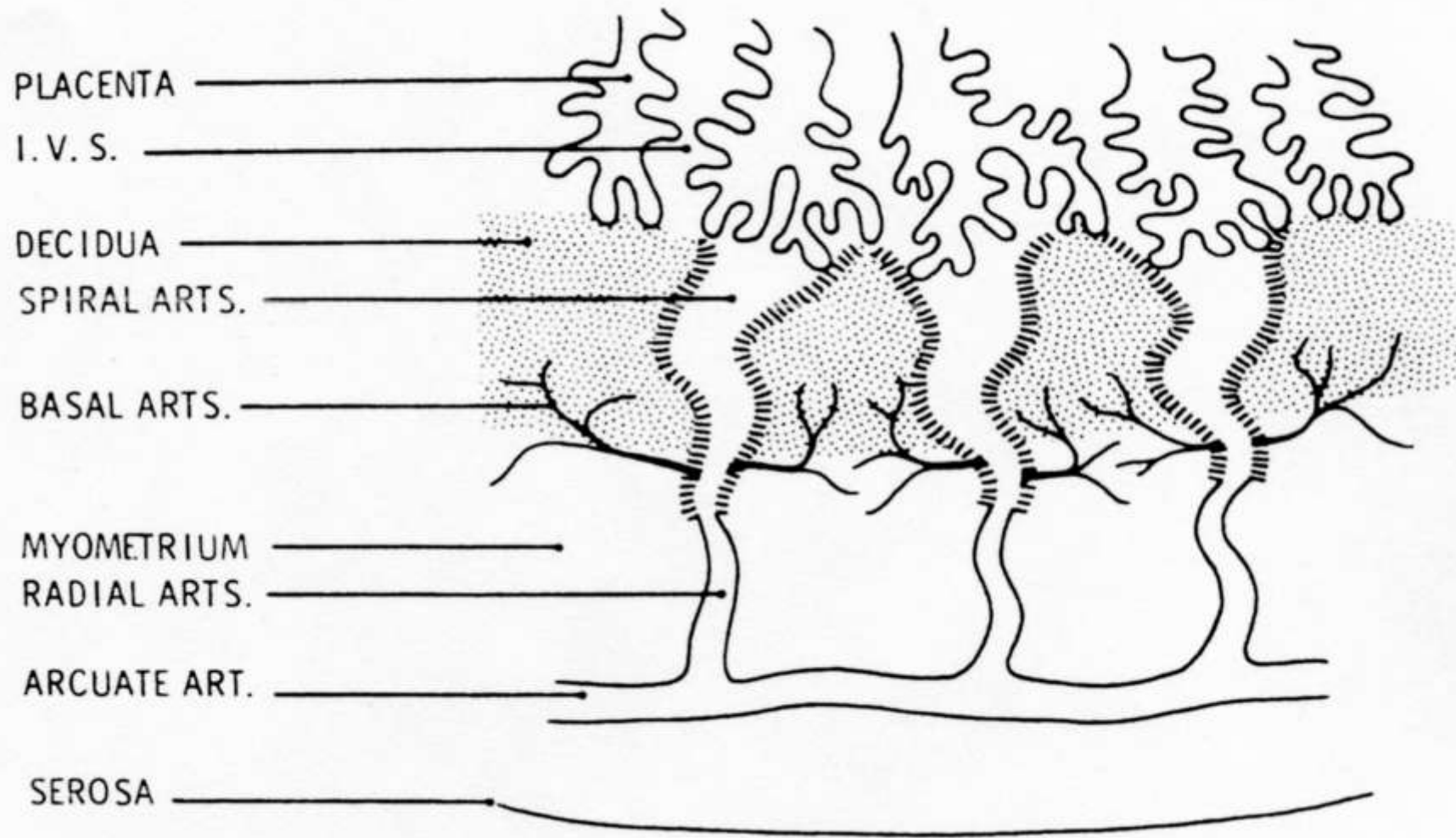




V1 = 0.447m/s  
V2 = 0.204m/s  
RI = 0.54  
S/D = 2.19

PW:2.5MHz





.18



.18



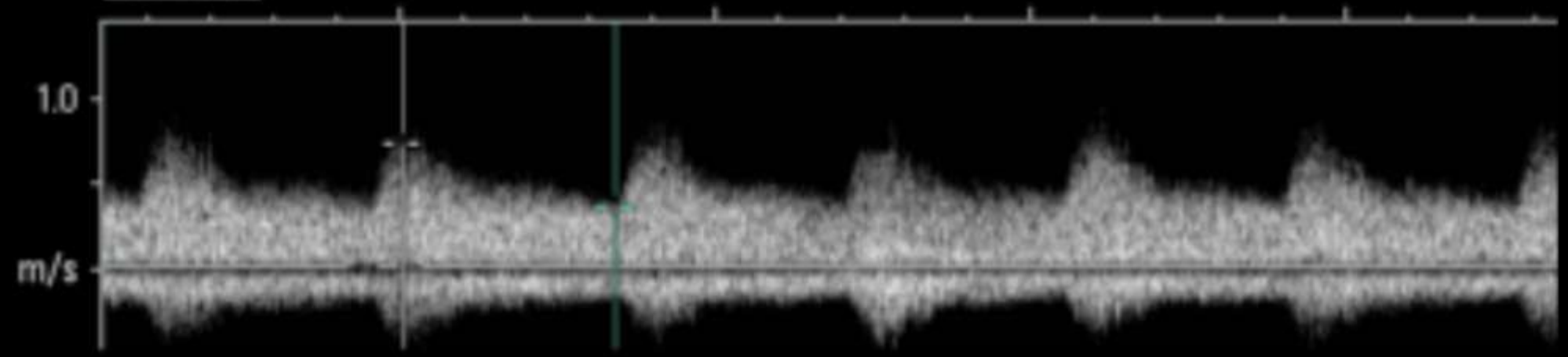
17:10:2  
6C2-S 13st  
H4.0MHz 100m  
OB 6C2  
General /V

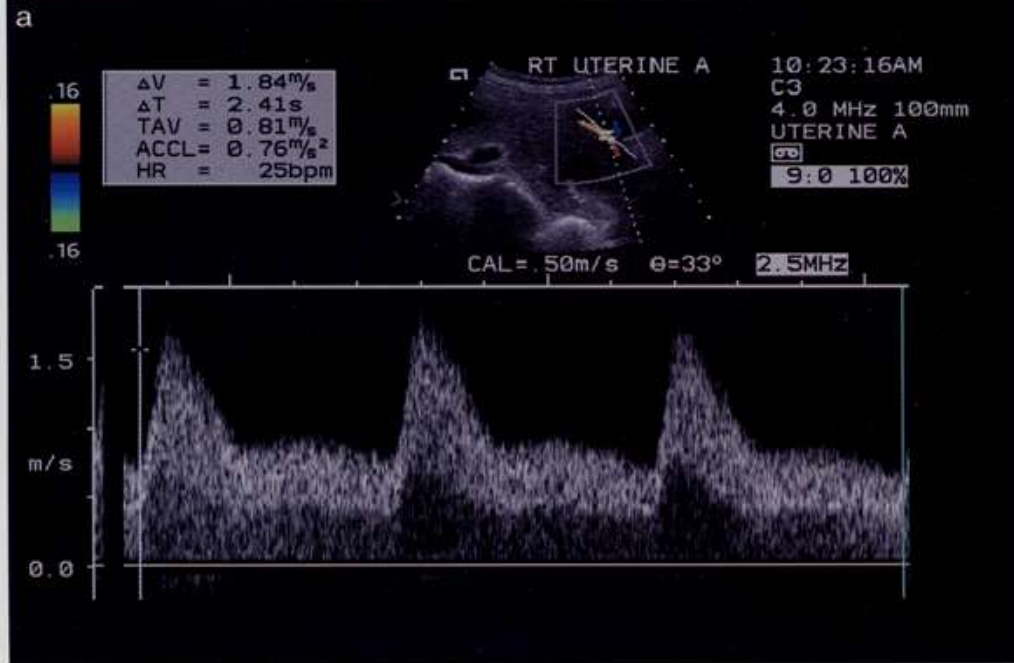
40dB 2 +/- 1/2/  
PW Depth= 28mm  
PW Gate= 4.0mm  
PW Gain=-13dB

Store in progress  
Sweep=50mm/s

V1 = 0.75m/s  
V2 = 0.37m/s  
RI = 0.50  
S/D = 2.00

PW:2.5MHz







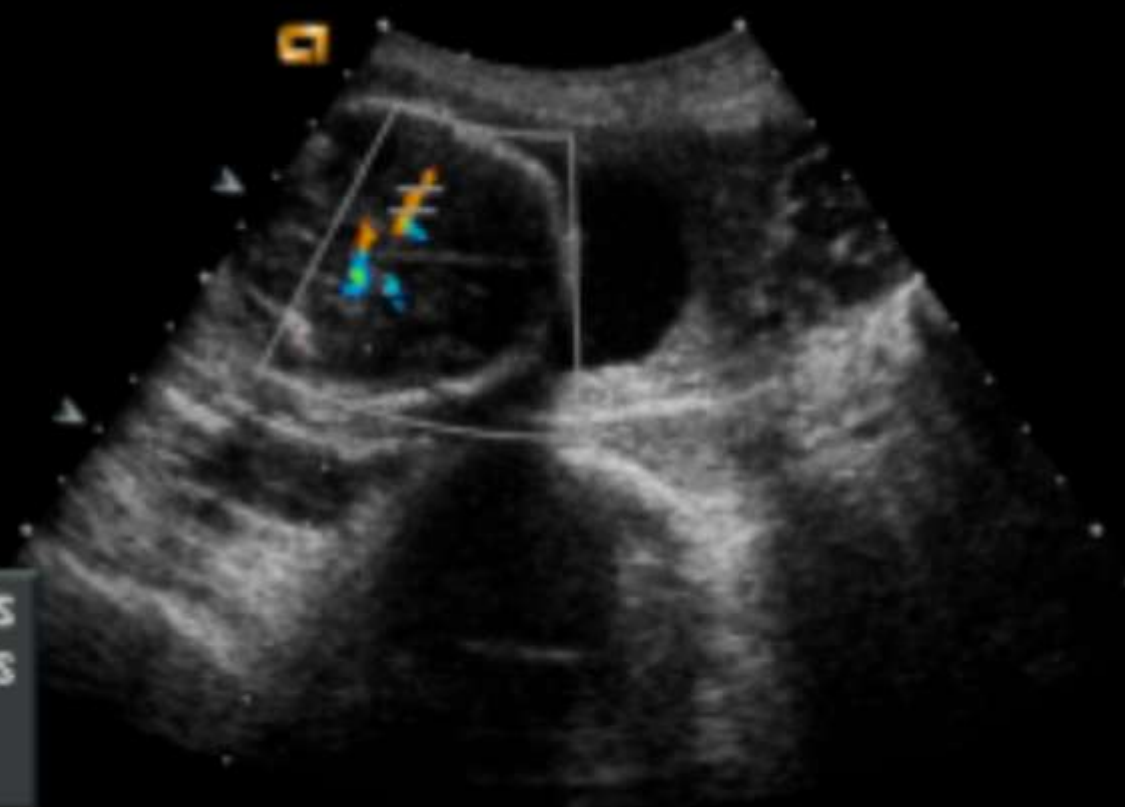
17:15:15

6C2-S 7sec  
H4.0MHz 120mm  
OB 6C2  
General /V

.18



.18

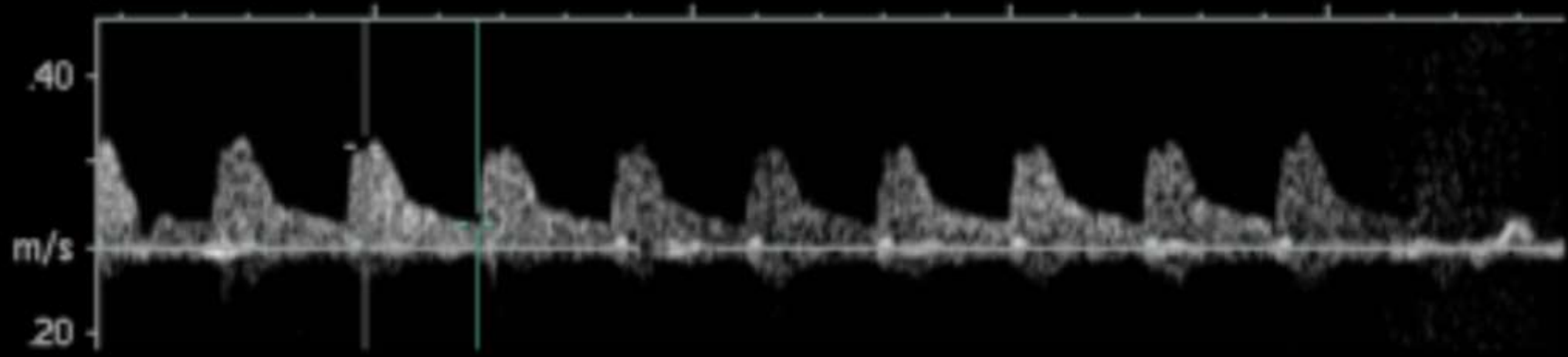


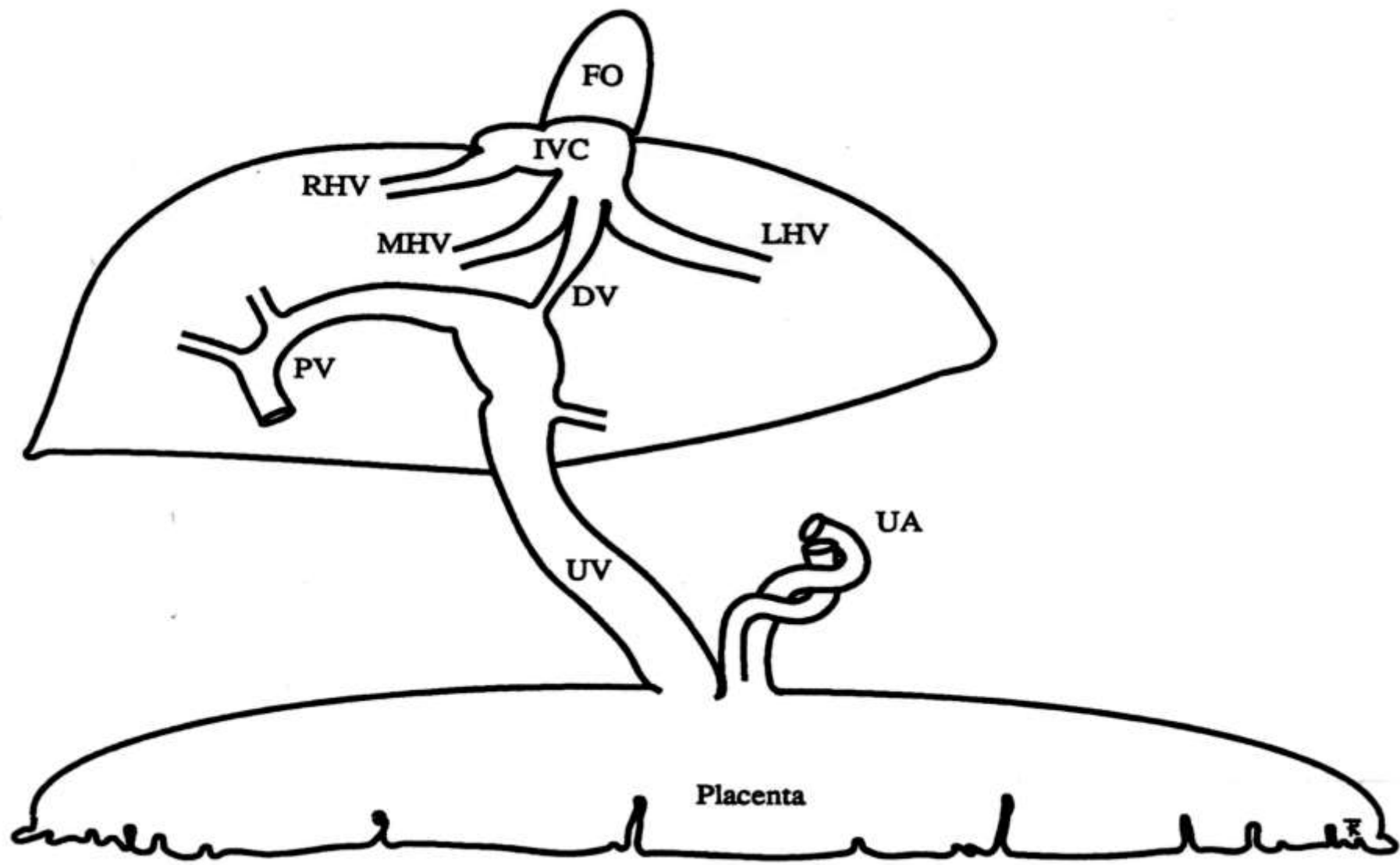
V1 = 0.238m/s  
V2 = 0.055m/s  
RI = 0.77  
S/D = 4.36

40dB 1 +/+1/2/5  
PW Depth= 25mm  
PW Gate= 4.0mm  
PW Gain= -8dB

Store in progress  
Sweep=50mm/s

PW:2.5MHz





22-OCT-99

12:19:37PM

C7

5.0 MHz **R30**

OB/GYN

**60**

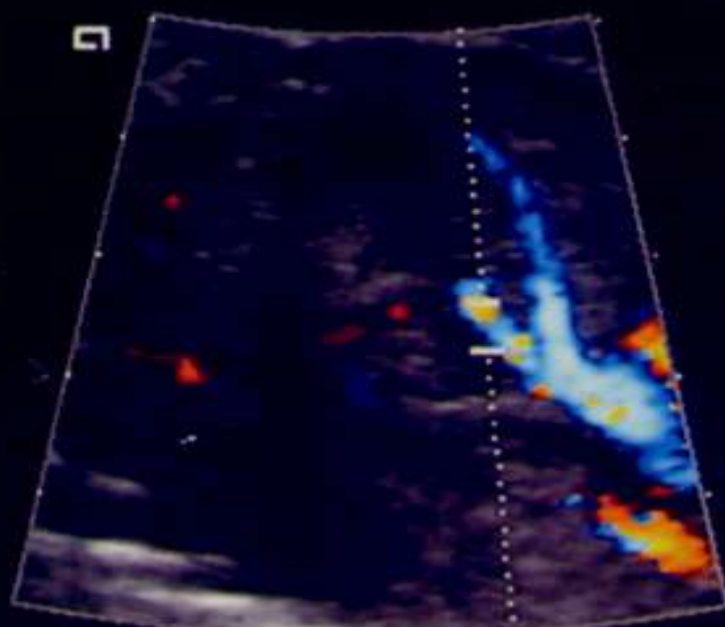
.16 30dB - / - / - / D

4.0mm/1

PW D=, 54mm



.16



INVERTED

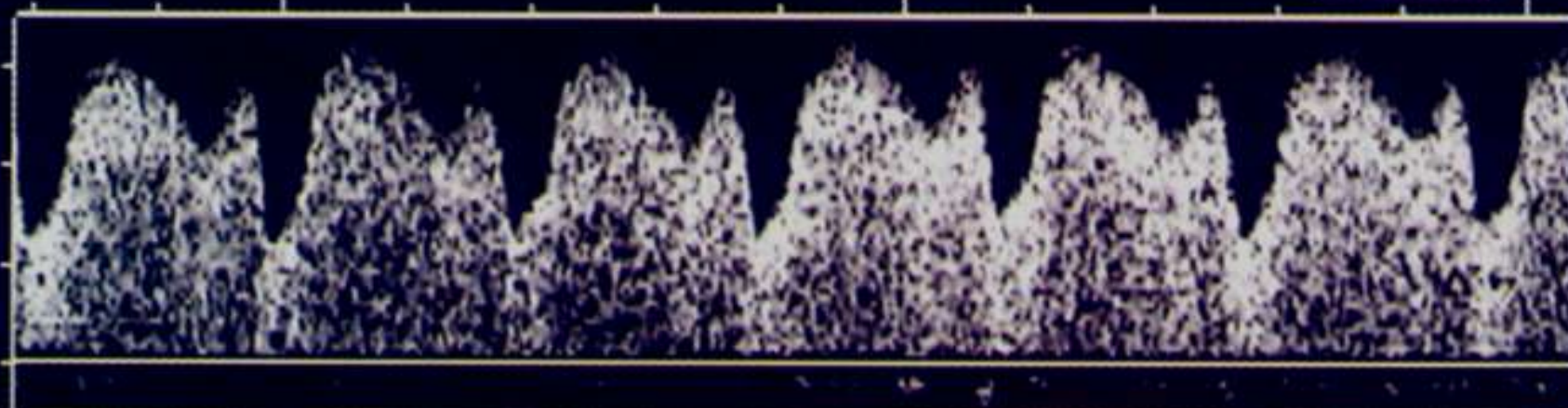
CAL = . 20m/s

**4.0MHZ**

.60

m/s

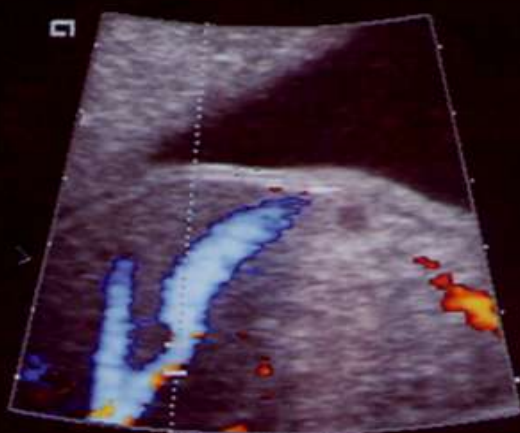
0.0



20 30dB - / - / - / D  
4.0mm/1  
PW D=104mm



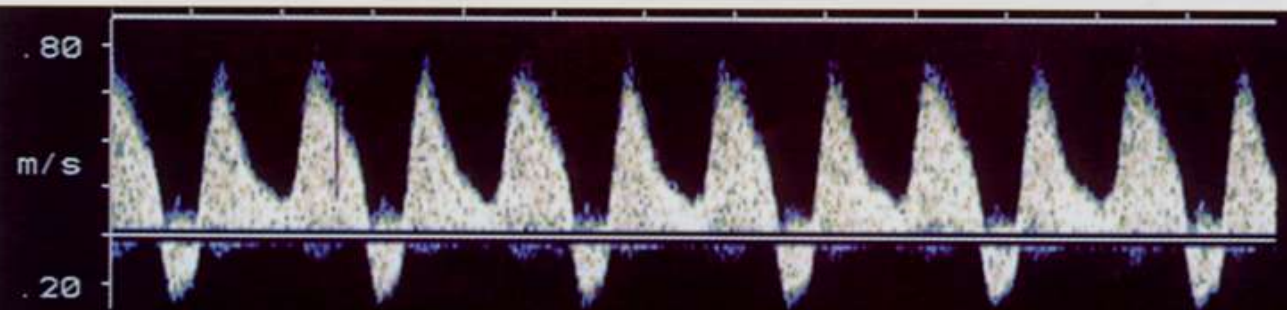
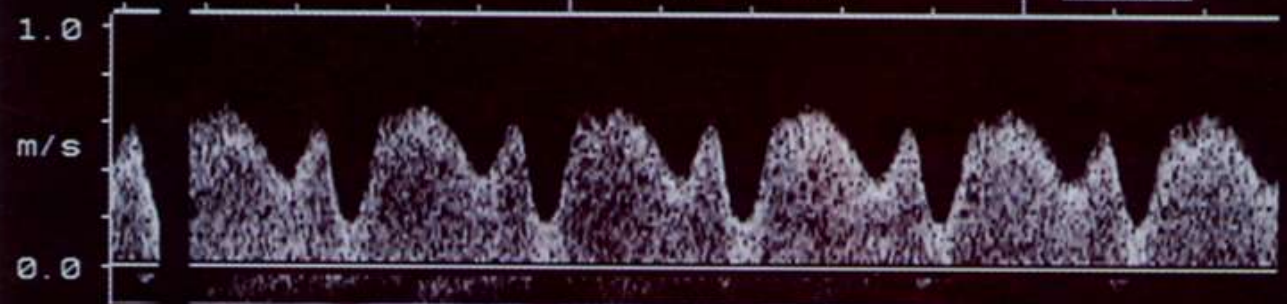
09-DEC-98  
12:16:52PM  
C7  
7.0 MHz **R55**  
OB/GYN  
+0:00:00:00



INVERTED

CAL = .20m/s

4.0MHz



2D/DOPPLER

3-RAINBOW

# **PRENATAL DIAGNOSIS**

## **EMBRYOSCOPY**

**DIRECT, DETAILED OBSERVATION OF FETAL ANATOMY AND INTEGUMENT**

**TRANSCERVICAL / TRANSABDOMINAL**

# **FETAL MEDICINE ULTRASOUND IMAGING**

## **ACCEPTED (PROVEN) BENEFITS**

- 1. BETTER GESTATIONAL AGE ASSESSMENT**
- 2. EARLIER DETECTION OF MULTIPLE PREGNANCIES**
- 3. EARLIER DETECTION OF CLINICALLY UNSUSPECTED  
FETAL MALFORMATIONS**

# **FETAL MEDICINE ULTRASOUND IMAGING**

**ANOMALY SCREENING REMAINS A CONFLICTUAL  
ISSUE**

**BUT**

**A DIAGNOSTIC TEST DEPENDS ON PROPER  
MANAGEMENT AFTER DIAGNOSIS TO BECOME  
EFFICIENT**