2025

KARNATAKA RADIOLOGY EDUCATION PROGRAM

DEPT. OF RADIODIAGNOSIS, JJMMC, DAVANGERE
Mentor: Dr. Sowmya J , Assistant professor
PG Resident: Dr. Lakshmi R

Case- 1- Clinical history

- 28Y/F, no known comorbidities, non- consanguineous marriage
- G3P2L0A0 (Two stillbirth at term)
- 1st trimester scan done on 26/11/24 revealed SLIUP at 11w0d with regular cardiac activity but increased NT- 3mm (>99th percentile). However normal NB, DV flow and no TR noted.
- Patient was suggested review scan at 13 weeks
- Review scan done on 11/12/24 revealed SLIUP at 12w5d with prominent NT- 2.6mm (95th percentile). However normal NB, DV flow and no TR noted.
- Patient was then suggested dual marker assay and TIFFA scan at 16- 18 weeks
- Dual marker assay done on 13/12/2024 – Revealed increased beta- hCG levels and very high PAPPA

IMMUNOASSAY REPORT

DOUBLE SCREENING

TEST	RESULT	UNIT	CORR MOM
Free Beta HCG,Serum	105	ng/ml	1.94
PAPP-A	27872	mIU/L	3.26

The MoMs have been corrected according to maternal weight and ethinic origin.

For anomaly scan correlation / NIPT if clinically indicated

Impression (D-MST)

TRISOMY 21	The calculated risk for trisomy 21 is (1:1754) below the cu off which represent a low risk.
TRISOMY 18 SCREENING	The Calculated risk for trisomy 18 is < 1:100000 which indicate a low risk.
TRISOMY 13 SCREENING	The Calculated risk for trisomy 13 is < 1:100000 which indicate a low risk.
THE FIRST TRIMESTER DOUBLE SCREENING	SCREEN NEGATIVE

For anomaly scan correlation / NIPT if clinically indicated

NOTE — NT - 2.6 mm Suggested TIFFA SCAN for further evaluation.

Pregnancy, Calculated EDD: 18/06/2025 (MAEDD: 29)

29	18/06/2025	11/09/2024	CRL
LMP DATE: 10/09/2024	Not stated		1
No			
	140		
	At term		

Notes

NOTE CREATED FOR	SAMPLE ID / SCAN DATE	NOTE TEXT	NOTE CREATED AT
Biochemistry	84912423877	PAPP-A Corr. MoM > 2.0	14/12/2024

Biochemistry

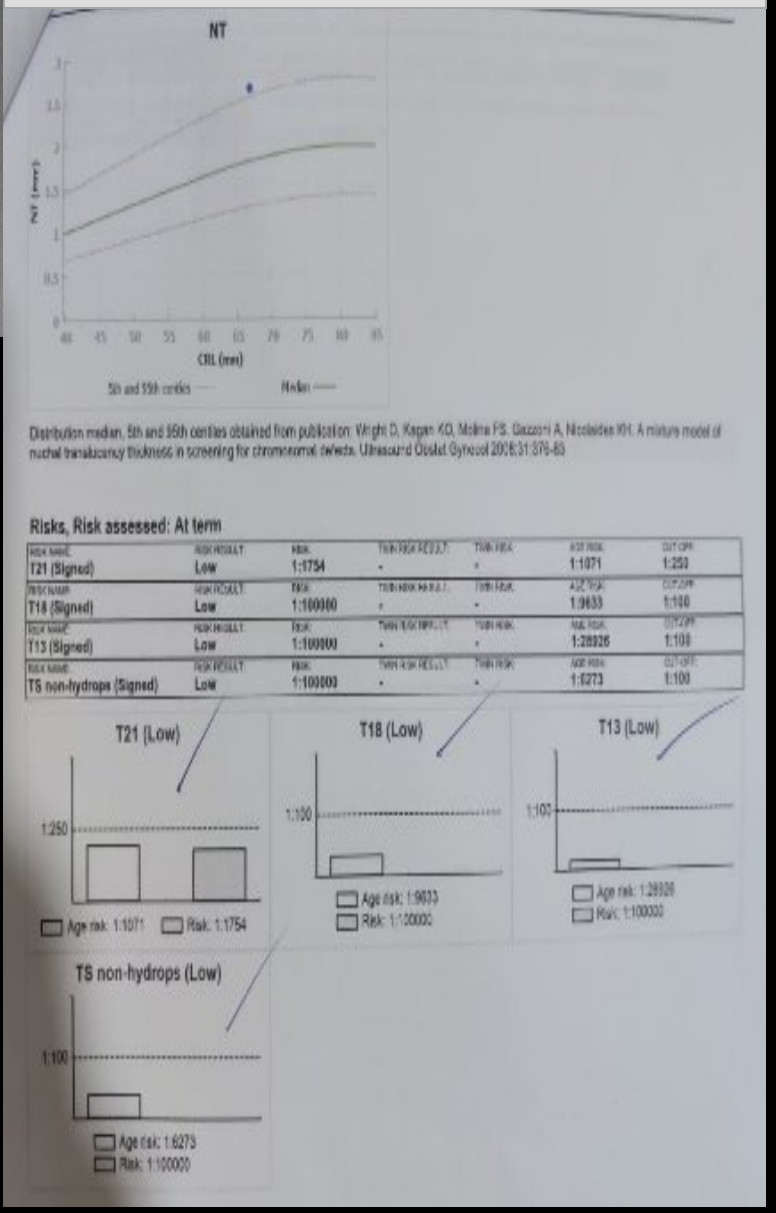
SAMPLE ID		WEIGHT (KG)	TEST AT SAMPLE DATE (W + D)
84912423877	12/12/2024	37	13 w 1 d
SAMPLE TYPE: Serum			

Ultrasound

SCAN DATE	CRL	BPD	FL
11/12/2024	67	-	-
GEST AT SAMPLE DATE (W + D)	CRL (MM)	BPD (MM)	HC (MM)
13 w 0 d	-	-	-
GEST AT MANUAL ENTRY (W + D)	SAMPLE TYPE	WEIGHT (KG)	
0 w 0 d	-	-	

Tests

TEST	SAMPLE ID	DATE	GEST AT SAMPLE DATE (W + D)	VALUE	UNIT	CORR MOM	WEIGHT (KG)
hCGb (Signed)	84912423877	12/12/2024	13 w 1 d	105	ng/mL	1.94	37
PAPP-A (Signed)	84912423877	12/12/2024	13 w 1 d	27872	mIU/L	3.26	37
NB (Signed)	-	11/12/2024	13 w 0 d	Present	-	-	-
NT (Signed)	-	11/12/2024	13 w 0 d	2.6	mm	1.79	-

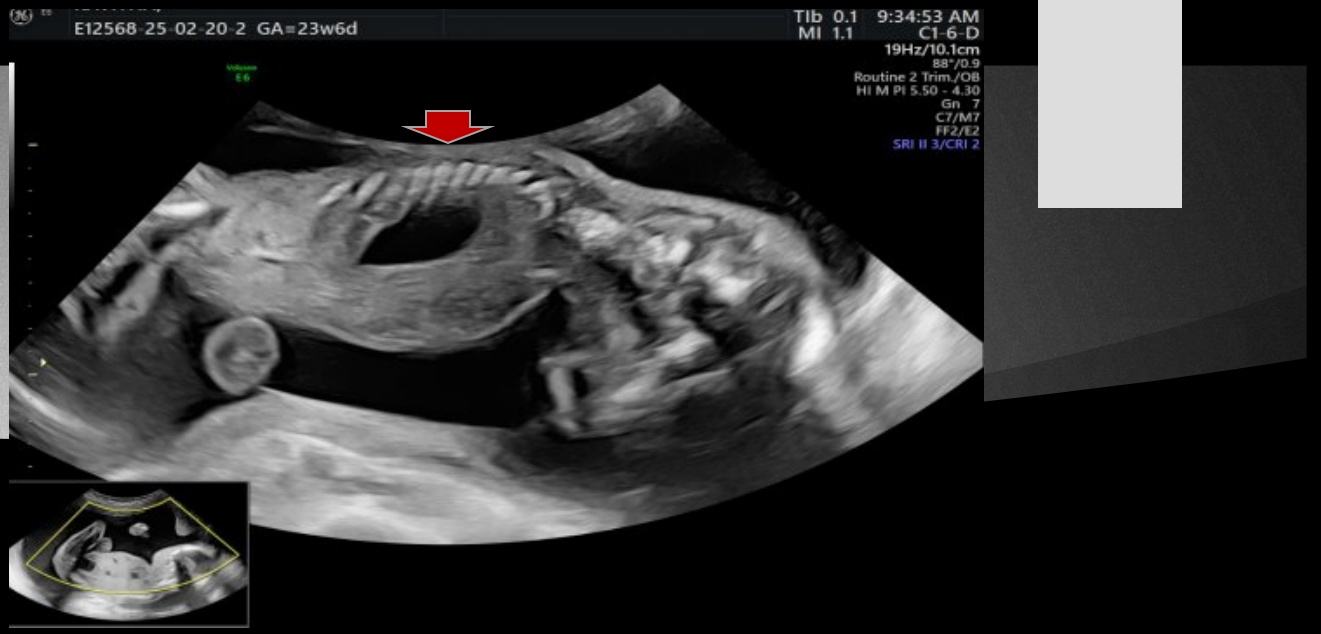


Distribution median, 5th and 95th centiles obtained from publication: Wright D, Kagan KO, Molina FS, Gazzoni A, Nicolaides KH. A mixture model of nuchal translucency thickness in screening for chromosomal defects. Ultrasound Obstet Gynecol 2008;31:376-80

Risks, Risk assessed: At term

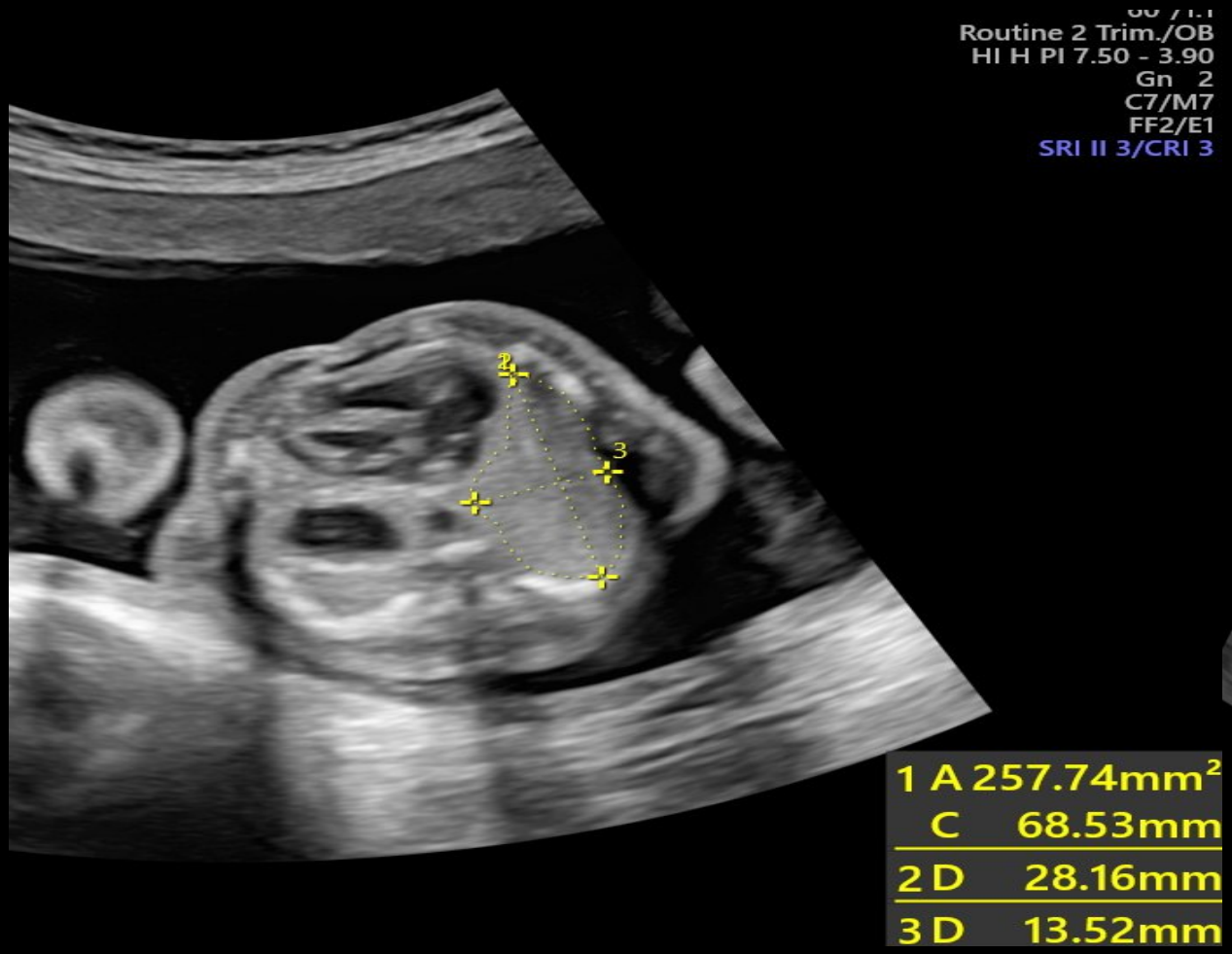
T21 (Signed)	Low	1:1754	-	-	1:1071	1:250
T18 (Signed)	Low	1:100000	-	-	1:9633	1:100
T13 (Signed)	Low	1:100000	-	-	1:28926	1:100
TS non-hydrops (Signed)	Low	1:100000	-	-	1:6273	1:100

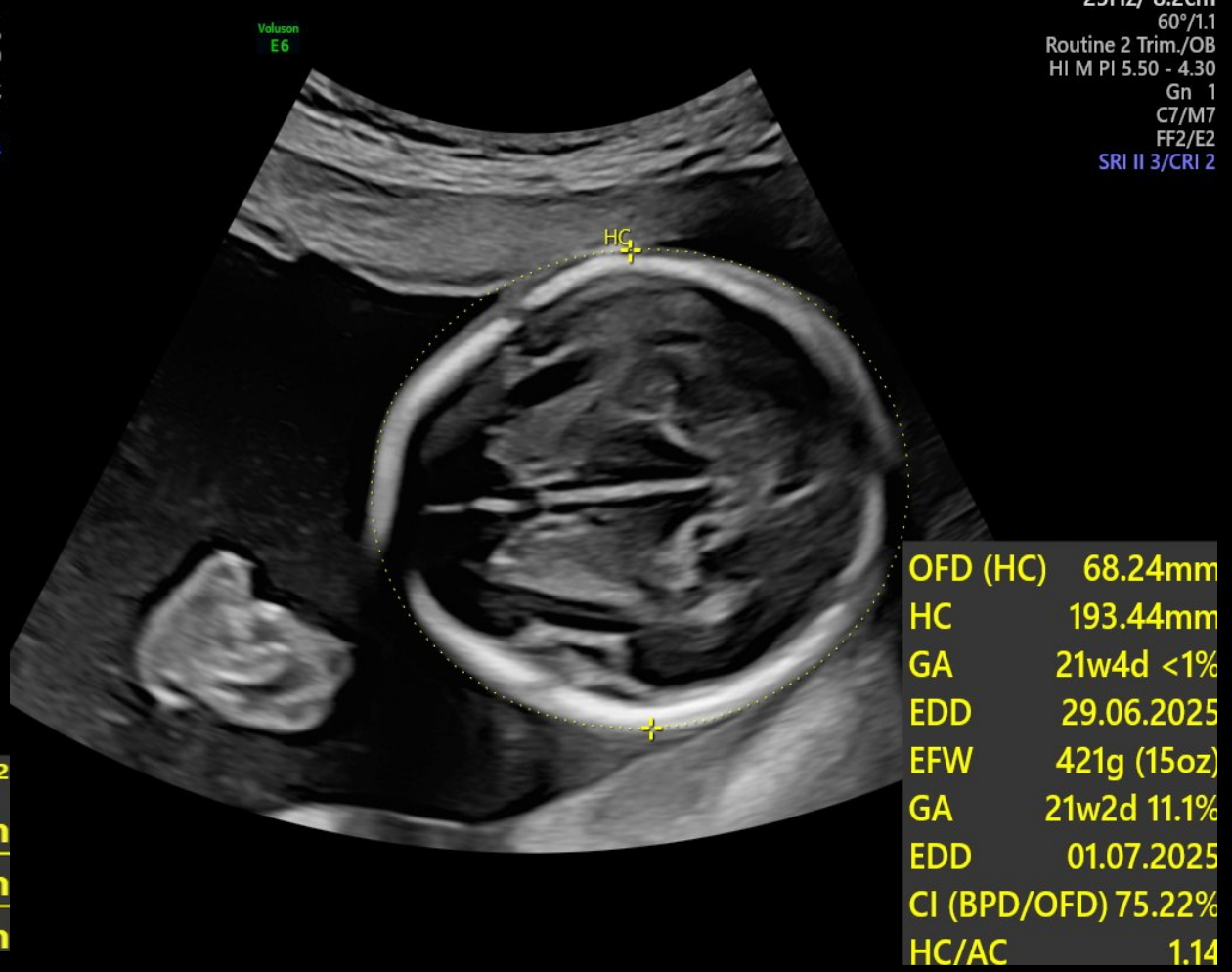
- Mid-trimester anomaly scan done on 13/2/2025 revealed SLIUP at 21-22 weeks with ? Left congenital diaphragmatic hernia/ Eventration of left hemidiaphragm with mild polyhydramnios AFI- 16 cm (SLVP: 6cm). However, no other defined lethal anomalies.
- Repeat anomaly scan done at another center on 15/2/2025 revealed SLIUP at 21w4d with fetal stomach in high position in left side, partially in abdomen and in lower thorax with no mass effect on cardiac position- most likely due to eventration of left hemidiaphragm.
- So, patient was referred to MRI for further evaluation and confirmation



Fetal Chest: Thorax- Normal in shape. Cardia is normal in position with apex pointing towards left. 4 chambered, LVOT, RVOT ,Three vessel view, three vessel tracheal view, ductal and aortic arch, bicaval view are normal.
Diaphragm: Right dome of diaphragm is intact. E/o herniation of stomach bubble (more than half) noted into the left hemithorax likely due to defect in the posterior aspect of left dome of diaphragm/ significantly elevated left dome of diaphragm (eventration).
Lungs –Left hemilung is reduced in size due to left diaphragmatic hernia (left upper lung visualised). No focal lesions seen in left hemi lung. Right hemi lung appear normal in echogenicity. No focal lesions seen.

Fetal abdomen: Situs maintained. More than half of stomach bubble appears to be within the left hemithorax.
Fetal both kidneys appear normal. Fetal urinary bladder appears normal.





Lung-to-head (LHR) ratio: Left CDH: - By tracing area method: Area traced is 257.74mm2. Fetal HC is 193.44mm. QLI (Quantitative lung index): 0.7 – (< 1.0: poor prognosis, 1.0-1.4: 61% survival). (< 0.6 – very poor prognosis - < 1st percentile- small lung for 16-32 weeks).

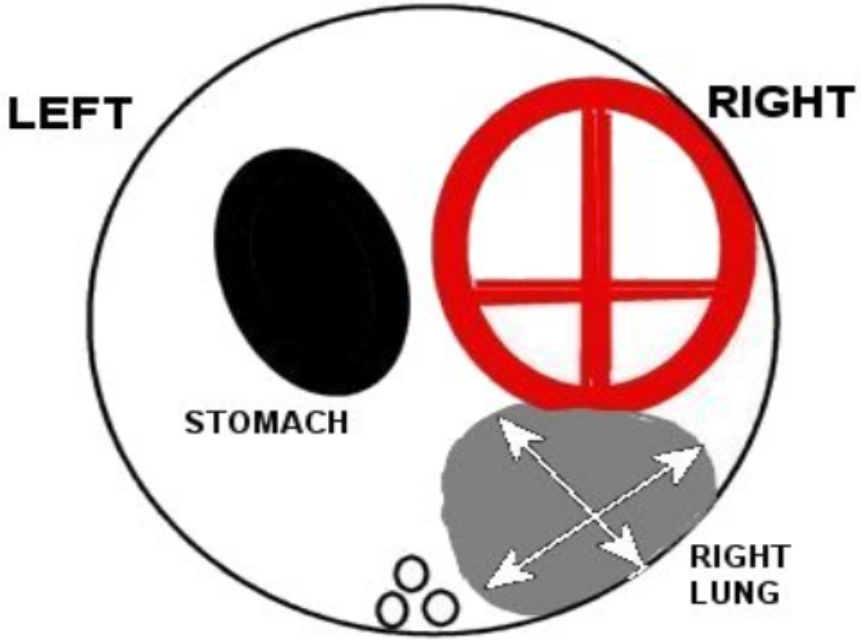
The Lung area to Head circumference Ratio (LHR),

The lung-to-head circumference ratio (LHR) is a sonographic measure proposed to identify fetuses with congenital diaphragmatic hernia (CDH) that have a poor prognosis (4).

The lung area contralateral to the CDH was originally obtained by taking the product of the longest two perpendicular linear measurements of the lung measured at the level of the 4-chamber view of the heart on a transverse scan of the fetal thorax. The product is divided by the head circumference (HC) to obtain the LHR.

Lung area = Length 1 X Length 2

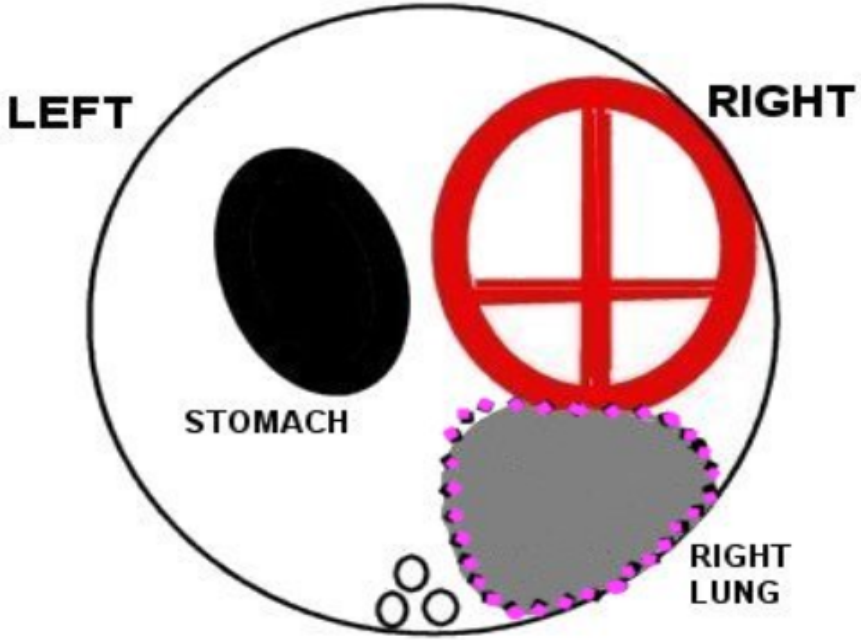
The Lung area to Head circumference Ratio (LHR) = Lung area / Head circumference

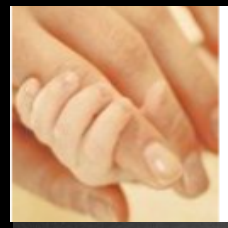


In a cross-sectional study of 650 normal singleton pregnancies Peralta and associates (5) found manual tracing of the lung to be a more reproducible way of measuring the lung area. In addition, the longest diameter method overestimated the right and left lung areas by about 45% compared to the tracing method.

Using the tracing method the lung area contralateral to the CDH is obtained by tracing of the limits of the lung.

The Lung area to Head circumference Ratio (LHR) = Lung area / Head circumference





perinatology.com

The Lung area to Head circumference Ratio (LHR), The Observed/expected lung-to-head ratio (o/e LHR), and The Quantitative Lung Index (QLI)

1. Select Congenital diaphragmatic hernia (CDH) is on the ◉ **Left side** ○ **Right side**

Enter Parameters for Lung Area

2. Longest Diameter Method	**3.** Tracing Method
Enter: Length 1 [ ] mm	Enter: Area traced= [257] mm2
Enter: Length 2 [ ] mm	

4. Enter Fetal Head Circumference [193] mm

5. Enter Gestational Age [23] weeks [6] days

Calculate Clear (1 cm ^2 = 100 mm^2)

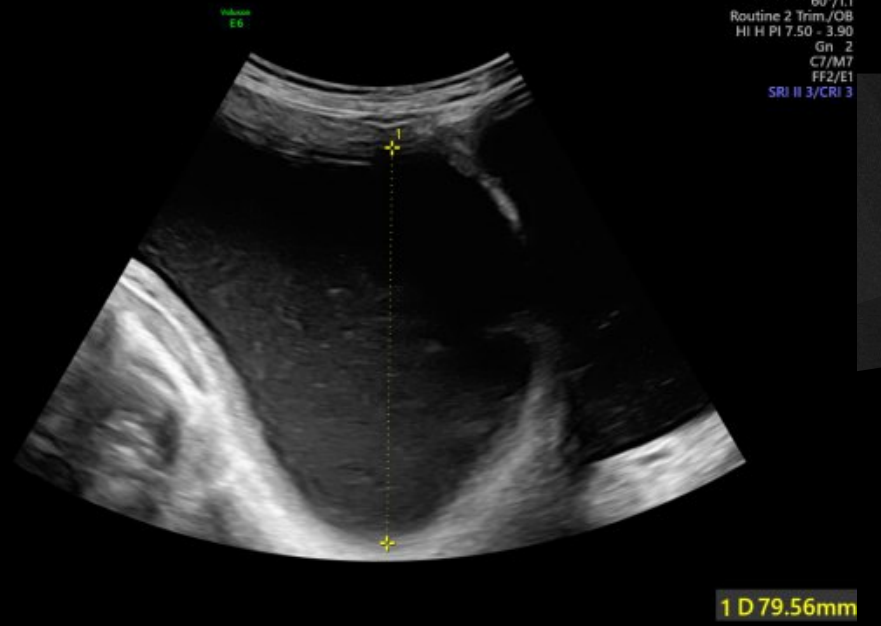
Calculations

Longest Diameter Method	Tracing Method
Observed LHR= [0]	Observed LHR= [1.331606]
Expected LHR (Jani)= [3.33] Expected LHR (DeKoninck)= [3.77]	Expected LHR(Peralta)= [2.35] Expected LHR(Jani)= [2.3] Expected LHR (DeKoninck)= [2.43]
O/E LHR (Jani) = [0.00] % O/E LHR (DeKoninck) = [0.00] %	O/E LHR (Peralta) = [56.66] % O/E LHR (Jani) = [57.89] % O/E LHR (DeKoninck) = [54.79] %
QLI= [0]	QLI= [0.689951]

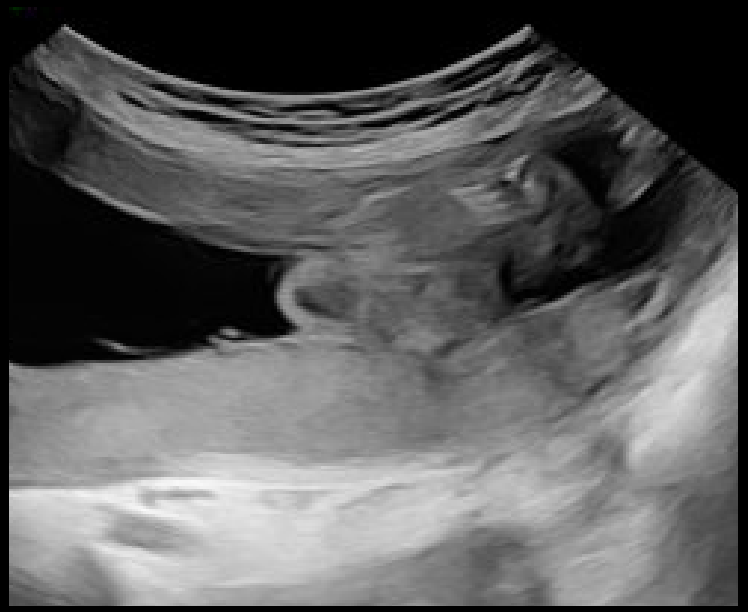
1) LHR <=1, prognosis is poor.
The prognosis is poorer still if liver is in the thorax.
2) LHR 1.0 to 1.4, extracorporeal membranous oxygenation (ECMO) is often needed.
3) LHR >1.4, prognosis is better

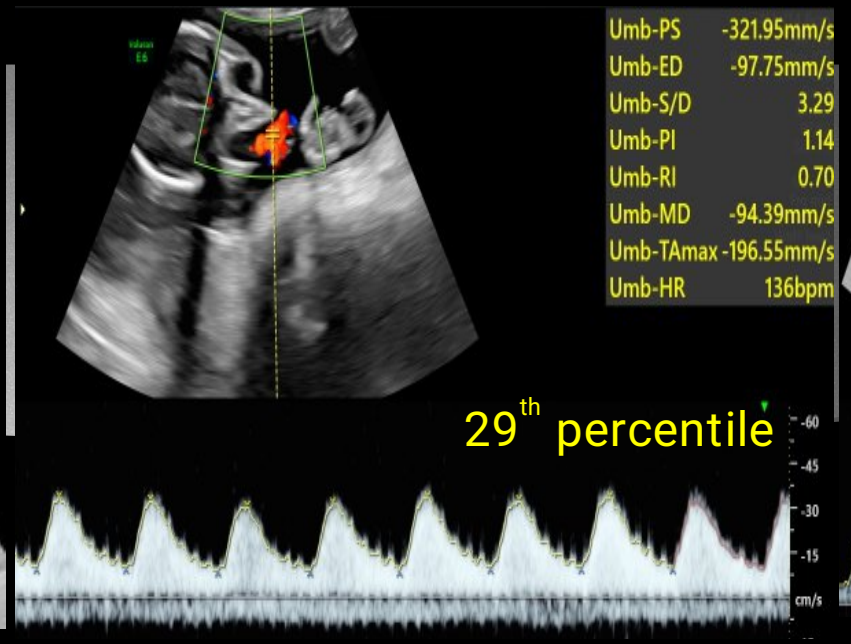
Quantitative lung index (QLI) = lung area/(HC/10)^2
The 50th percentile for QLI is at ~1 for gestational age between 16-32 weeks. A small lung (1st percentile) is QLI < 0.6

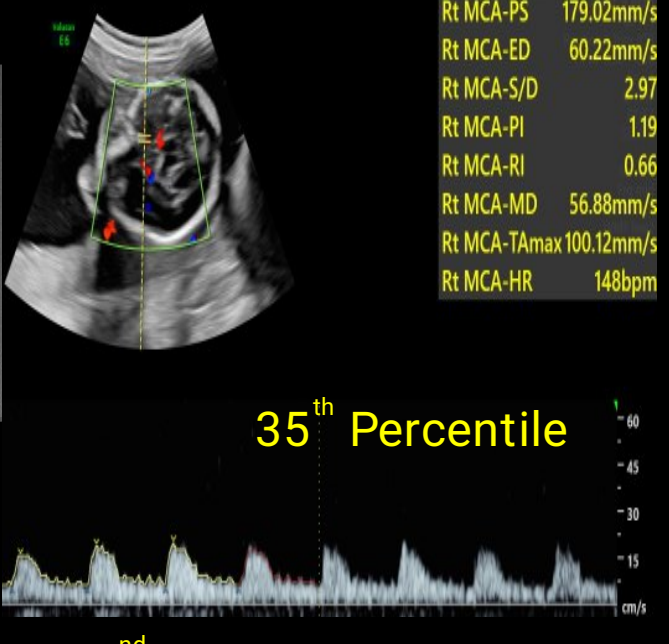
O/E LHR is more than 45% - 100% survival in patients with isolated CDH (on ultrasound)
O/E LHR is less than 25% Few survivors



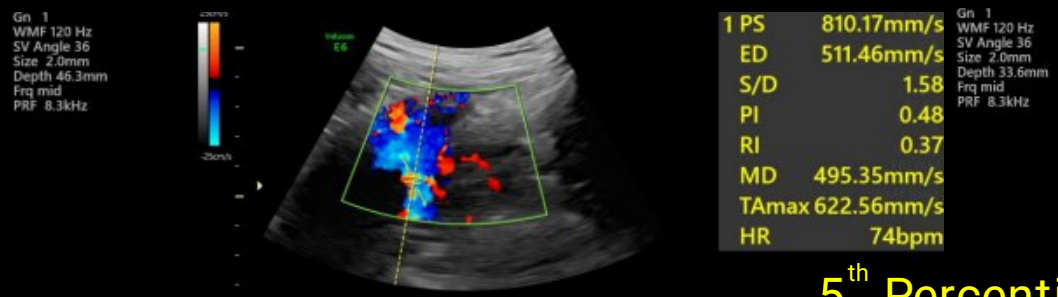
All parameters are less than 3rd percentile. Mild polyhydramnios noted (SLVP: 8cm). However, fetal spine and extremities – Normal

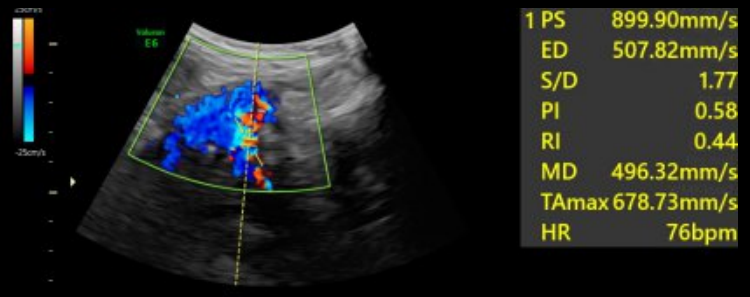




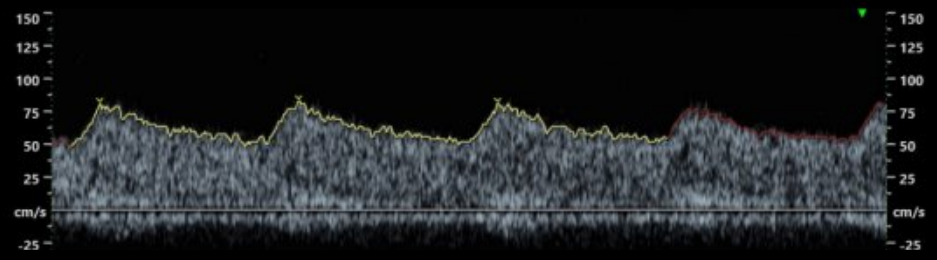


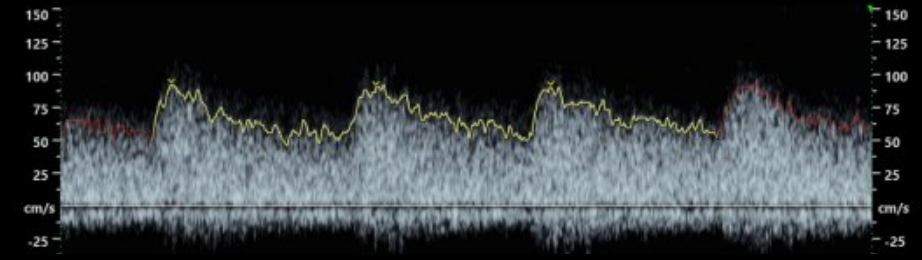
CPR- 42nd Percentile





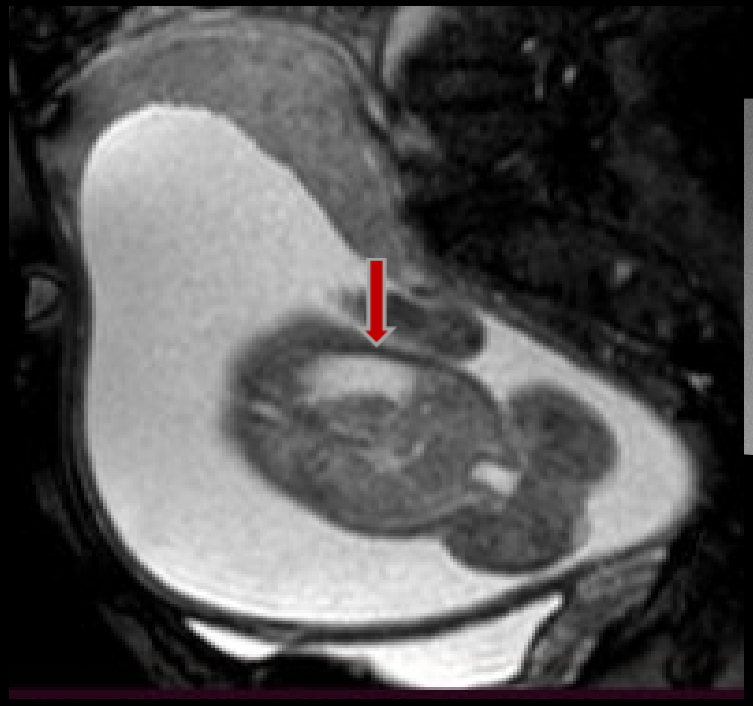
5th Percentile

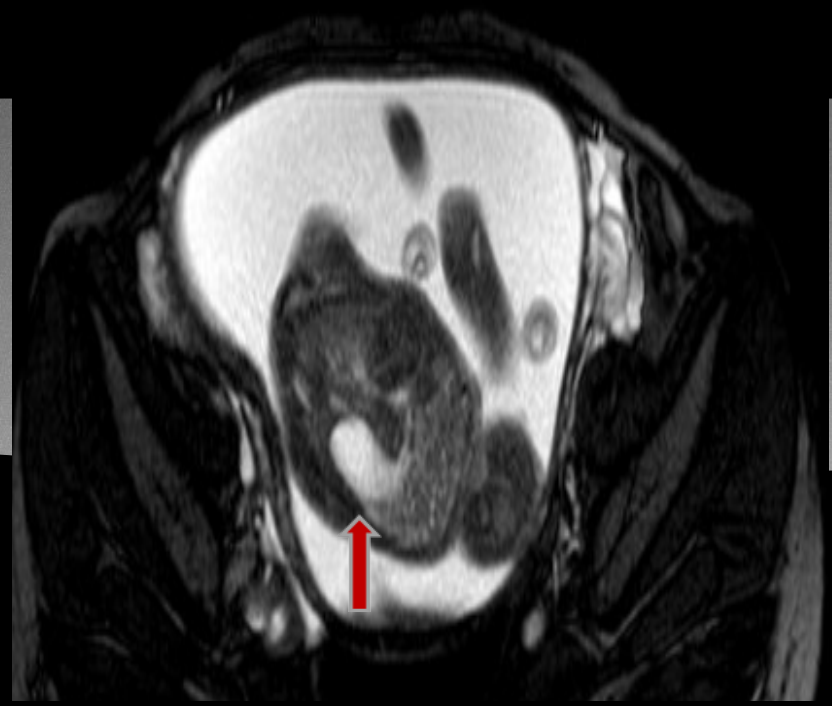




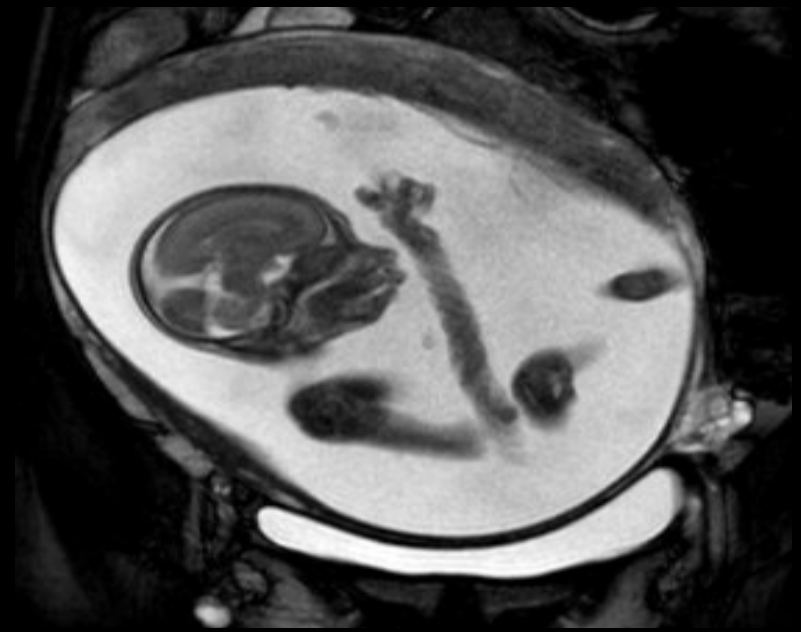
Fetal head, face and neck- Normal, Umbilical cord- Normal. Umbilical artery, MCA, bilateral uterine artery doppler indices normal.

BTFE TSE : coronal plane of fetal abdomen section shows herniation of stomach bubble (more than half) noted into the left hemithorax likely due to defect in the posterior aspect of left dome of diaphragm/ significantly elevated left dome of diaphragm (eventration) with visualisation of left upper lung. Right hemidiaphragm normal.

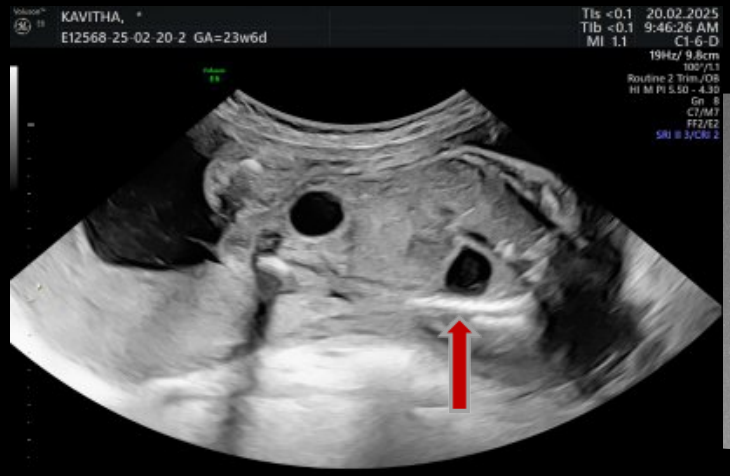


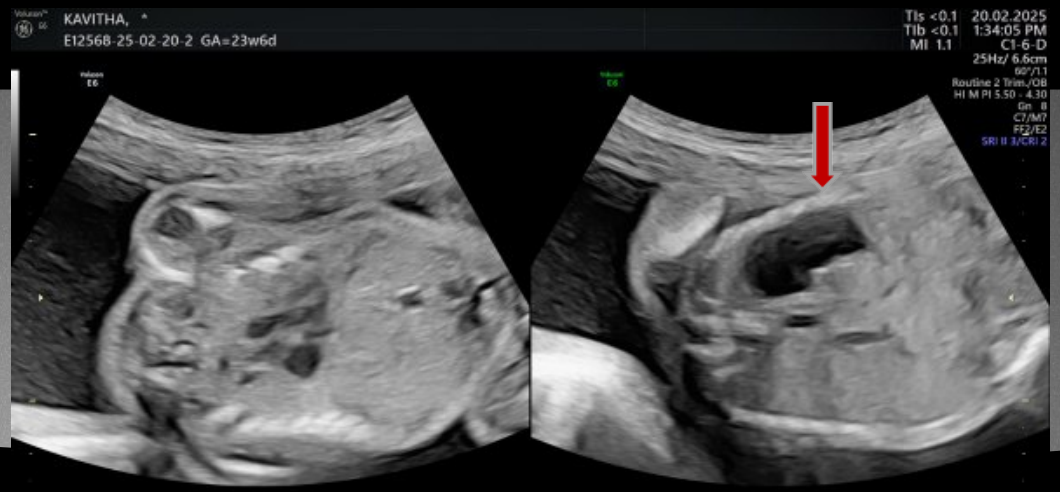


BTFE and single shot T2 sequences - coronal plane showing fetal abdomen section shows herniation of stomach bubble (more than half) noted into the left hemithorax likely due to defect in the posterior aspect of left dome of diaphragm/ significantly elevated left dome of diaphragm (eventration) with visualisation of left upper lung. Right hemidiaphragm normal.



BTFE- Sag plane of fetal head – shows normal facial profile and single shot T2 sequence- axial plane of fetal head shows normal sulcation, gyration, layers of supratentorial brain, white matter development.





Exam Type:

Name		DOB		Sex	Female
Pat. ID		Perf. Phys.			
		Ref. Phys.			
Indication		Sonogr.			

LMP	06.09.2024	GA(LMP)	23w6d	EDD(LMP)	13.06.2025	G	Ab
DOC		GA(AUA)	21w2d	EDD(AUA)	01.07.2025	P	Ec

EFW (Hadlock)	*Value*	*Range*	*Age*	*Range*	*GP*	*Williams*
AC/BPD/FL/HC	417g (15oz)	± 61g	21w2d			10.7%

2D Measurements	*AUA*	*Value*	*m1*	*m2*	*m3*	*Meth.*	*GP*	*Age*
BPD (Hadlock)	☑	51.30 mm	52.37	53.27	51.30	last	<1%	21w4d
OFD (HC)		66.52 mm	68.14	65.18	66.25	avg.		
HC (Hadlock)	☑	186.75 mm	191.76	183.65	184.84	avg.	<1%	21w0d
HC* (Hadlock)	☐	18.58 cm	19.03	18.68	18.55		<1%	20w6d
AC (Hadlock)	☑	170.10 mm	180.16	174.09	170.10	last	3.5%	22w0d
FL (Hadlock)	☑	33.84 mm	35.74	33.84		last	<1%	20w4d
Cereb (Hill)	☐	22.69 mm	22.69			avg.	5.8%	21w1d
CM		5.02 mm	5.02			avg.		

2D Calculations

CI (BPD/OFD)	77.14% (70 - 86%)	FL/BPD	65.89% (71 - 87%)
FL/HC (Hadlock)	0.18 (0.19 - 0.21)	FL/AC	19.87% (20 - 24%)
HC/AC (Campbell)	1.10 (1.05 - 1.21)		

Impression

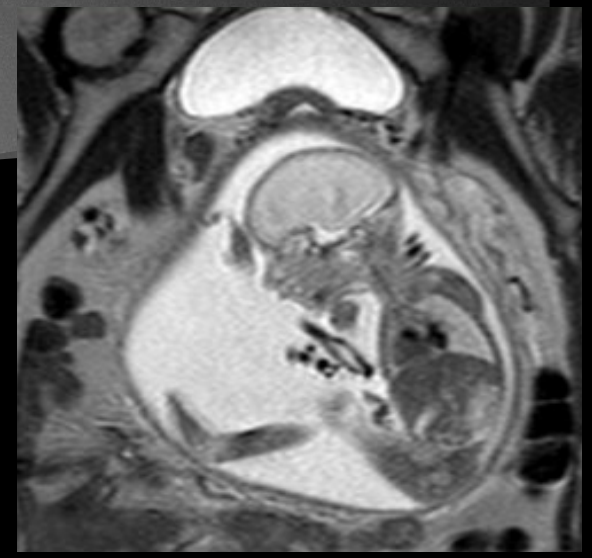
- Single Live Intrauterine Gestation corresponding to 21 weeks 5 days (as per current scan) with mild polyhydramnios
- Gestational age assigned as per LMP: 23weeks 6day with EDD: 13/06/2025
- All parameters are less than 3rd percentile, however doppler indices normal
- Negative for screening for PIH. No evidence of Utero-placental or placenta-fetal insufficiency.
- F/S/O Grade-I early onset Intrauterine growth restriction with mild polyhydramnios
- Herniation of stomach bubble (more than half) into the left hemithorax likely due to defect in the posterior aspect of left dome of diaphragm/ significantly elevated left dome of diaphragm (eventration) Features likely s/o Left sided Congenital Diaphragmatic hernia (Likely Bochdalek hernia)/ severe left diaphragmatic eventration

(QLI as per tracing method: 0.7 (<1.0: poor prognosis, 1.0-1.4: 61% survival))

[Suggested close follow-up after 1 month and amniocentesis to rule out chromosomal anomalies]

Case-2- 32-year-old, non-consanguineous marriage,

G2P1L1A0 – G2- Present pregnancy- 23w0d



SSFSE coronal and sag section shows stomach bubble within abdomen on left, heart pushed to right hemithorax and with e/o elevated left hemidiaphragm with minimal residual left upper lung. Right hemidiaphragm normal.
BTFE sag section shows herniation of left lobe of liver into left hemi-thorax with possible hernial sac.
Cardia pushed to right hemithorax with apex pointing towards left. Stomach bubble within the abdomen on left.
Significantly elevated anterior aspect of left dome of diaphragm/ likely defect in the anterior aspect of left dome of diaphragm with herniation of left lobe of liver (POORER PROGNOSIS) into thorax with possible hernial sac

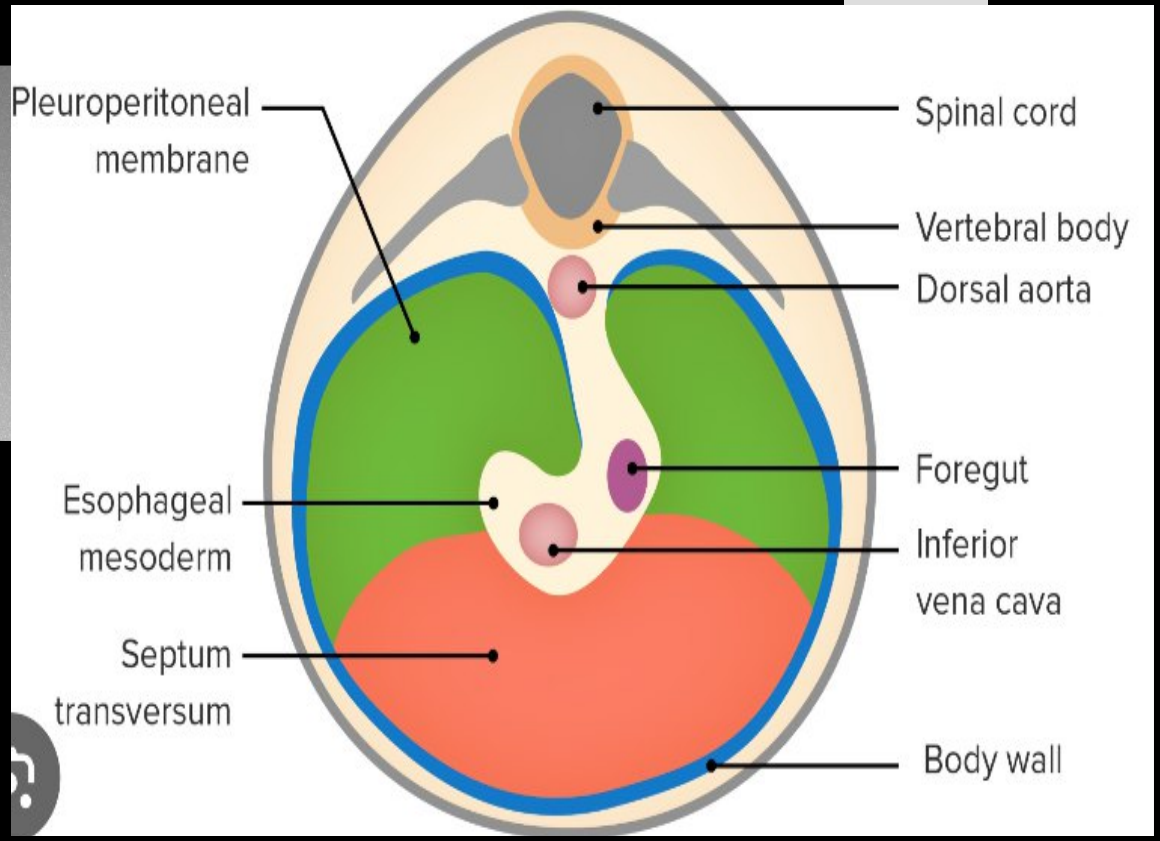
Impression

Single Live Intrauterine Gestation corresponding to 23 weeks 3 days (as per current scan)

- Cardia pushed to right hemithorax with apex pointing towards left. Stomach bubble within the abdomen on left.
- Significantly elevated anterior aspect of left dome of diaphragm/ likely defect in the anterior aspect of left dome of diaphragm with herniation of left lobe of liver (POORER PROGNOSIS) into thorax with possible hernial sac.
- Features likely s/o Left sided Congenital Diaphragmatic hernia with herniation of left lobe of liver with possible hernial sac / Severe left eventration
- Observed LHR < 1, Observed/ Expected LHR: < 25%, QLI < 0.6 S/o POORER PROGNOSIS (as described)

DISCUSSION

- Congenital diaphragmatic herniation (CDH) is protrusion of abdominal viscera into the thoracic cavity through an abnormal opening or defect in the diaphragm which is present at the birth
- Most common non-cardiac fetal intrathoracic anomalies- 1 of every 2000-4000 live births.
- 84% are left-sided, 13% are right-sided and 2% bilateral
- Most CDH are detected either soon after birth or on antenatal ultrasound.
- Mortality is due to pulmonary hypoplasia (mass effect) & pulmonary hypertension leading to hypoxia.



Diaphragmatic development- complete by ~9th week of gestation.

CDH due to failure of fusion of one of the pleuroperitoneal membrane at about 8 weeks of gestation.

Antenatal USG findings:

- Polyhydramnios
- Cardiomediastinal shift +/- abnormal cardiac axis
- Inability to demonstrate the normal stomach bubble
- Absent bowel loops in the abdomen
- Peristaltic bowel movements in chest
- Intrathoracic herniation of the liver- 85% of cases and is associated with worse prognosis
- Abdominal circumference is reduced (due to herniation of organs)

- Left-sided CDH- Stomach and small bowel (echo-free) at the same transverse level as the heart on four-chamber view (easier to detect). Stomach and small bowel superior to the inferior margin of the scapula. Leftward displacement of gallbladder.

Right-sided CDH: Hepatic vein obstruction and liver edema in herniated liver, Gallbladder present above the diaphragm. Echogenic space between the left heart border and stomach representing the left hepatic lobe. Color Doppler study shows leftward bowing of the umbilical segment of the portal vein, portal branches to the lateral segment of the left hepatic lobe coursing towards or above the diaphragm.

THANK YOU!