The sonologist in the Century of Obesity!

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Scanning obese pregnant women

Reference	*Congenital anomaly*	*BMI category**	*Study design*	*Odds ratio*	*95% CI*
Rasmussen et al.[41] (2008)	Spina bifida	Obese	Meta-analysis	1.70	1.34–2.15
Waller *et al.*[22] (2007)	Spina bifida	Obese	Case–control	2.10	1.63–2.71
Waller *et al.*[19] (1994)	Spina bifida	Obese	Case–control	2.60	1.50–4.50
Watkins et al.[21] (2003)	Spina bifida	Obese	Case–control	3.50	1.20–10.3
Shaw *et al.*[23] (1996)	NTD	Obese	Case–control	1.90	1.30–2.90
Watkins *et al.*[26] (1996)	NTD	Obese	Case–control	1.92	1.08–3.40
Hendricks *et al.*[27] (2001)	NTD	Obese	Case–control	1.73	1.03–2.92
Queisser-Luft *et al.*[28] (1998)	Encephalocele	Obese	Case–control	7.30	1.70–30.6
Waller *et al.*[19] (1994)	Other CNS	Obese	Case–control	8.20	1.20–54.6
Queisser-Luft *et al.*[28] (1998)	Eye anomalies†	Obese	Case–control	5.00	1.30–20.0
Waller *et al.*[22] (2007)	Heart defects	Obese	Case–control	1.40	1.24–1.59
Waller *et al.*[22] (2007)	Heart defects	Overweight	Case–control	1.13	1.01–1.26
Watkins *et al.*[21] (2003)	Heart defects	Obese	Case–control	2.00	1.20–3.40
Watkins *et al.*[21] (2003)	Heart defects	Overweight	Case–control	2.00	1.20–3.10
Mikhail *et al.*[29] (2002)	Heart defects	BMI > 27	Retrospective cohort	6.90	1.20–34.9
Cedergren and Kallen[23] (2003)	Heart defects	Obese	Case–control	1.41	1.22–1.64
Cedergren and Kallen[23] (2003)	Heart defects	Overweight	Case–control	1.18	1.09–1.27
Waller *et al.*[19] (1994)	GA defect	Obese	Case–control	6.20	1.40–27.4
Queisser-Luft *et al.*[28] (1998)	GA defect	Obese	Case–control	4.80	1.10–17.7
Queisser-Luft *et al.*[28] (1998)	CAT	Obese	Case–control	6.30	1.60–24.8
Waller *et al.*[22] (2007)	Anorectal atresia	Obese	Case–control	1.46	1.10–1.95
Queisser-Luft *et al.*[28] (1998)	Urogenital system	Obese	Case–control	1.70	1.10–2.80
Waller *et al.*[22] (2007)	Hypospadias‡	Obese	Case–control	1.33	1.03–1.72
Waller *et al.*[22] (2007)	Hypospadias‡	Overweight	Case–control	1.25	1.01–1.54
Waller *et al.*[22] (2007)	Limb reduction	Obese	Case–control	1.36	1.05–1.77
Waller *et al.*[22] (2007)	CDH	Obese	Case–control	1.42	1.03–1.98
Waller *et al.*[22] (2007)	Omphalocele	Obese	Case–control	1.63	1.07–2.47
Waller *et al.*[22] (2007)	Omphalocele	Overweight	Case–control	1.30	1.04–2.17
Waller *et al.*[19] (1994)	Omphalocele	Obese	Case–control	4.20	1.20–14.6

*Obesity defined as BMI > 29.9 kg/m^2 and overweight as BMI = 25.0–29.9 kg/m^2. †Including anophthalmia and microphthalmia. ‡High-grade hypospadia. CAT, common arterial trunk; CDH, congenital diaphragmatic hernia; CNS, central nervous system; GA, great arteries; NTD, neural tube defects.

Scanning obese pregnant women
How to use …*the scanner*

Ultrasound Obstet Gynecol 2009; 33: 720–729

Anatomical structure	*Mean GA (weeks)*	*Suboptimal visualization rate (%) for BMI category:*				
		Normal weight < 30 kg/m²	*All obese ≥ 30 kg/m²*	*Obese Class I 30–34.9 kg/m²*	*Obese Class II 35–39.9 kg/m²*	*Obese Class III ≥ 40 kg/m²*
Heart	19	19	37	30	39	49
Heart; rescan*	23	2		12	17	20
Craniospinal†	36	29	43	37	44	53

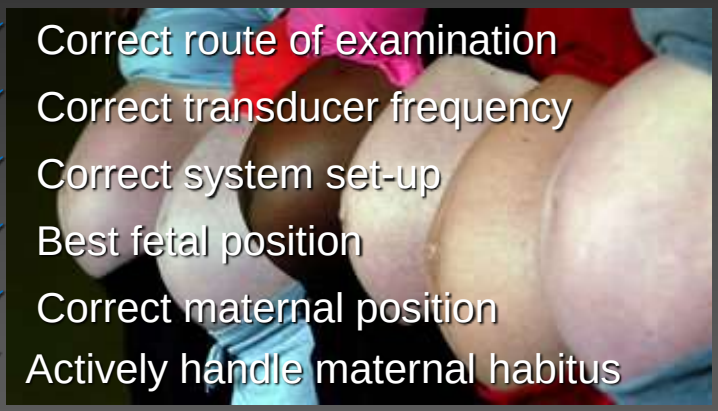
Adapted from Hendler *et al.*[34,35]. $P < 0.001$ for all differences vs. normal weight (BMI < 30 kg/m²). *Rate of suboptimal visualization at recall ultrasound 2 weeks later[35]. †Includes cerebellar diameter and posterior fossa, midline, cavum septi pellucidi, lateral ventricle atrial width and spine. GA, gestational age.

2. Obesity impaires visualization on routine anomaly ultrasound

Fog in utero!

…how to climb the *mountain…and survive*

(*Tips for scanning the obese patients*)



- ✓ Correct route of examination
- ✓ Correct transducer frequency
- ✓ Correct system set-up
- ✓ Best fetal position
- ✓ Correct maternal position
- ✓ Actively handle maternal habitus
- ✓ Get to know what…looms ahead (anomalies with higher incidence in obese women)!

1. *Route of examination (TA vs TV)*

CAT in a 100 kg *lady @ 22 weeks*

nited to < 15 weeks…

part to examine

, if applicable

e uterine fundus

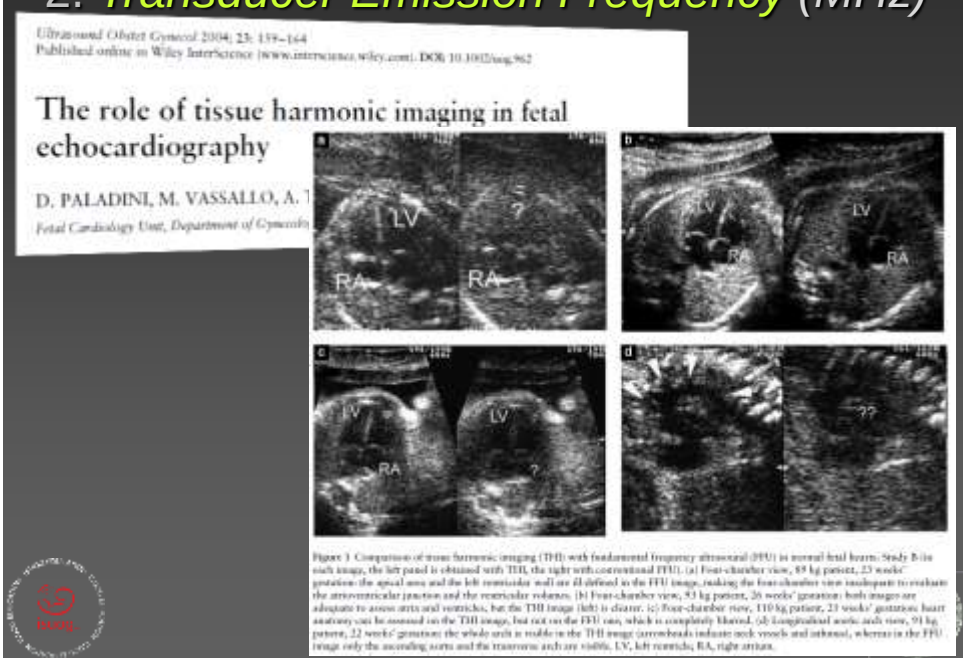
ttings (see after)

6. If not „pure" vertex, it is possible to explore limbs, abdomen, heart…and lips

2. *Transducer Emission Frequency* (MHz)

1. Use always lowest emission frequency (both TA and TV)
2. If scanner has *real tissue harmonic imaging*, try lowest frequency with harmonic
3. If scanner has *contrast harmonic imaging*, try without or with lower harmonic
4. Consider that emission frequency is separated for greyscale and Color Doppler: reduce both…
5. For Color Doppler, reduce box size

2. *Transducer Emission Frequency* (MHz)



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The role of tissue harmonic imaging in fetal echocardiography

D. PALADINI, M. VASSALLO, A. T

Fetal Cardiology Unit, Department of Gynecolo

Figure 1 Comparison of tissue harmonic imaging (THI) with fundamental frequency ultrasound (FFU) in normal fetal hearts. Study B (in each image, the left panel is obtained with THI, the right with conventional FFU). (a) Four-chamber view, 89 kg patient, 23 weeks' gestation: the apical area and the left ventricular wall are ill-defined in the FFU image, making the four-chamber view inadequate to evaluate the atrioventricular junction and the ventricular volumes. (b) Four-chamber view, 93 kg patient, 26 weeks' gestation: both images are adequate to assess atria and ventricles, but the THI image (left) is clearer. (c) Four-chamber view, 110 kg patient, 23 weeks' gestation: heart anatomy can be assessed on the THI image, but not on the FFU one, which is completely blurred. (d) Longitudinal aortic arch view, 91 kg patient, 22 weeks' gestation: the whole arch is visible in the THI image (arrowheads indicate neck vessels and isthmus), whereas in the FFU image only the ascending aorta and the transverse arch are visible. LV, left ventricle; RA, right atrium.

2. *Transducer Emission Frequency* (MHz)

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In normal BMI women (unselected):
- visualization rate is similar
- resolution is higher with FFU than with THI

Scoring system	*Arm*	*Mean*	*SD*	*SE*	*95% CI*	*ANOVA*
Visualization	1 (FFU)	6.52	0.87	0.17	6.16–6.88	$P = 0.06$
	2 (THI)	6.88	0.33	0.06	6.74–7.02	
Resolution	1 (FFU)	21.80	2.60	0.52	20.73–22.87	$P < 0.001$
	2 (THI)	18.24	2.82	0.56	17.08–19.40	

*Arm 1, fundamental frequency ultrasound (FFU) echocardiography; Arm 2, tissue harmonic imaging (THI) echocardiography. SE, standard error.

In obese & overweight women:
- both resolution and visualization are higher with THI than with FFU

Scoring system	*Method*	*Mean*	*SD*	*SE*	*95% CI*	*ANOVA*
Visualization	FFU	4.33	1.41	0.47	3.25–5.42	$P < 0.001$
	THI	6.60	0.84	0.27	6.00–7.20	
Resolution	FFU	13.22	4.02	1.34	10.12–16.31	$P < 0.01$
	THI	18.70	4.16	1.31	15.72–21.67	

FFU, fundamental frequency ultrasound; SE, standard error; THI, tissue harmonic imaging.

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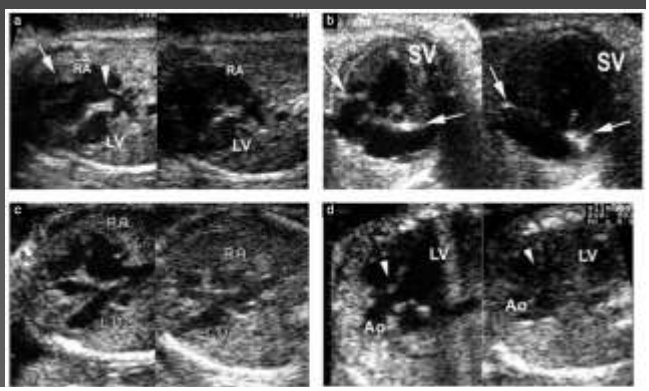
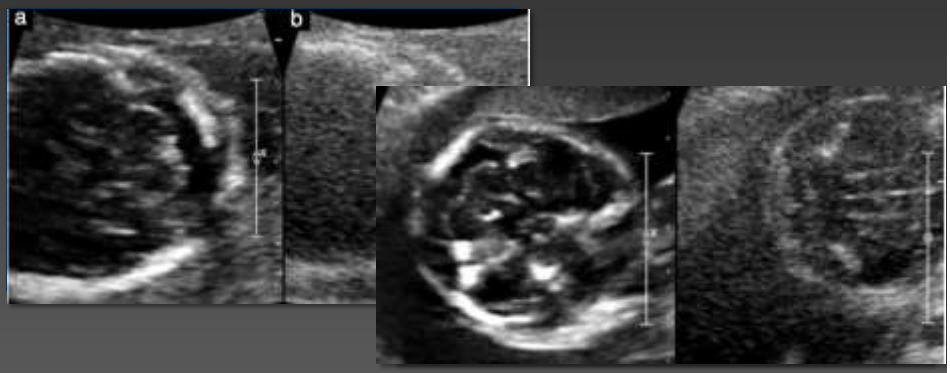


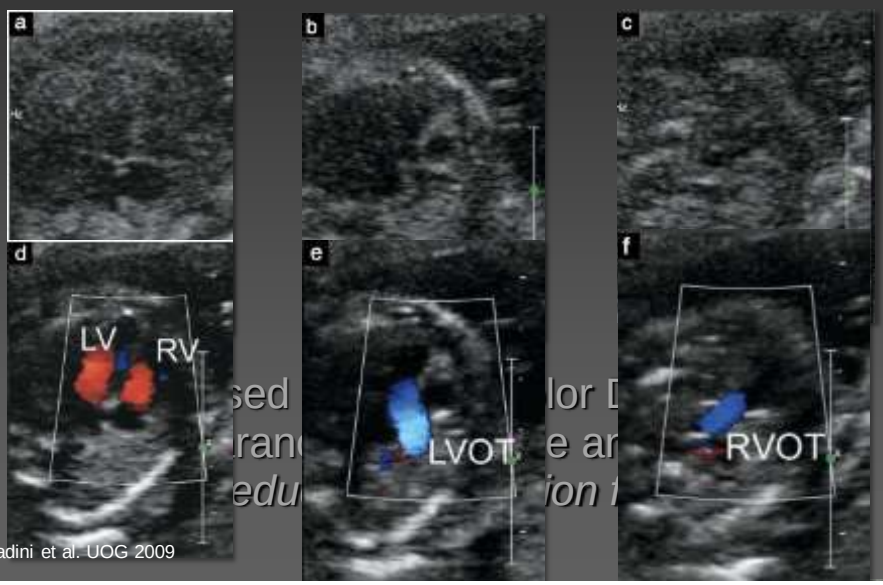
3. *System setup* (greyscale filters)



3. Get used to use all greyscale „tricks“ such as *harmonics, crossbeam and SRI (speckle reduction imaging)*

Paladini et al. UOG 2009

3. *System setup* (Color Doppler)



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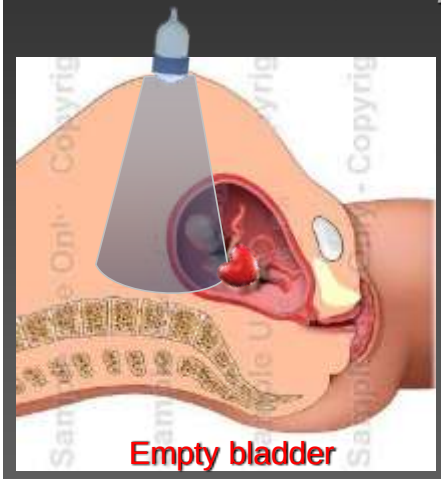
4. *Fetal position* (best possible…)

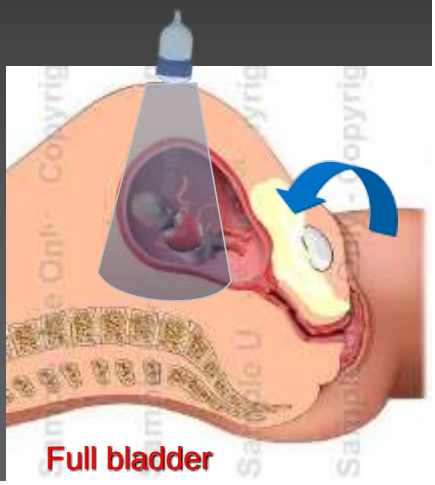
Fight actively to get *the best possible position*

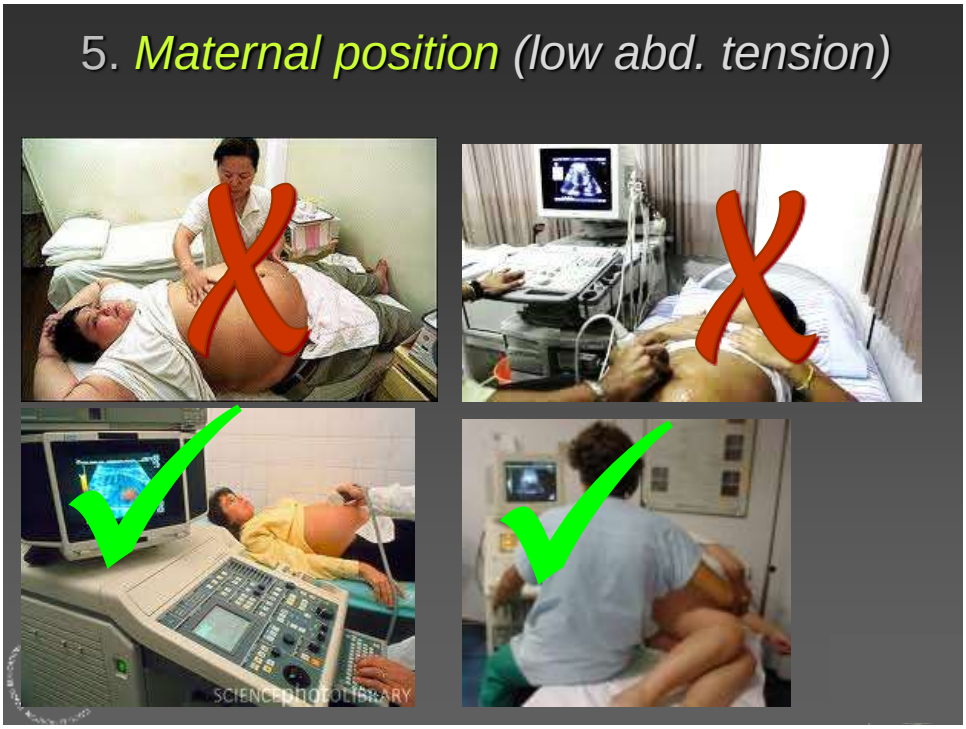
4. *Fetal position* (best possible…)

How to use the *peri-umbilical window*



20 weeks of gestation




5. Maternal position (low abd. tension)
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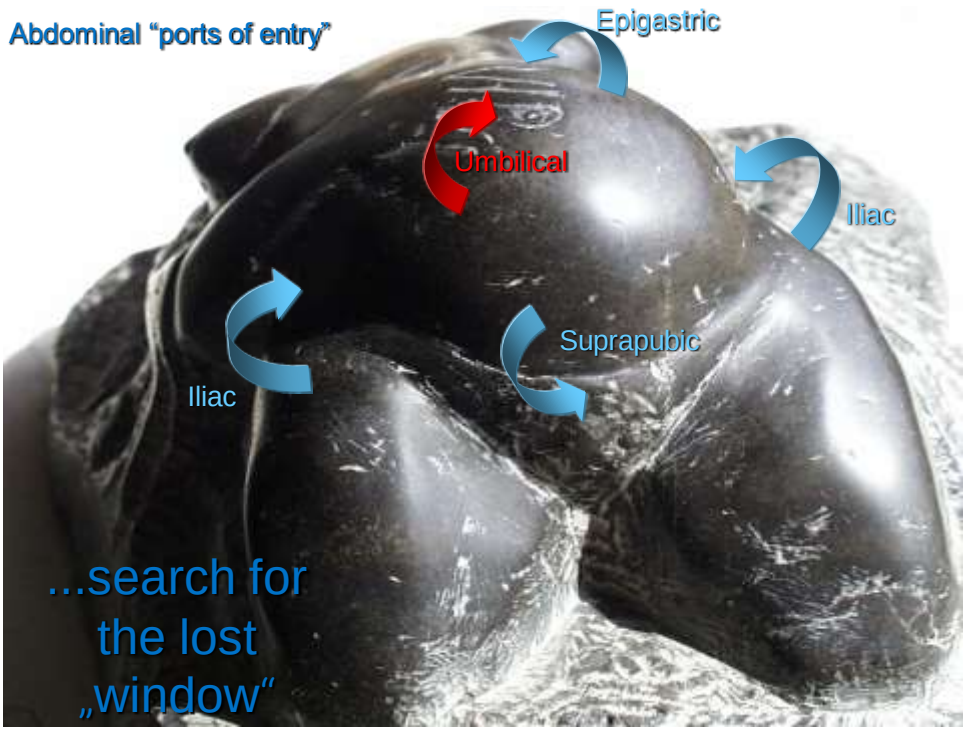
Abdominal "ports of entry"
Epigastric
Umbilical
Iliac
Suprapubic
Iliac
...search for the lost „window"

6. *Fetal anomalies* with increased incidence in obese women

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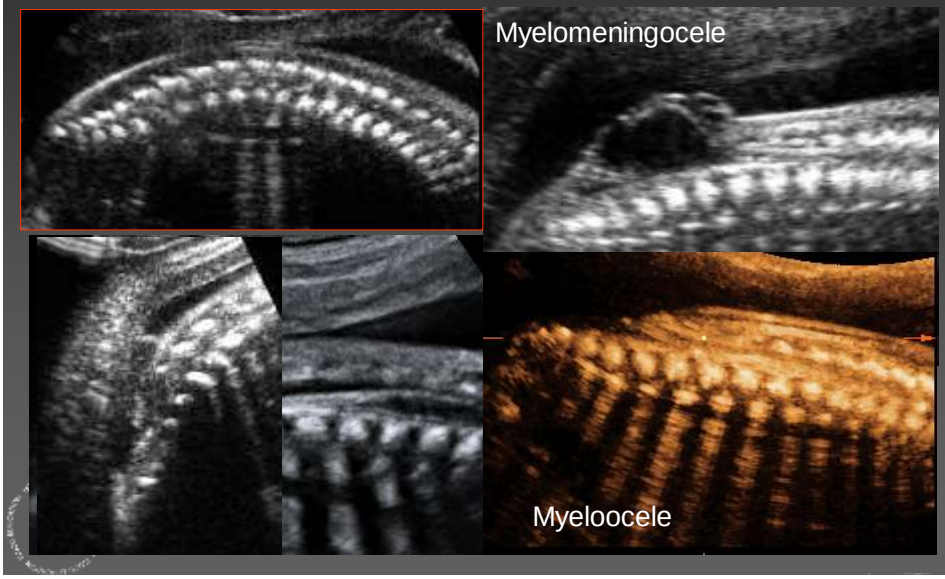
- ✓ Classic malformations, but with higher incidence in obese women, due to homocysteine/folate pathway interference
- ✓ Unusual malformations especially related to obesity (diabetes)

6. *Fetal anomalies* with increased incidence in obese women



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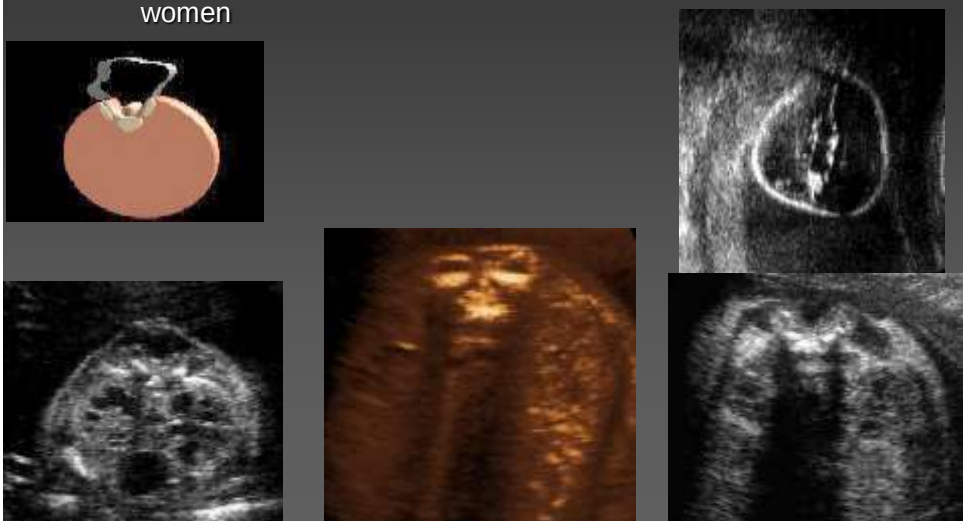

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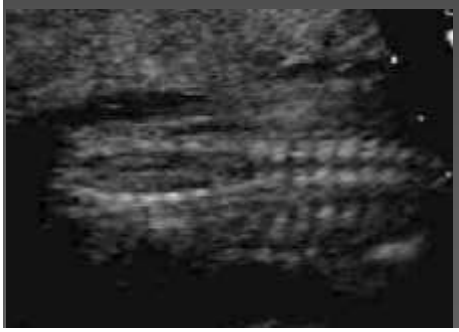
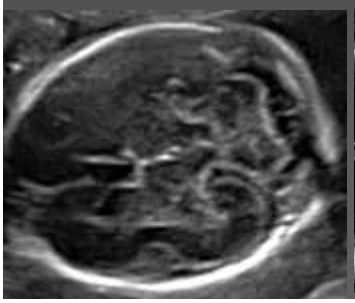
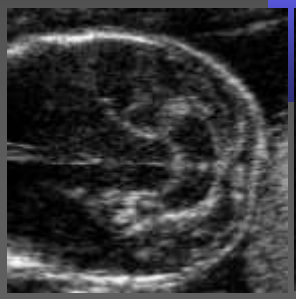


6. *Fetal anomalies* with increased incidence in obese women

Chiari II:
nulled cisterna magna + dysmorphic and hypoplastic cerebellum

BANANA SIGN





6. *Fetal anomalies with increased incidence in obese women*

- ✓ Classic malformations, but with higher incidence in obese women

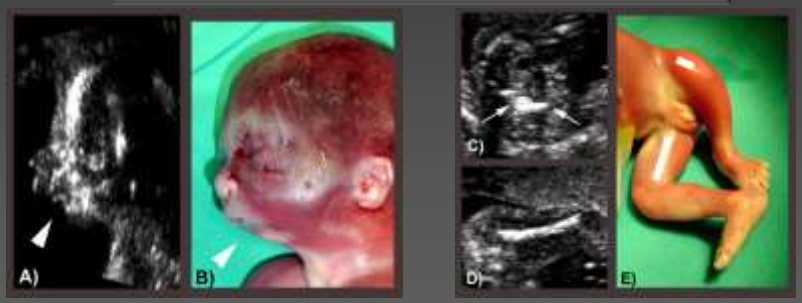
RV aneurysm

Tetralogy of Fallot

6. *Fetal anomalies with increased incidence in obese women*

- ✓ Unusual malformations, especially related to obesity (diabetes)

Femoral Hypoplasia Unusual Facies Syndrome (FHUFS, OMIM 134780)



Unusual face: micrognathia, maxillary hypoplasia, cleftings
Asymmetric focal femoral hypoplasia

6. *Fetal anomalies* with increased incidence in obese women

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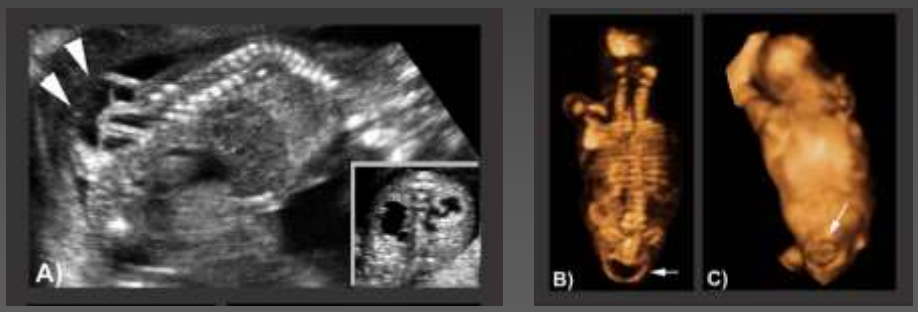
Caudal Regression / Sirenomelia



Complex lumbosacral NTD (sacral agenesis), renal abnormalities, backmass

6. *Fetal anomalies* with increased incidence in obese women

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Caudal Regression / Sirenomelia

Vertebral defect with sacral agenesis, single lower limb or fused limbs, renal agenesis

Scanning obese pregnant women
Conclusions

- ✓ If possible, plan ahead and go for TVUS @ 14-15 weeks (NT, IT, limbs/extremities and heart)
- ✓ After 15 wks, wait until 21-22 wks to carry out the anomaly scan
- ✓ Wait or actively seek a favourable fetal position, without stubbornly do the scan with an unfavourable position
- ✓ Consider recalling at later stage or MRI (...if the patient fits in the cylinder) for unresolved queries