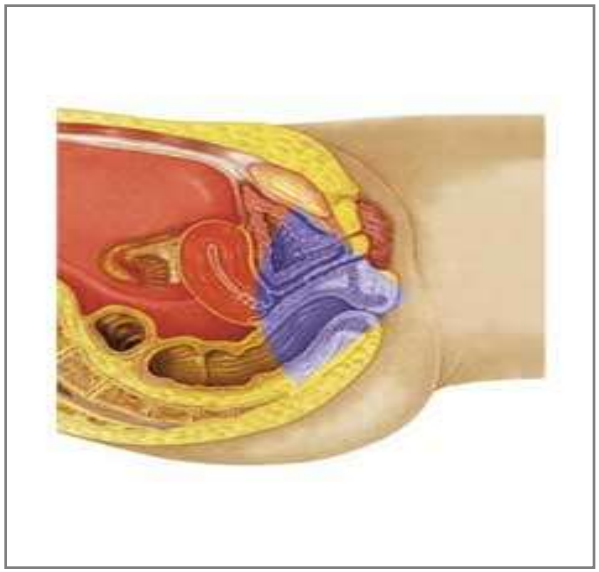
News from the floor

מה חדש ברצפת האגן?

Dr. Vered Eisenberg

Department of Obstetrics and Gynecology,
Chaim Sheba Medical Center, Tel Hashomer

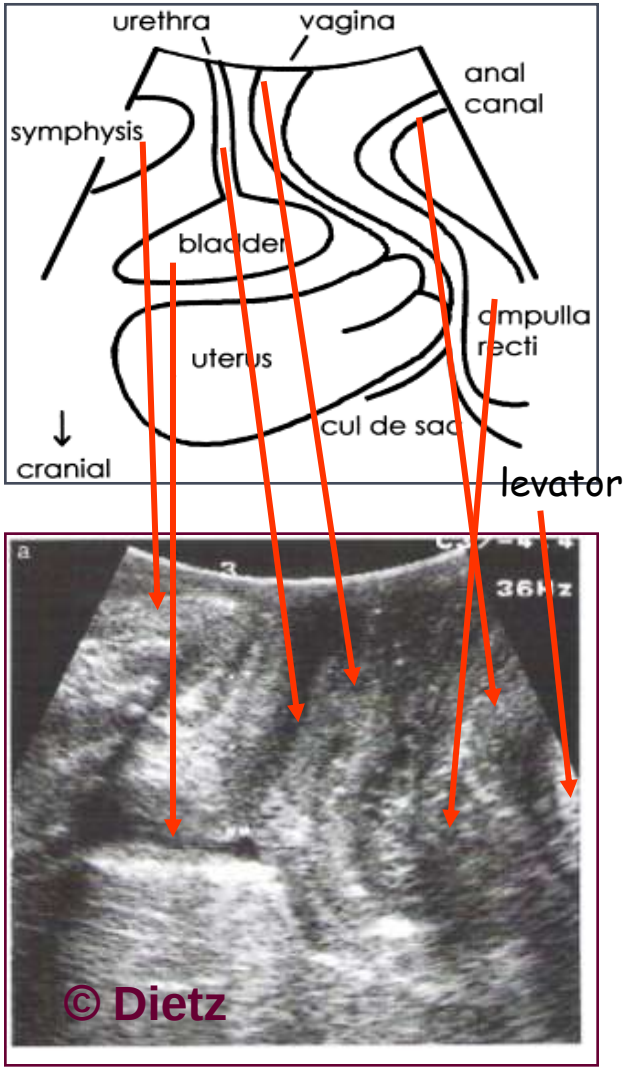
How?



3.5-7 MHz on perineum, mid-sagittal view
empty bladder, supine, dorsal lithotomy
Rest, Valsalva and Contraction

Pelvic floor ultrasound – 2D

- View from anterior to posterior:
  - Symphysis pubis, urethra and bladder neck, vagina, cervix, rectum and anal canal, levator plate (puborectalis muscle)

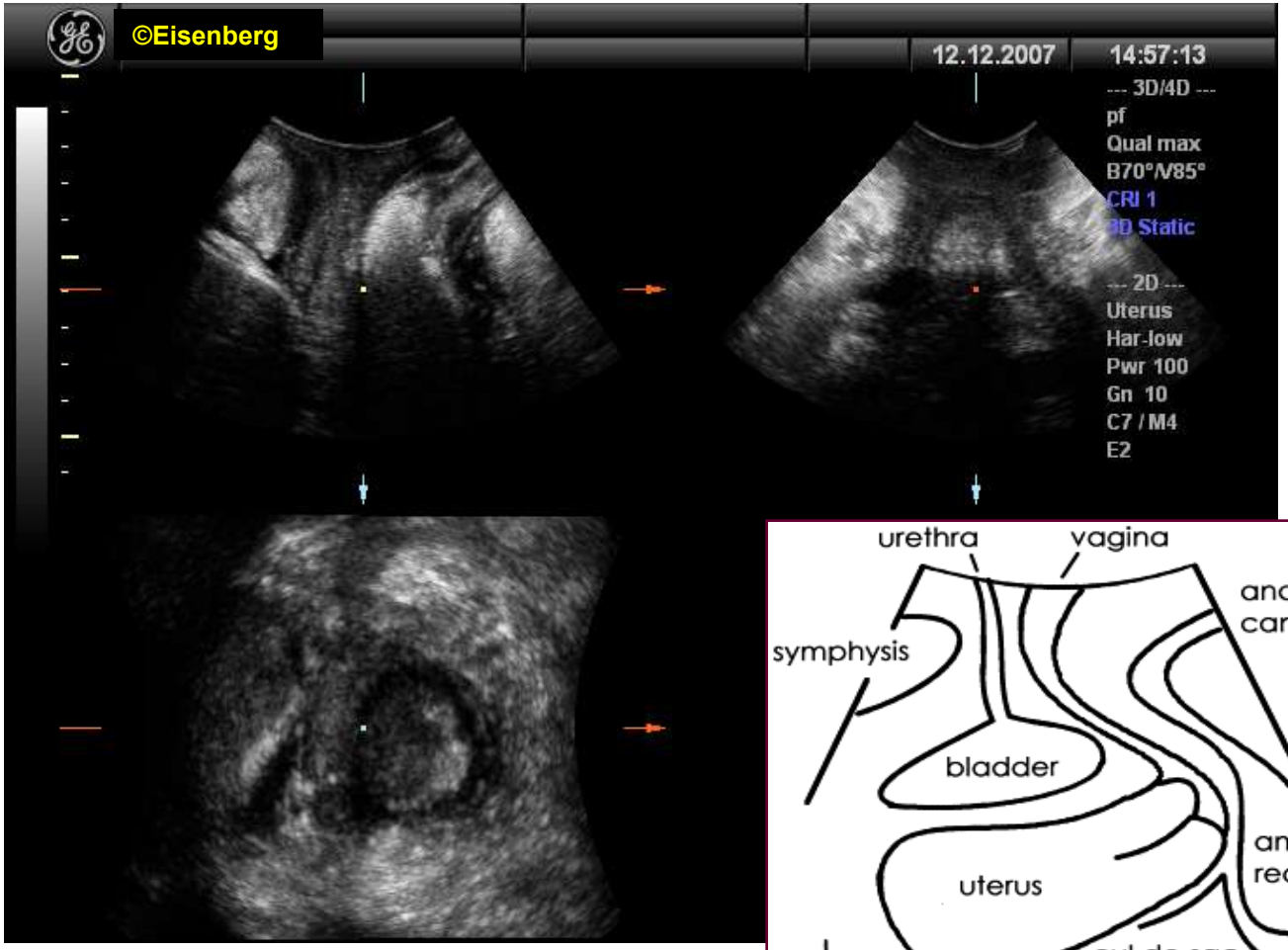


3D - Volume rest sectional planes

Mid-sagittal

Coronal

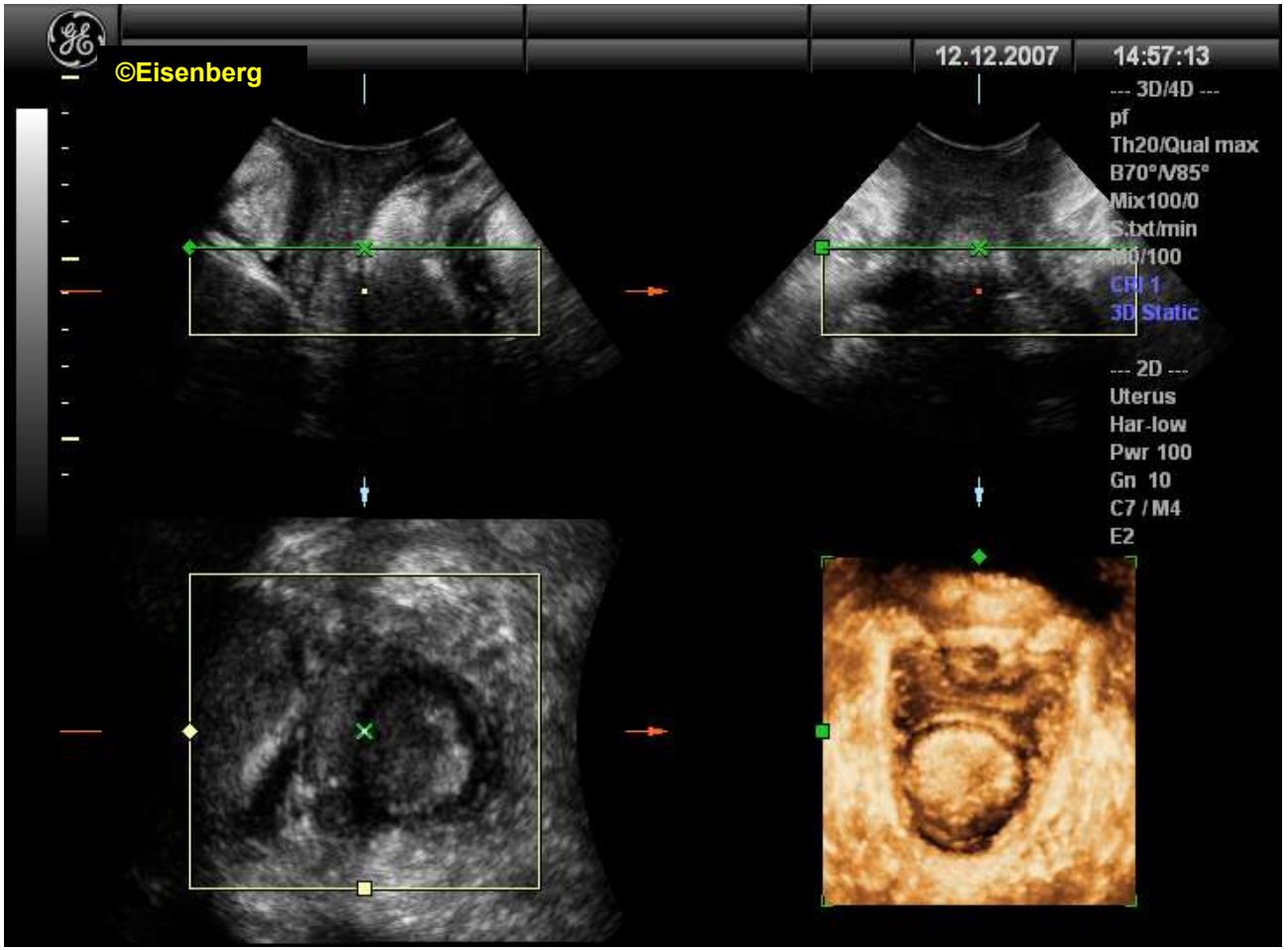
Axial



3D - Volume rest render mode

Mid-sagittal

Coronal



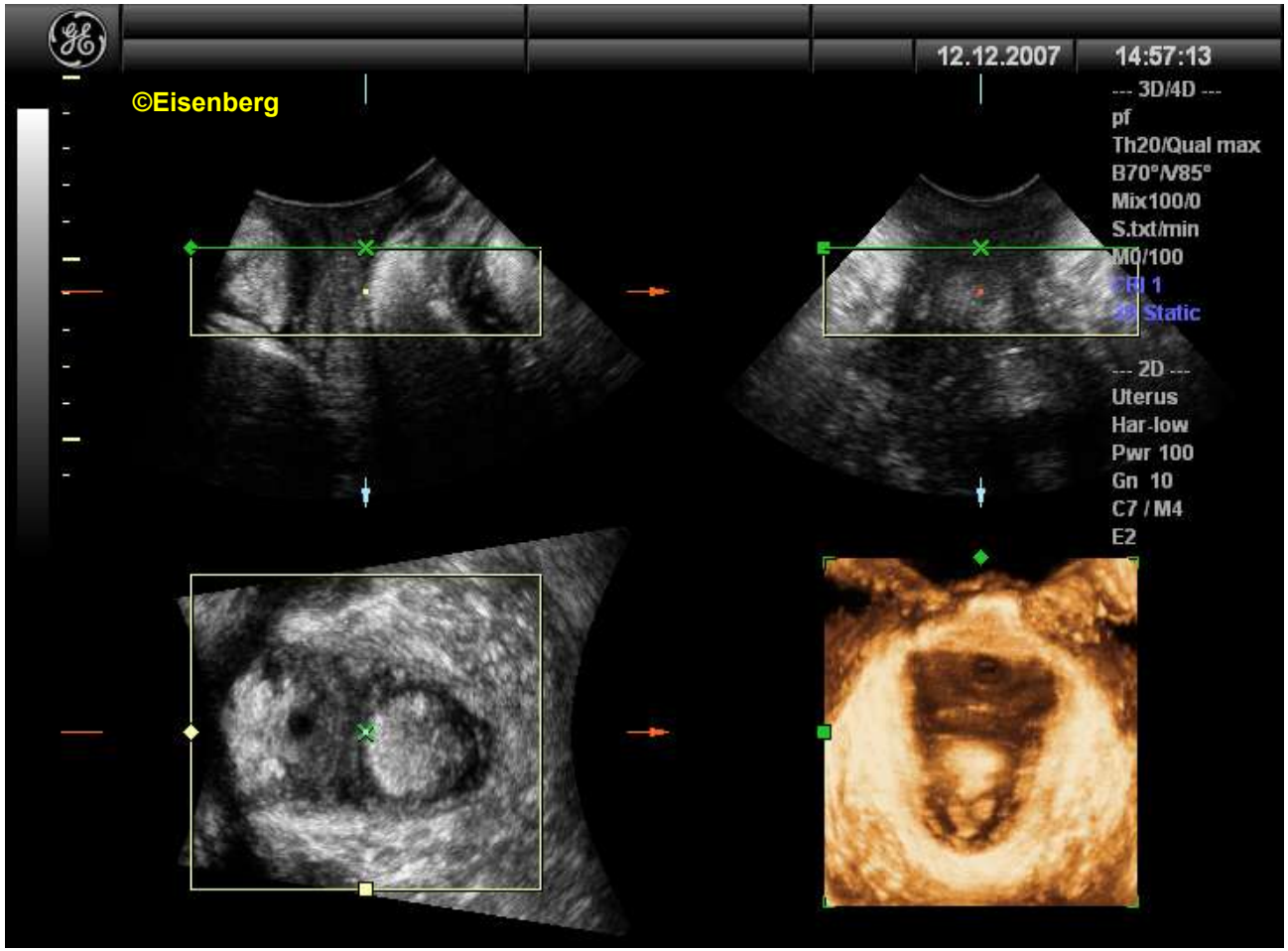
Axial

Rendered image

3D - Volume processing

Mid-sagittal

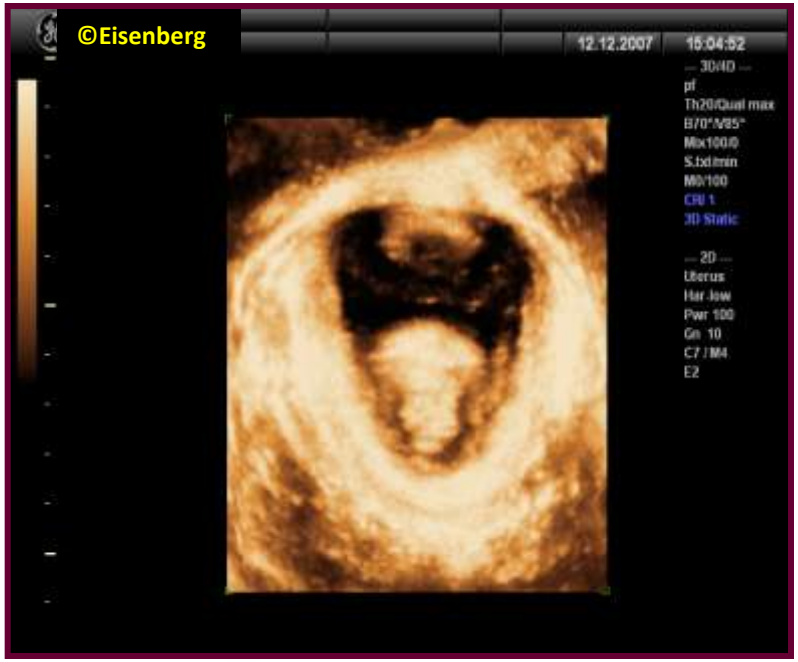
Coronal

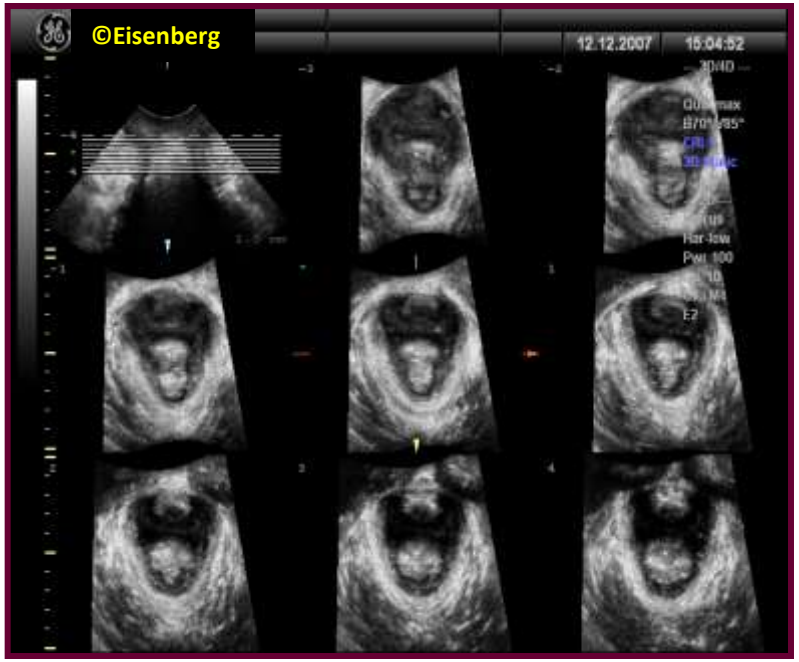


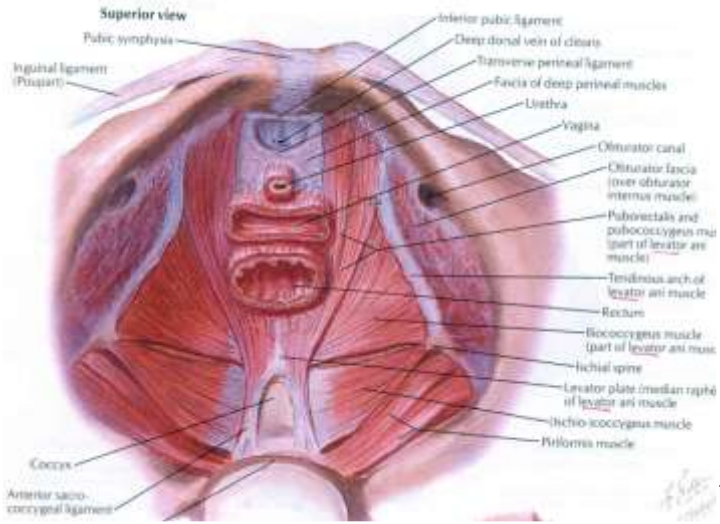
Axial

Rendered image

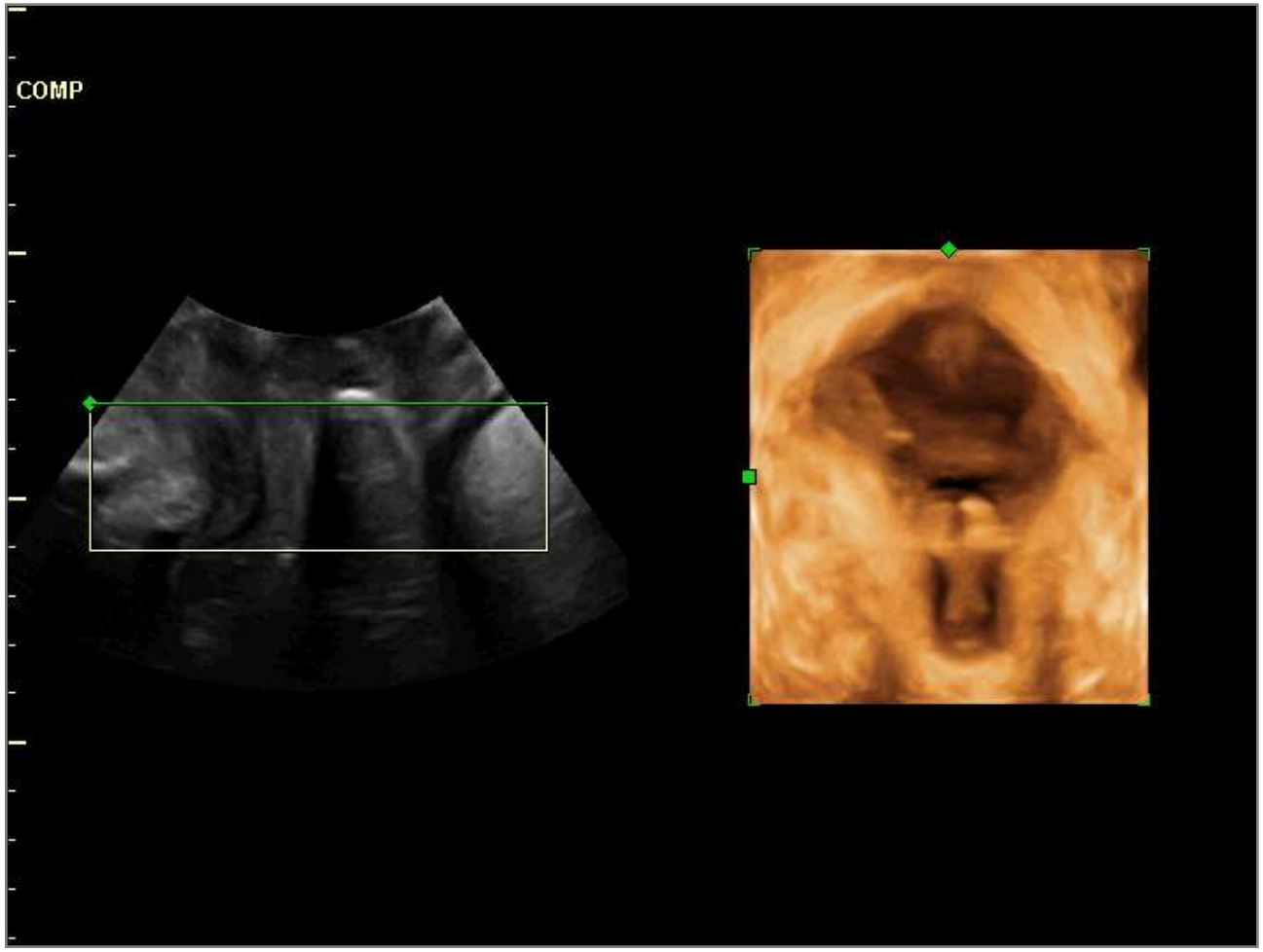
Levator imaging and TUI



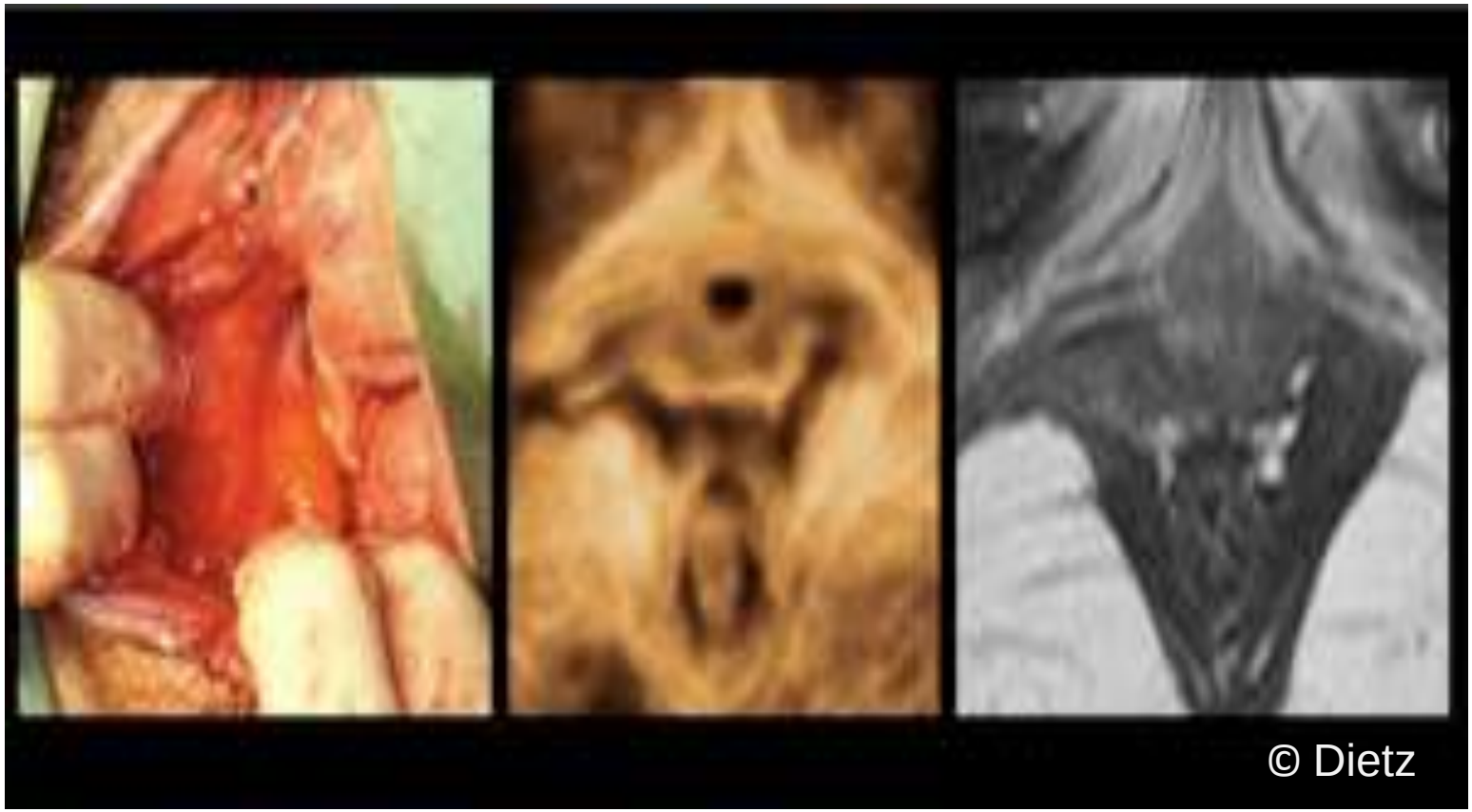




Dynamic transperineal ultrasound – 4D



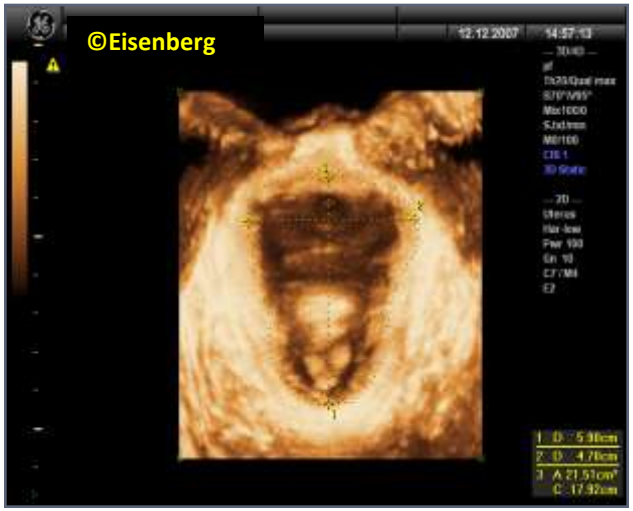
© Eisenberg



Levator ani pathology

Levator avulsion defect = puborectalis injury

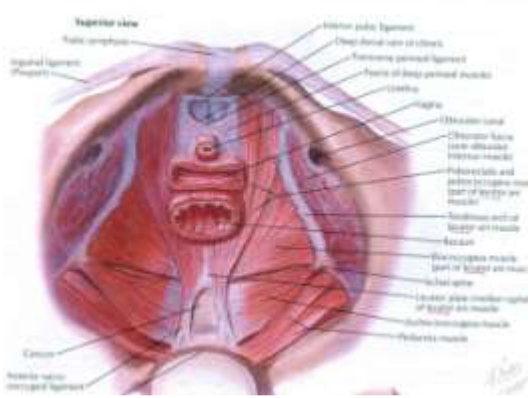
Normal



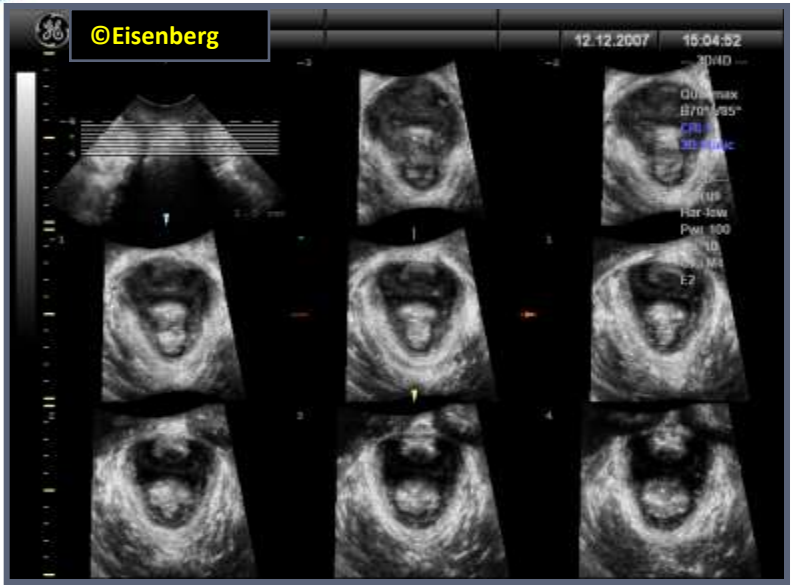
Unilateral avulsion

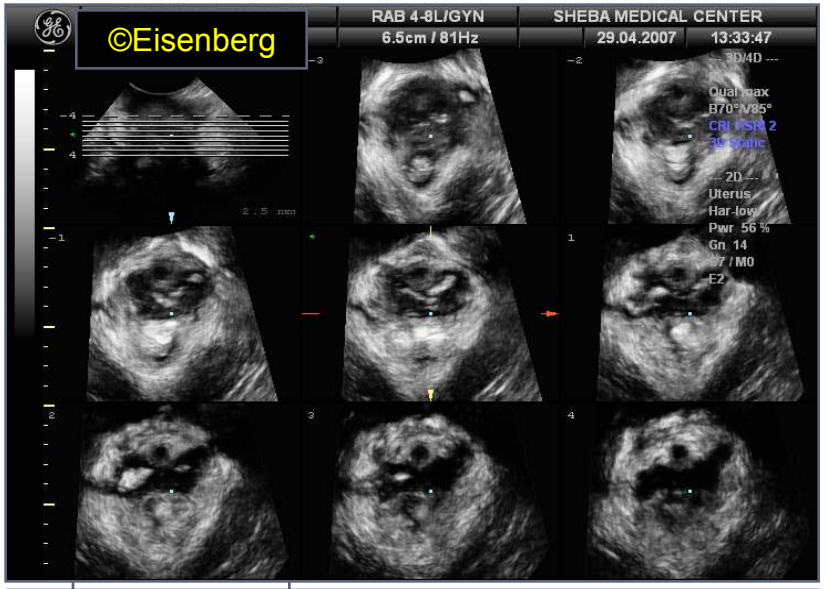
Bilateral avulsion

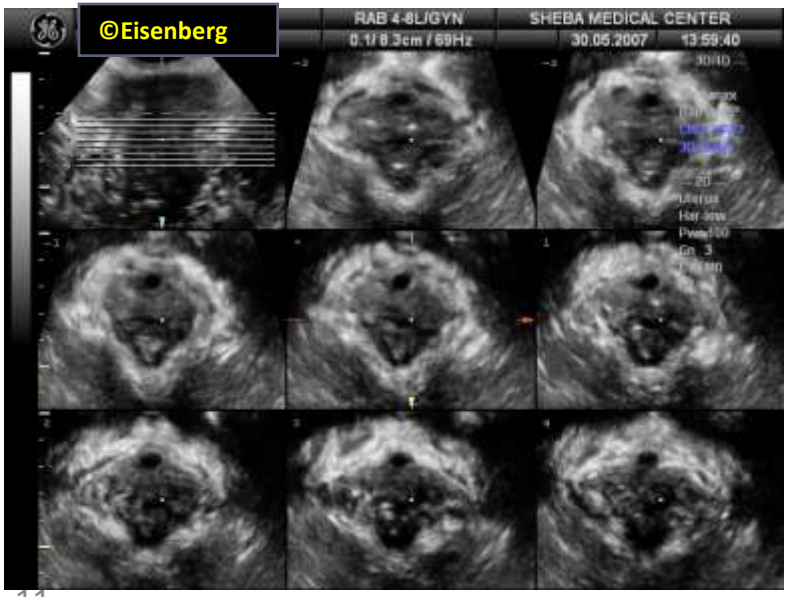
Avulsion of anteromedial aspect of the puborectalis muscle of the pelvic sidewall

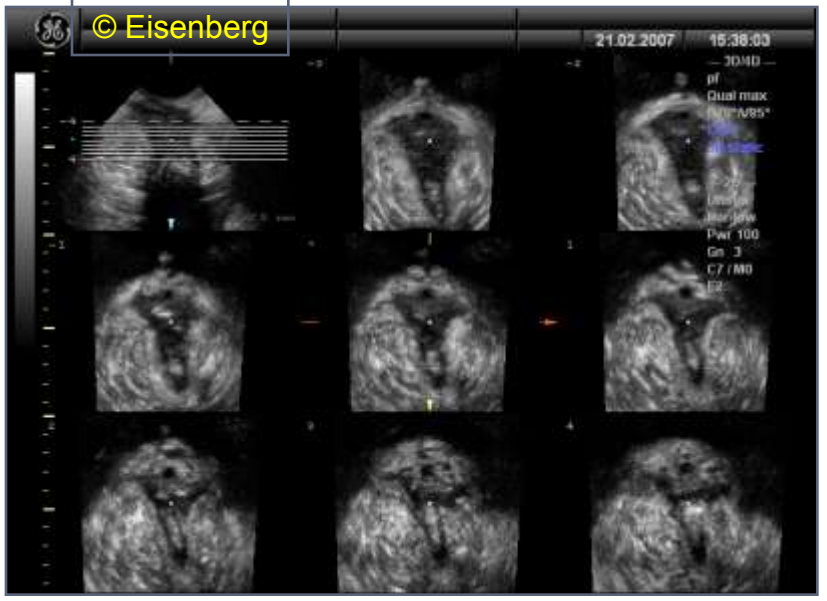


Levator avulsion defect - TUI

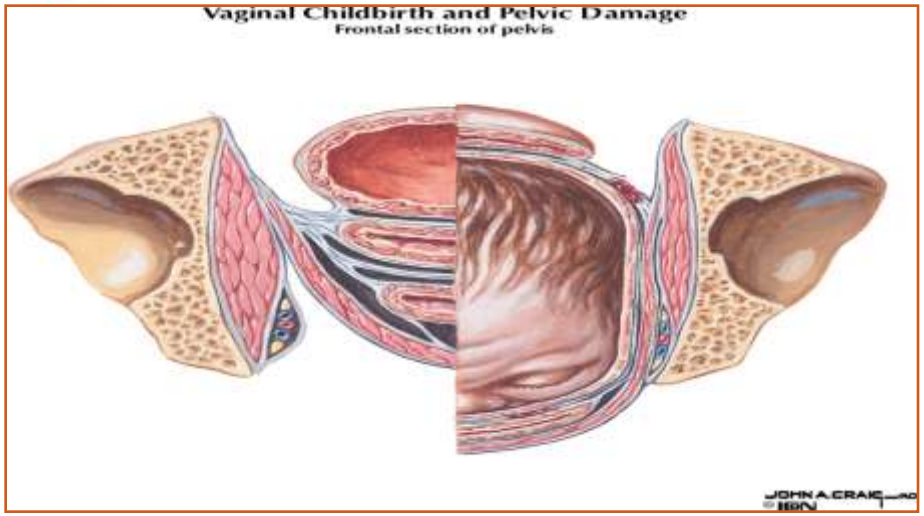


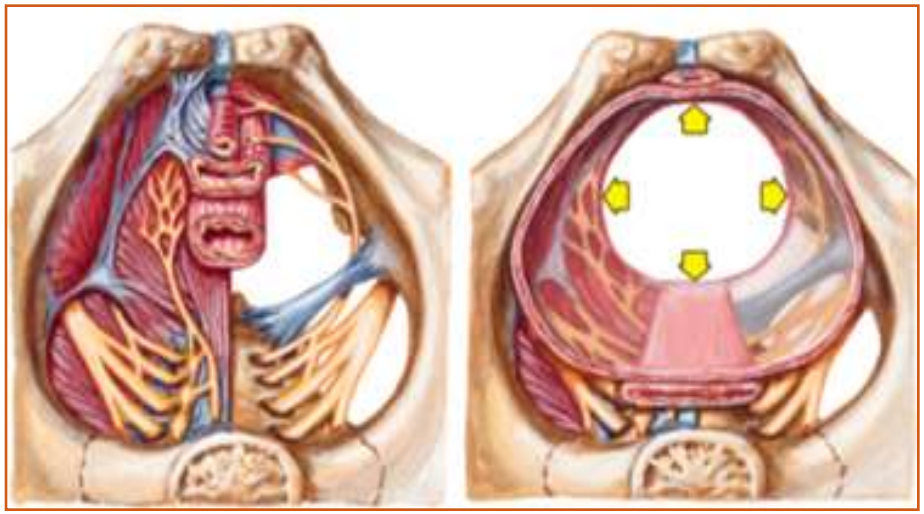






Puborectalis injury - pathogenesis





- Skeletal muscle normally tears if stretches by a factor 2
- MRI - The levator ani muscle stretches by 2.5 times during NVD (Lien 2004, Hoyte 2008)
- US - Levator stretches by 200-1000% depending on elasticity (Svabik 2008)
- A more elastic muscle means a shorter 2nd stage of labor
- The puborectalis muscle tears during crowning
- After tearing the muscle shrinks and retracts
- Scar tissue can bridge a partial tear

Risk factors for levator avulsion

- Vaginal childbirth
- Age at first delivery (10% every year) (Dietz 2005 and 2007, Kearney 2006)
- Instrumental delivery (mainly forceps)
- 3rd and 4th degree tears
- Prolonged 2nd stage (>160-OR 3.5,>180)
- Large fetal weight (>3750,>4000)
- Fetal head circumference (HC≥35.5)
- Both: HC ≥35.5 and 2nd stage ≥110 – OR 5.32. (Valsky 2009)

- Genetic factors
- Tissue factors

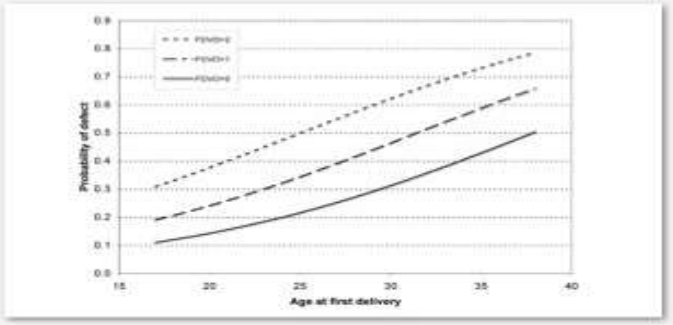
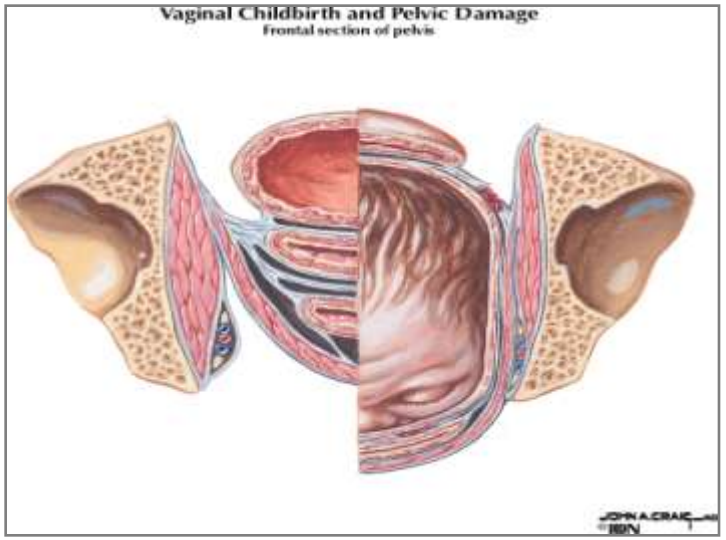


Figure 4: The relationship between maternal age at first delivery and levator trauma. The dotted lines represent the risk of avulsion injury in patients with one or two vaginal operative deliveries (from: Dietz and Simpson, ANZJOG 2007; 491-495)

© Dietz

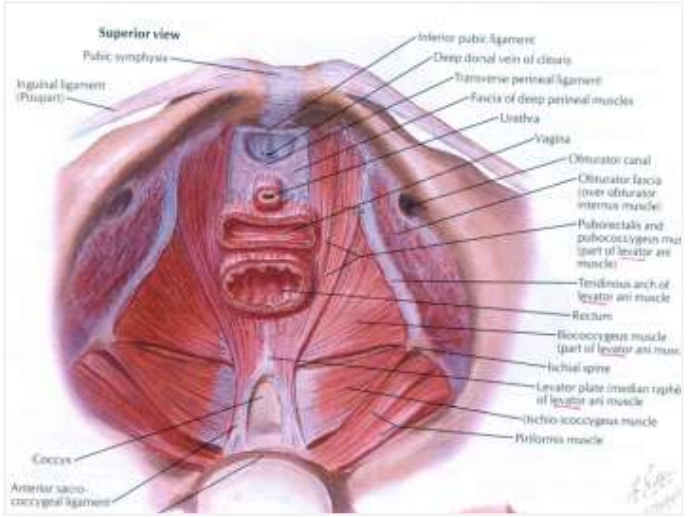


Prevalence of avulsion defect

- 15-25% - serious damage (urogyne patients)
- 9% - bilateral
- MR and ultrasound studies - major levator defects in 20-35% of vaginally parous women (Dietz 2005, DeLancey 2003)
- 50-62% of women after 3rd and 4th degree perineal tears

Dietz

Natural course



- Many are asymptomatic
- Symptoms may develop over time

- Possible compensation by the iliococcygeus muscle

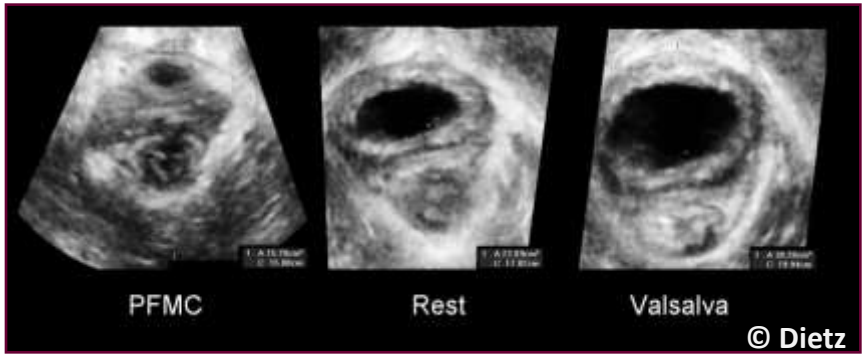
- Other life style influences take place:
  - Chronic cough (COPD, Asthma)
  - Stool straining
  - Obesity, heavy load carrying
  - Disease states
  - Genetic contribution, connective tissue, etc.

DeLancey NEJM 1993;329:1956-57

- Poor correlation between damage severity and long term effects

Consequences of avulsion injury

- Decreases pelvic floor muscle strength (DeLancey 2007, Abdool 2009)
- Increases size of levator hiatus by 6 cm², 20-30%, in coronal plane, becomes more distensible (50%) and less contractile (Abdool 2009)



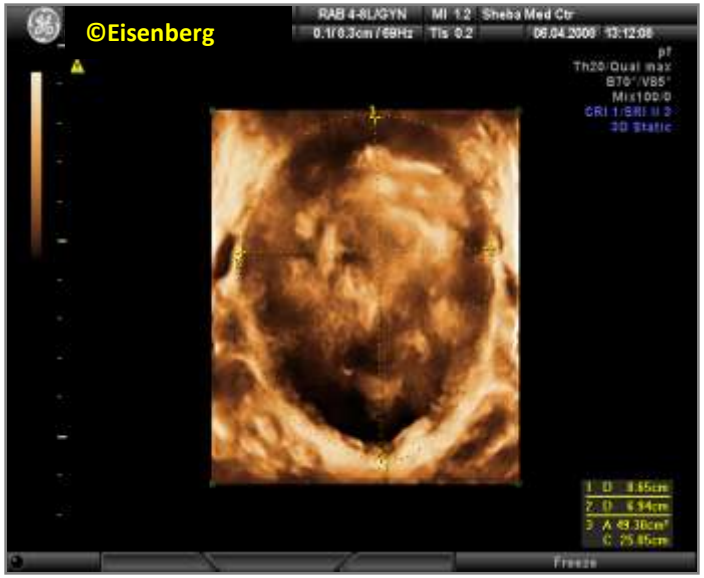
- Major levator defects are a risk factor for "ballooning" (an abnormal hiatal area on Valsalva of 25 cm²) (Dietz 2008)

Levator ballooning

- Mild - 25-29.9 cm²
- Moderate - 30-34.9 cm²
- Marked - 35-39.9 cm²
- Severe ≥ 40 cm²

(De Leon 2007)

- Relative risk of ballooning:
  - 3.5 – unilateral avulsion
  - 3.96 – bilateral avulsion
- May be congenital or due to levator 'micro-trauma' rather than actual tears (Dietz 2009)



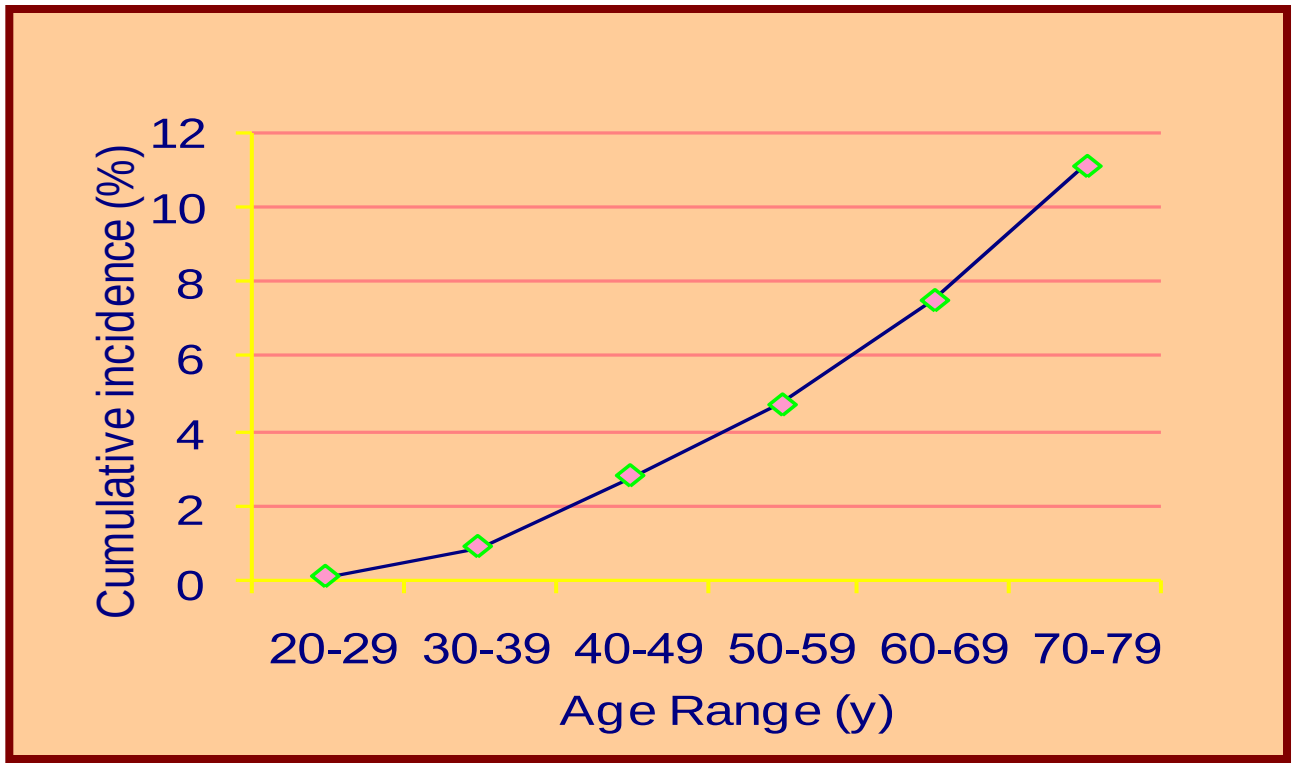
Avulsion defect – effect on POP

- **The levator hiatus is the largest potential hernial portal in the human body**
- Strong risk factor for POP:
  - Cystocele (anterior compartment) - RR=2.3
  - Uterine prolapse (central compartment) - RR=4.0

  (DeLancey 2007, Dietz 2007)

- Width and depth, and # of abnormal slices on TUI correlate with likelihood of prolapse and prolapse symptoms (Dietz 2007)
- Levator avulsion and hiatal ballooning are independent risk factors for POP

POP risk



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1/3

Olsen et al, Obstet Gynecol, 1997

- **Demand for POP surgery will increase by 45% in the next 30 years** (Luber 2001)

Significance of avulsion injury

- Risk factor for recurrent or de novo POP after hysterectomy, anti-incontinence and prolapse surgery – triples risk (Adekanmi 2005, Dietz 2009, Model 2009)
- Relative risk of 3-4 for cystocele recurrence after anterior colporrhaphy (Dietz 2009)
- Levator assessment can identify patients at high risk of POP recurrence and may be useful as an adjunct in clinical decision making

To mesh or not to mesh: The Urogyne's dilemma

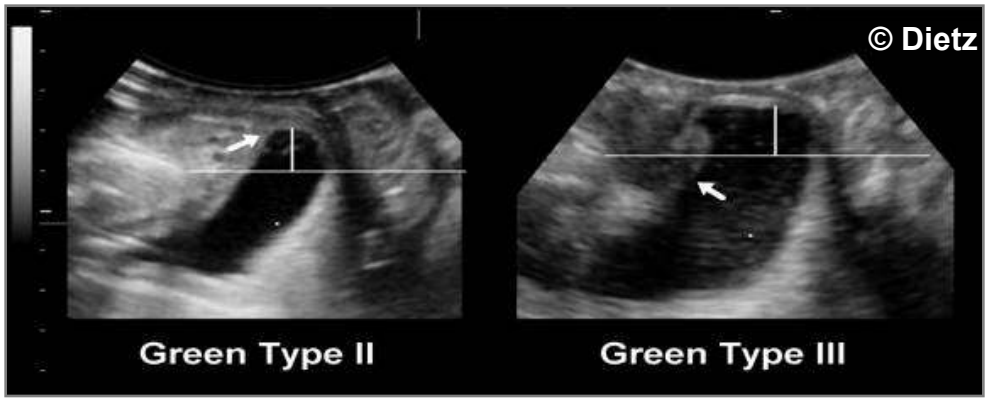
- Impact on choice of surgery?

Can levator defects be predicted?

Late diagnosis in a urogynecological patient: (Dietz, ICS 2009)

- Levator defects are most likely to be found on ultrasound in:
  - First child by vaginal operative delivery (RR=2.0) over the age of 30 (RR=2.0)
  - Prolapse symptoms (RR=2.5) w/out concomitant SI
  - Clinical findings:
    - cystocele (RR=3.77-6.51)
    - uterine prolapse (RR=1.63-2.49)
    - strength of a pelvic floor muscle contraction
    - side differences in contraction strength

Cystocele types



Category	Measure	Green type II (n=63)	Green type III (n=39)	P value
Demographics	Age	48.7±13.4	59.4±10.6	<0.001
	Instrumental delivery	20.6%	40.8%	0.013
Symptoms	Stress incontinence	92%	64%	<0.001
	Prolapse sensation	43%	71%	0.004
Ultrasound exam	Cystocele descent	-13.9±9.1mm	-25±14.2mm	<0.001
Urodynamic data	USI	77%	65%	0.133
	Voiding dysfunction	18%	39%	0.018
	Bladder capacity	443±94ml	482±69ml	0.019
Levator parameters	Hiatal area (rest)	17.69±4.25	20.32±5.53	0.014
	Hiatal area (Valsalva)	30.61±7.70	34.19±8.91	0.041
	Hiatal area (PFMC)	14.24±3.30	17.33±5.30	0.003
	Levator avulsion defect	35%	69%	0.001
	Abnormal slices on TUI	3.4±5.7	8.0±6.7	0.001*

Is antenatal prediction possible?

- 367 nullips at 36-38 wks and 4 mos. Postpartum
  - NVD – 187 (51%)
  - Instrumental – 54 (15%)
  - CS – 126 (34%)
- Avulsion rate – 34 (14%)
- The only predictor was lower BMI (P=0.005)
- None other from those checked: age, family Hx, hiatal dimensions, BND etc.

Dietz, AJOG 2010

Is ultrasound better than other modalities?

- Types of imaging:
  - Radiology
  - CT
  - **MRI**
  - Video urodynamics
  - Cysto – vaginography
  - **Defecography**

US vs. MRI

- MRI not yet dynamic enough
- Prolapse assessment limited by need for fast acquisition, not widely available
- axial and coronal T2- weighted
- Post-processing
- New US techniques allow better resolution
- Improved tissue discrimination (SRI)

- Limitations of MRI:
  - Supine (only)
  - Access, price
  - Time consuming (30-40 minutes)
  - Patient unacceptability
  - Spatial resolution lost with rapid acquisition
  - Limited use in pregnancy

US vs. defecography

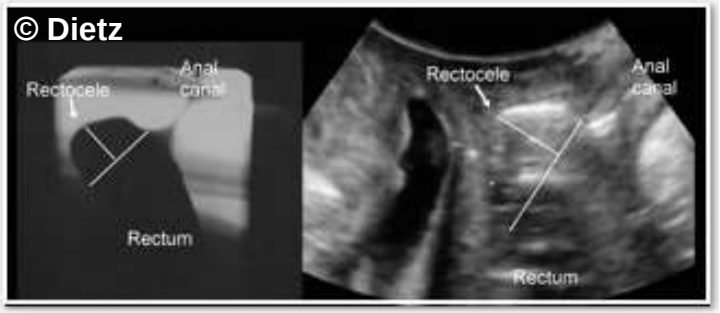
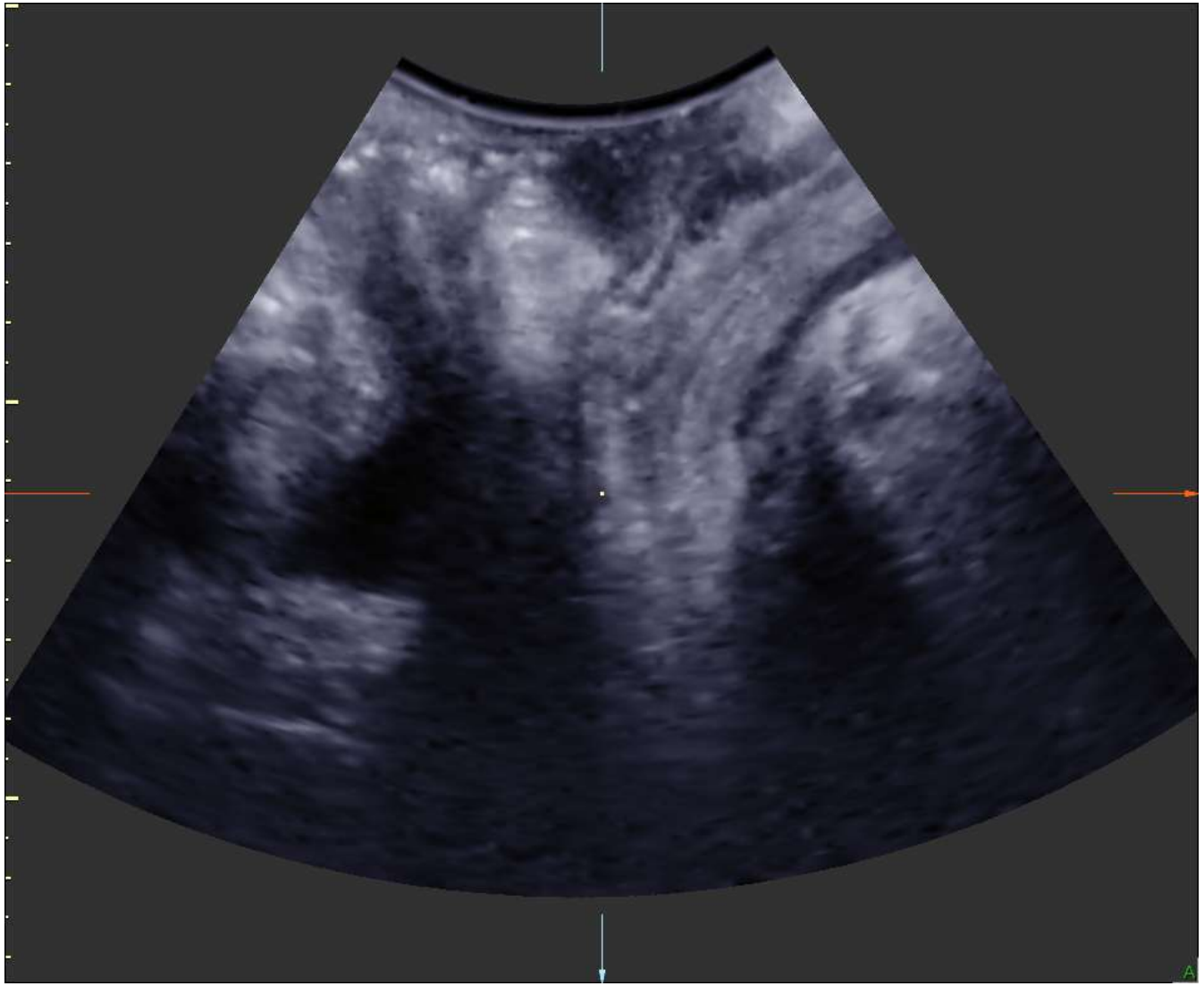


Figure 8: Rectocele on defecation proctography (rotated for easier comparison) and ultrasond in a patient with symptoms of obstructed defecation.

Figure 9: Rectal intussusception (propelled by sigmoid colon) on defecation proctography and ultrasond in a patient with symptoms of obstructed defecation.

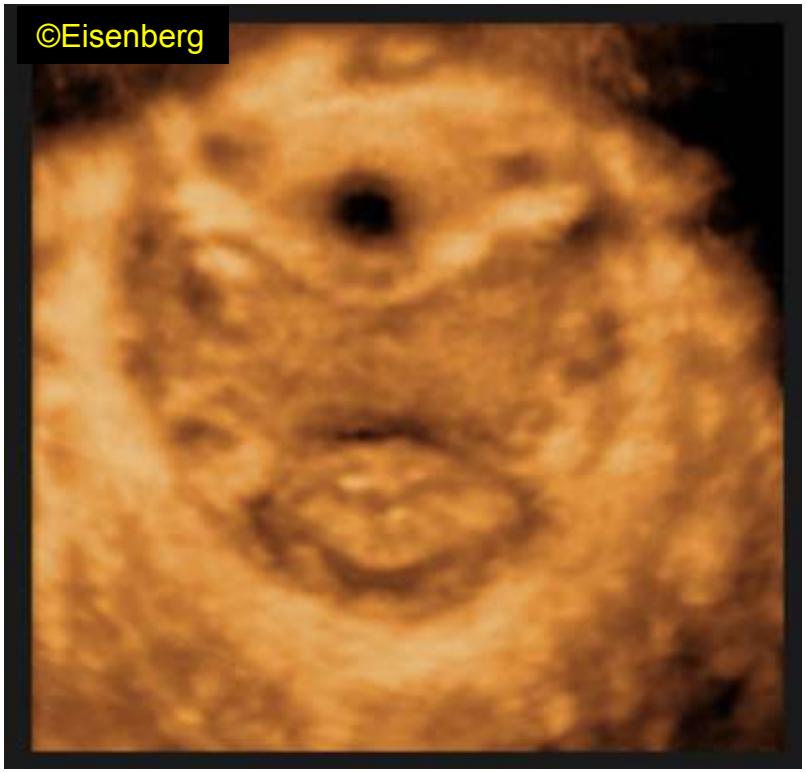
- Evaluation of obstructed defecation:
  - Rectocele, rectal prolapse, perineal descent, rectoanal intussusception (enterocele descending through anal canal)
- Cumbersome, subjective (Zbar 2005)
- High dose radiation
- Contrast material
- Alternative:
  - Dynamic MRI
  - Transperineal US
- Methods show varying agreement but US useful in initial investigation and better tolerated (Perniola 2008, Beer-Gabel 2008)

US vs. defecography



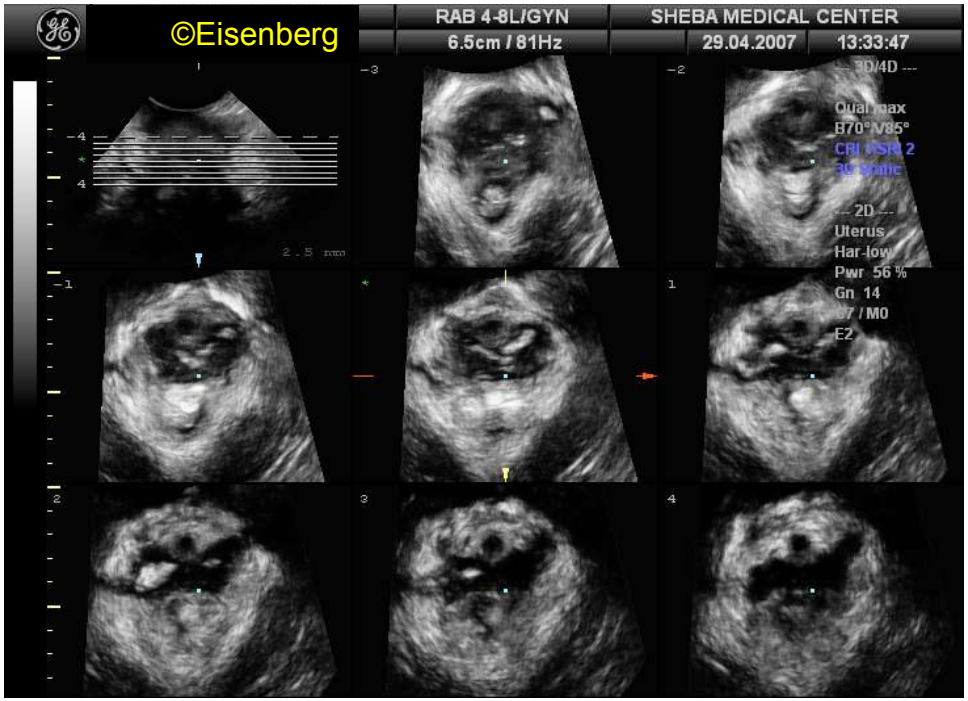
Surgical audit and complications - Suburethral slings and meshes

TVT

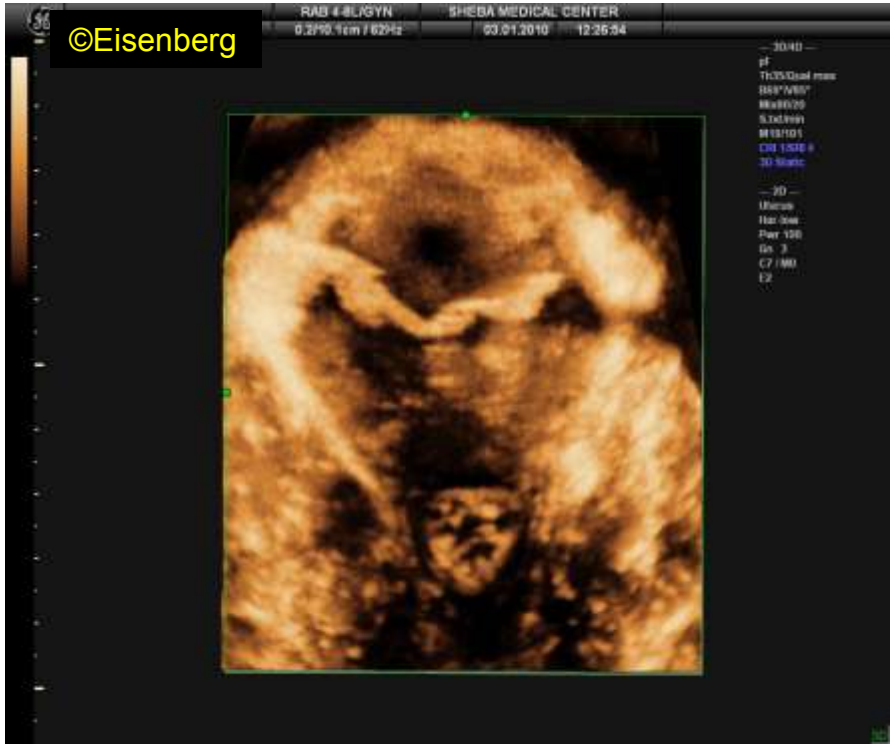


TVTO

Infected TOT



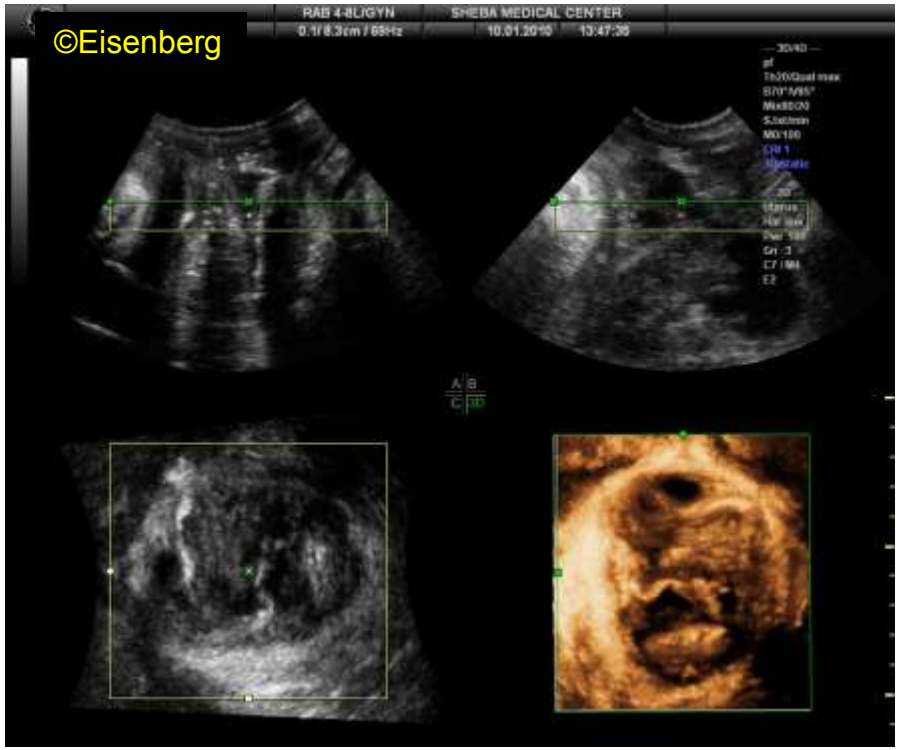
Surgical audit and complications - Suburethral slings and meshes

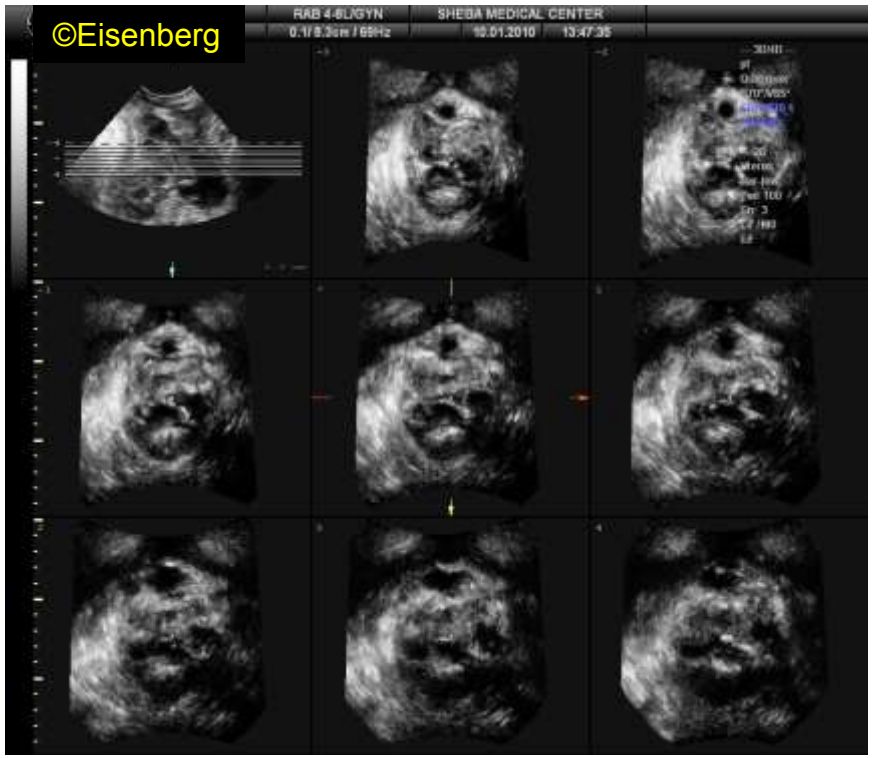


Folded TOT

Perigee

Surgical audit and complications - Suburethral slings and meshes





TOT APOGEE collection

Why every pelvic floor surgeon should use pelvic floor ultrasound

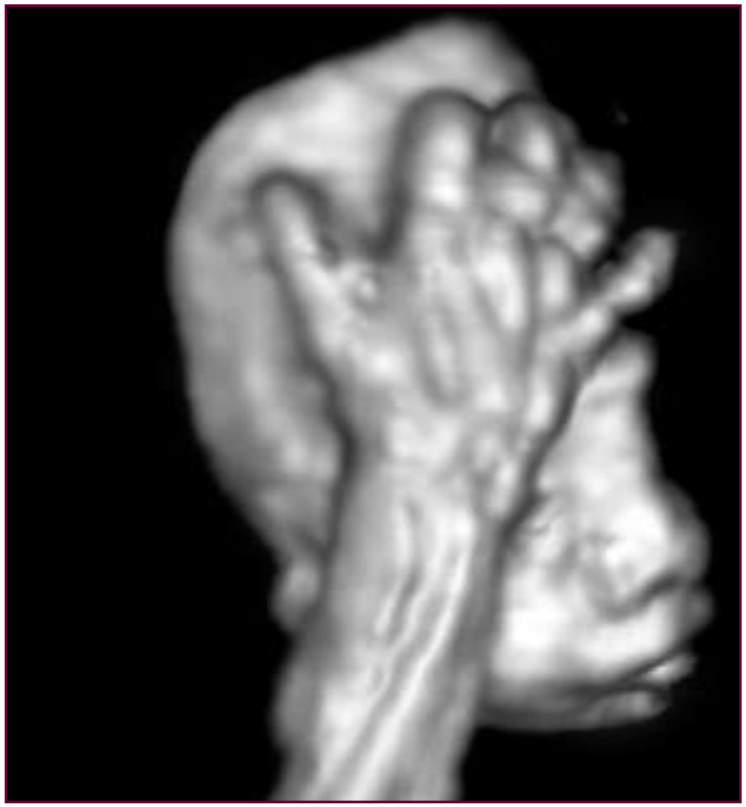
- 4D pelvic floor ultrasound is a promising non invasive tool for anatomical and functional evaluation
- Validated
- Availability of advanced US technology
- Easy acceptability by patient
- New diagnostic standard and not just a research tool?

- May enhance specific tailoring of therapeutic options
- Plan individualized surgery
- New surgical frontiers?
- To mesh or not to mesh?

And what can the perinatologist gain from pelvic floor ultrasound

- Evaluation of delivery related pelvic floor trauma (vaginal and perineal tears)
- Learn more about prenatal prevention or screening in high risk cases:
  - Elderly primiparity
  - Macrosomia – new standards for low BMI?
  - Instrumental delivery
  - Prolonged second stage (>120?)
  - Prior sphincter laceration – what to recommend for repeat deliveries
- Consider when intervention is needed, offer elective C/S?
- Enhance counseling ability
- **Prevention methods are helpful (PFE)**

Thank you



veredeis@bezeqint.net

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