Pelvic floor Ultrasound
Basic settings and procedures

HP Dietz, KL Shek, S Chan, R Guzman Rojas

This document has been produced by the Special Interest Group 'Pelvic Floor Imaging' of IUGA. It provides instructions for the acquisition of ultrasound images and 3D/4D data sets obtained by translabial imaging, the currently most widely used method for pelvic floor imaging. It is recognised that some practitioners use transvaginal and endo-anal techniques, to which this text does not apply.

- Basic Setup:
  - Ask patient to void and empty bowel if possible.
  - Position in lithotomy, heels close to buttocks
  - 4-8 MHz curved array or similar volume transducer
    - apply a layer of gel before and after covering the probe with a transducer cover/ non-powdered glove (or plastic film), avoid air bubbles between the probe and the probe cover
    - place on introitus, vertically in midline (Fig 1).
  - Ultrasound settings:
    - Maximum aperture (up to 90 degrees)
    - 2 Focal zones
    - depth 7-9 cm
    - High harmonics,
    - SRI 4-5, CRI 2-3 or similar speckle reduction techniques if available.

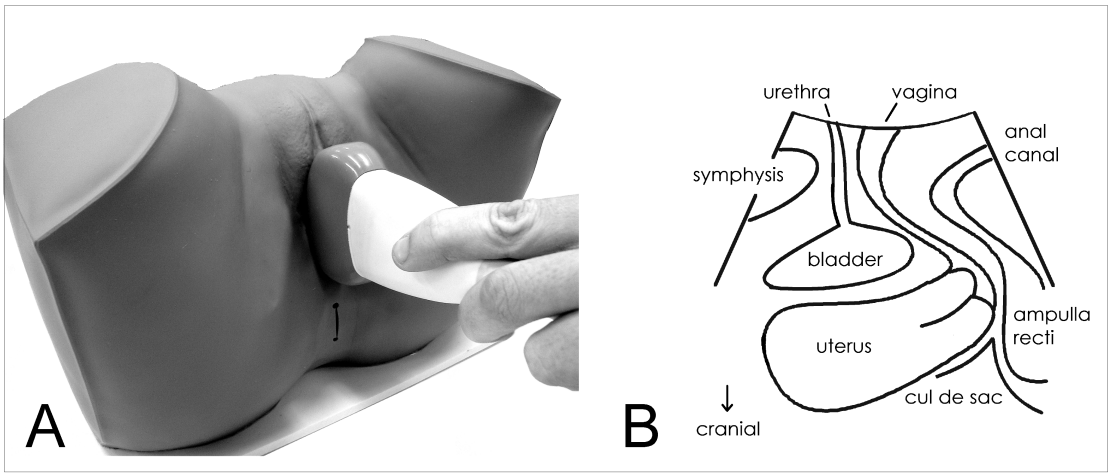

Figure 1: Transducer placement for assessment of residual urine, Detrusor Wall Thickness, organ descent, hiatal area, levator integrity.

1.) 2D image acquisition

- Leave probe on perineum once placed.
- Symphysis pubis in left hand corner, no more than 1 cm from transducer surface
- Urethra visible as black stripe to identify midsagittal plane, and the anal canal as tubular structure in the right upper quadrant.
- Residual urine: two maximal diameters vertical to each other, x*y*5.6= residual in ml (x and y measured in cm)
- Detrusor wall thickness (DWT) measured on dome, three locations in the midline, perpendicular to the mucosal surface after bladder emptying with residual <50mls.
- Split screen: images at rest (left) and on maximal Valsalva >= 6s, (right).
- Used to measure bladder neck and bladder descent (a,b), retrovesical angle (c,d) urethral rotation (e,f), (Fig 2).
- Single screen: image on maximal Valsalva to determine organ descent (Fig 3). Let the prolapse come- no pressure on perineum, without tilting the hand!
- Check for hyperechogenic structures (slings and meshes) in anterior and posterior vaginal wall.
- Check for cystic structures (urethral diverticula, Gartner cysts, nabothian follicles, ureterocele.

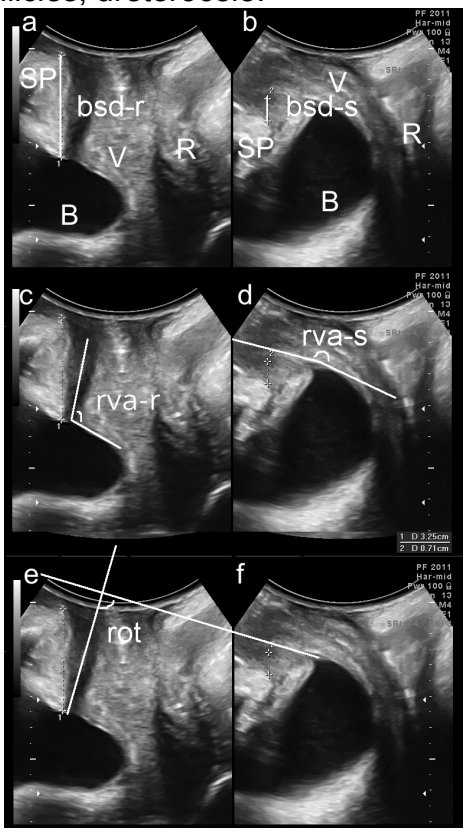

Figure 2: Split screen for BND, RVA, urethral rotation and bladder descent. BSD= bladder neck- symphysis distance, RVA= retrovesical angle, rot= rotation angle, r= at rest, s= on straining. SP= symphysis pubis, B= bladder, V= vagina, R= rectum.

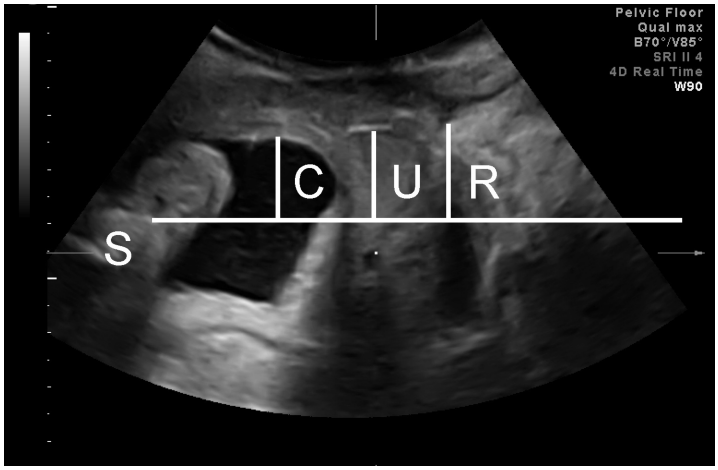

Figure 3: Single screen at maximum Valsalva (>=6s) for organ descent. S= symphysis pubis, C= cystocele, U= uterus, R= rectal ampulla.

2) 4D acquisition for prolapse/ hiatal area assessment

- Set acquisition angle at 85 degrees (or system maximum)
- 2 split screen with rendered volume on right, set the region of interest (the box shown in A) to 0.5-2 cm thickness, green line at top, place the box to include the plane of minimal hiatal dimensions (Fig 4). One may need to rotate the image so that the plane of minimal hiatal dimensions lies within the box, as in Fig 4.
- Keep right-hand image symmetrical and in the centre throughout acquisition, and keep SP in left- hand image. No pressure on transducer. Avoid levator co-activation (Fig. 5). Biofeedback teaching if there is levator coactivation. Valsalva >= 6 s.
- Measure hiatal area on rendered volume (right). Move the Box (area of interest) in A for clear image of the hiatus for measurement. Use whatever thickness (0.5-2 cm) gives you the best contour. Check distance of contour from image edge in A and B.

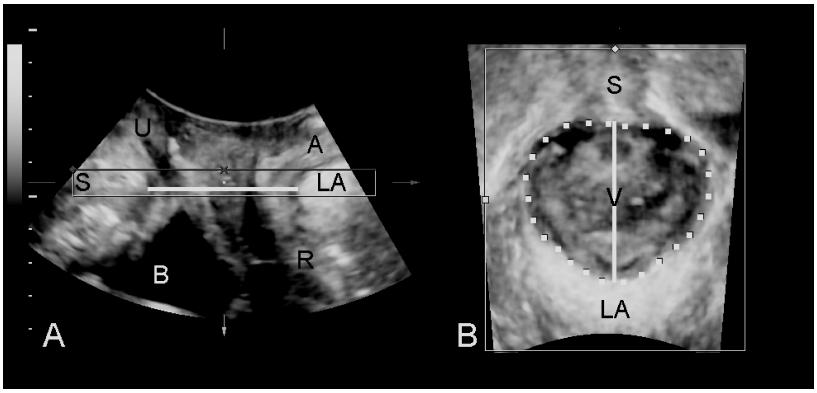

Figure 4: 4D acquisition for organ descent and hiatal ballooning (85 degree acquisition angle). The region of interest (box in A) is set between symphysis (S) on the left and the levator ani (LA) on right. B= bladder, U= urethra, R= rectal ampulla, A=anal canal, V= vagina. The dotted contour in B is the hiatus in the plane of minimal dimensions, the white line in A and B is the minimal hiatal diameter in the midsagittal (anteroposterior) plane.

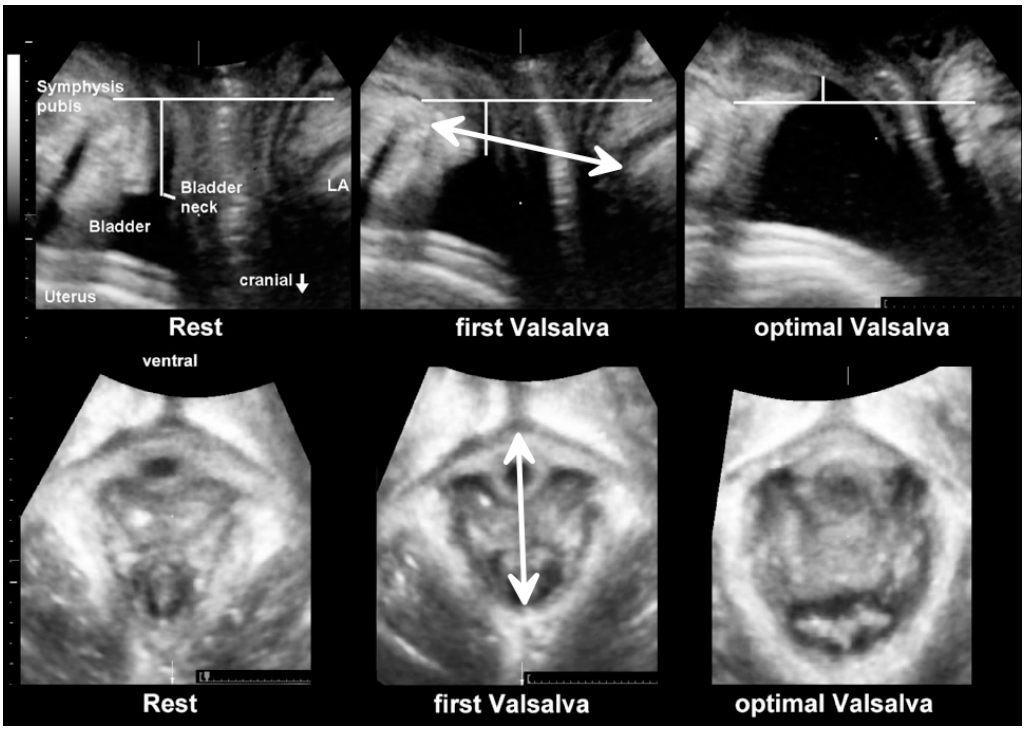

Fig. 5: Levator co-activation or co-contraction during Valsalva evidenced by a reduction in anteroposterior hiatal diameter (first Valsalva, vertical lines in central images). From Oerno et al., Ultrasound Obstet Gynecol 2007; 2007; 30: 346–350

3.) PFMC for tomographic imaging of levator integrity:

- Views as above- make sure symphysis is visible.
- Ask for PFMC, and make sure the levator ani muscle remains visible. May need pressure on the perineum.
- Rotate the A plane to place plane of minimal dimensions (minimal distance from SP to LA) in middle of box (Figure 6).

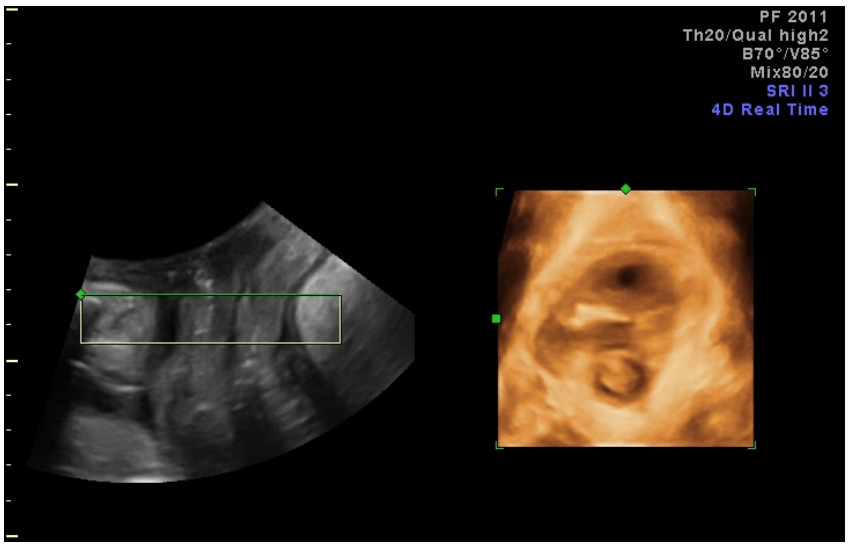

Figure 6: PFMC, plane of minimal dimensions placed in centre of box (region of interest)

- Switch to TUI (tomographic ultrasound imaging) in the C (axial) plane and rotate this plane so that the image is upright. Set the interslice interval at 2.5 mm, 8 slices (see Figure 7).
- May need further adjustment so that the SP in the 3 central slices (i.e.slice 3 to 5 in Fig 7) appear open (slice 3), closing (slice 4) and closed (slice 5) (Figure 7).
- Rate central three slices for integrity of the insertion of the puborectalis muscle.
- When in doubt measure levator-urethral gap between centre of the urethra and PR insertion (Figure 8). Limit of normal in Caucasians is 2.5 cm.

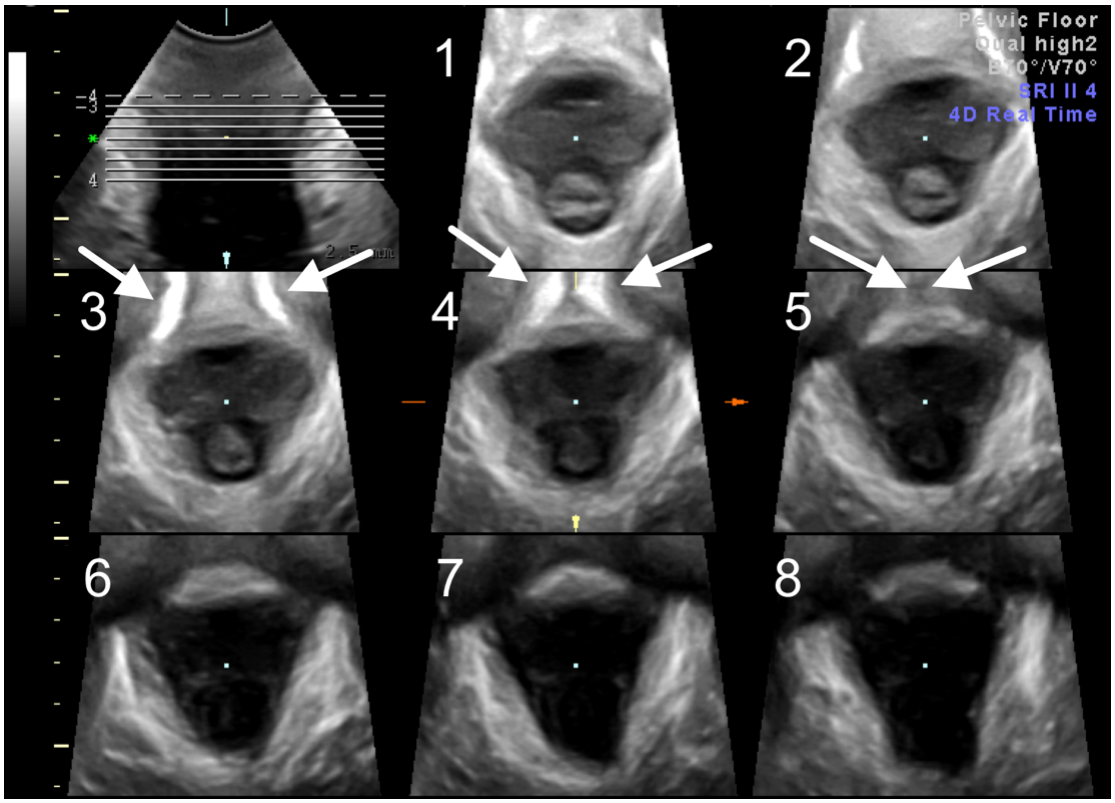

Figure 7: TUI in the C (axial) plane for assessment of levator integrity. Slice 1 is the caudal slice, slice 8 is the most cranial cranial slice.

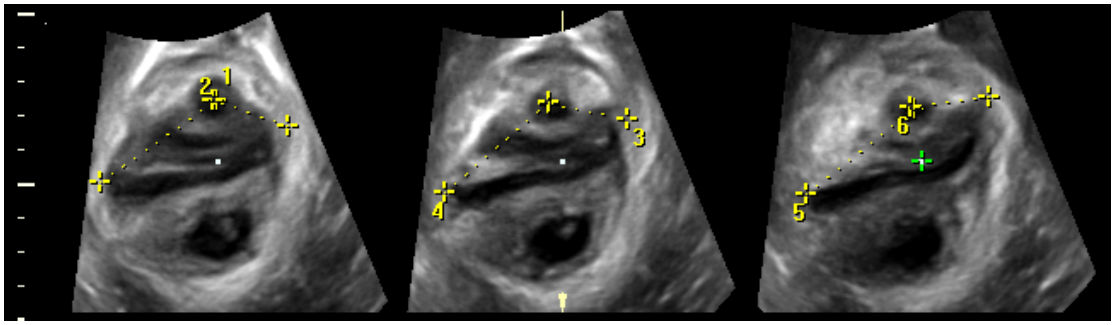

Figure 8: Levator-urethra gap measurement in the three central TUI slices in a patient with a right- sided avulsion.

4) 4D Acquisition for imaging of the anal canal

- Place transducer transversely over introitus after reducing aperture to 60 degrees. Apply additional gel centrally. Tilt the probe towards the canal (see Figure 9 A) so as to obtain a transverse view of the anal canal (see Figure 9 B)
- SRI 3-4, CRI 2-4, high harmonics, +/- VCI
- Set acquisition angle at 70 degrees to image the whole length of the anal canal.
- One focal zone as close as possible to the probe surface.

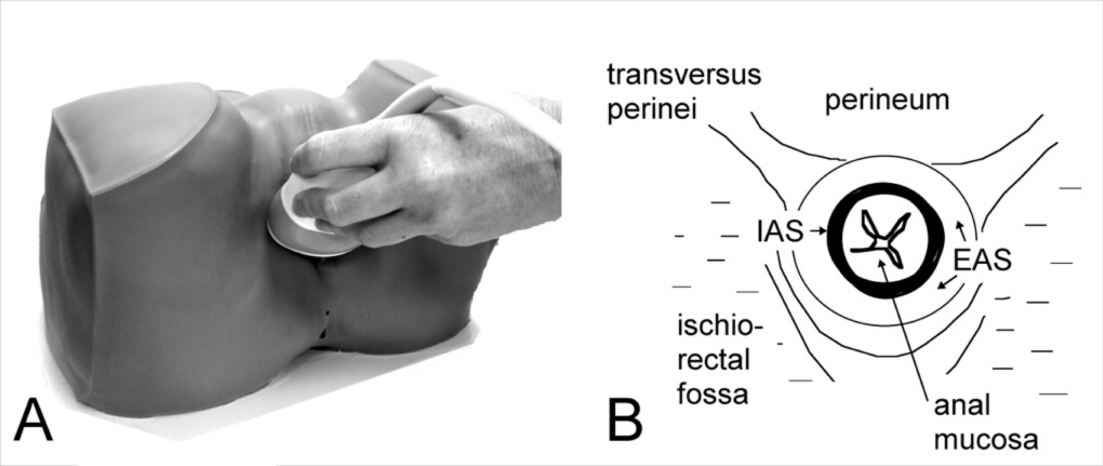

Figure 9: Transducer placement for exo-anal imaging of the anal sphincter

- view transverse plane as A, midsagittal plane as B, and identify the fascial plane separating the EAS from the levator ani in the B plane (Figure 10). If the B plane shows horizontal parallel dark stripes and if those parallel dark stripes, ie., the internal sphincter, are vertical in the C plane, then the image is properly centred.
- ask patient to perform PFMC, take care the entire EAS is within the field of vision.
- Adjust transducer pressure to stay close without deforming the ring shape of the sphincter.
- Select A plane and TUI. Adjust interslice interval to include the entire EAS (see Figure 11).
- Measure defects by determining defect angle (Figure 12) in slices 2-7.

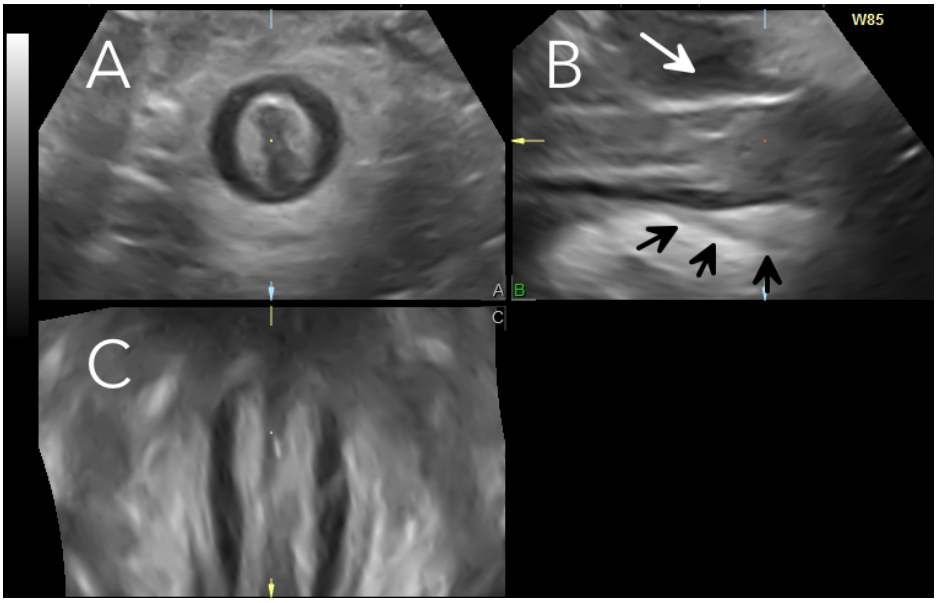

Figure 10: Identification of EAS limits in midsagittal (B) plane. The fascial plane in B (black arrows) identifies the true extent of the EAS. There is a clear deficiency of its ventral aspect (white arrow), which on tomographic imaging (examples in Figures 11 and 12) affected 3 out of 6 slices, although this defect is not visible in A.

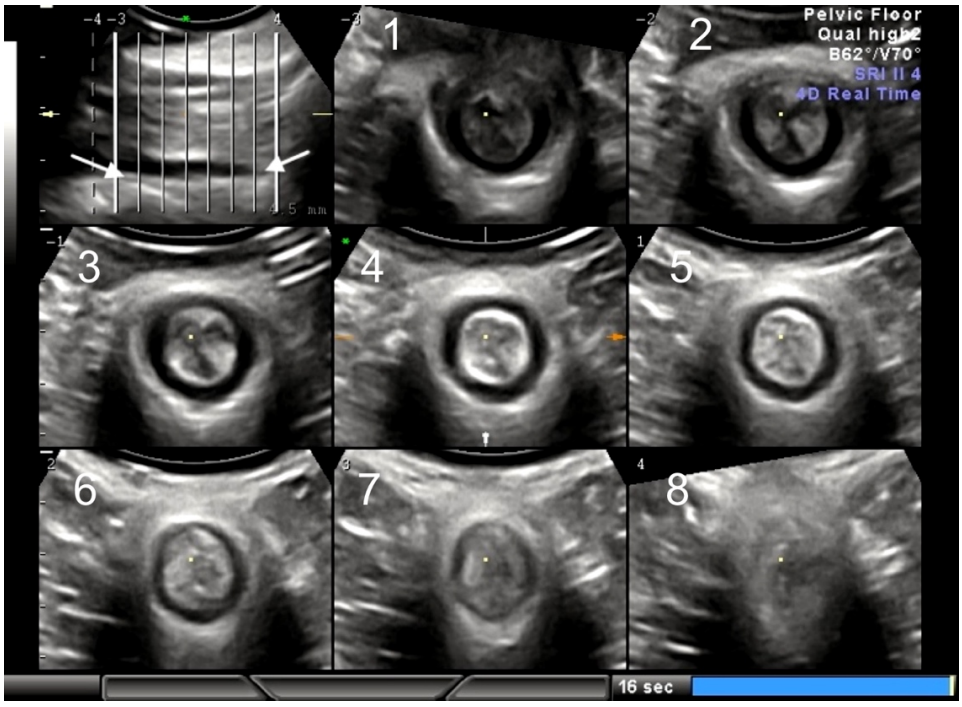

Figure 11: TUI for assessment of the anal sphincter, asymptomatic nullipara. The top left hand image in the midsagittal plane shows placement of the 8 transverse slices, which encompass the entire EAS from slice 2 to 7, with the possible exception of the most superficial part of the subcutaneous EAS.

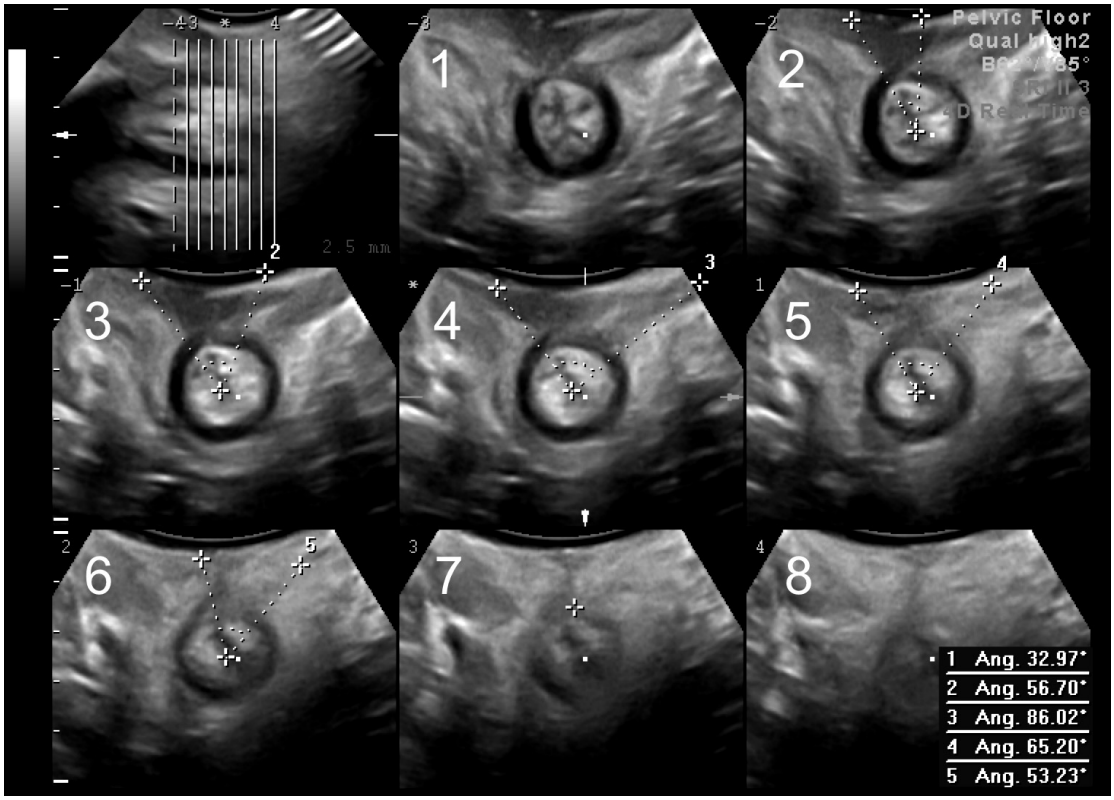

Figure 12: Measurement of EAS defect angle in symptomatic patient >20 years after EAS tear. The images show a defect of 30 degrees or more (one hour on the clock face) in slices 2-6.

Further reading:

Dietz HP. Pelvic Floor Ultrasound. In: Rizk and Puschek, Ultrasonography in Gynecology. Cambridge University Press 2013

Dietz HP. Ultrasonography. In: Evidence based physiotherapy for the pelvic floor: bridging research and clinical practice. 2nd Edition. K. Bo, B. Berghmans, M. van Kampen and S Morkved Eds. Butterworth Heinemann Elsevier, 2014

Shek KL, Dietz HP. Imaging of slings and meshes. Australasian Journal of Ultrasound in Medicine May 2014; 17 (2): 61-71

Dietz HP. Pelvic Floor Ultrasound. In: Sonography in Obstetrics and Gynecology: Principles and Practice. 8th ed. Fleischer AC et al., Mc Graw Hill 2016

Dietz HP. Pelvic Floor Ultrasound: Normal Anatomy. In: Merz E. Atlas of 3D/ 4D Ultrasound in Obstetrics and Gynecology. Thieme Stuttgart, 2016.

Dietz HP. Pelvic Floor Ultrasound: Abnormal findings. In: Merz E. Atlas of 3D/ 4D Ultrasound in Obstetrics and Gynecology. Thieme Stuttgart, 2016.

Shek KL, Dietz HP. Assessment of Pelvic Organ Prolapse: A Review - Ultrasound Obstet Gynecol Gynecol 2016; 48: 681-692 DOI: 10.1002/uog. 15881

Transperineal ultrasound report template Date of procedure:_____

Patient details:

Indication:_____

Transperineal ultrasound – performed: supine/standing
Bladder emptied: YES / NO

Residual urine volume: _____ mls Detrusor Wall thickness: _____mm

Bladder neck descent on Valsalva: _____ cm

Urethral rotation on Valsalva: _____ degrees RVA on Valsalva: _____deg.

Comments:

_____

_____

Pelvic Organ measurements (Valsalva) relative to SP:

Bladder position: _____mm

Uterus/vault: _____mm

Rectal ampulla: _____mm Rectocele depth: _____mm

Enterocele: _____mm
Intussusception:_____

Comments:

_____

_____

Mesh or slings: YES/NO

If sling present, sling pubis gap measurement: _____mm

Comments:

_____

_____

3D/ 4D ultrasound:

Status of levator muscle – RIGHT: Intact / Partial / Complete avulsion
LEFT: Intact / Partial / Complete avulsion

Levator hiatal area on Valsalva: _____cm^2
Other:_____

Anal Sphincter Complex: Intact / Defects noted: IAS …. / 6 EAS .... / 6

_____

_____

_____

Findings & Conclusion:

_____

_____

_____

Letter Template

Date:

Re: _____

Ms _____ was seen for a Pelvic Floor Ultrasound on _____. She is suffering from symptoms of _____. 2D and 3D/4D pelvic floor ultrasound was performed using a _____ system.

Findings:

2D: The postvoid residual was ____ml. The urethra appears _____. Detrusor wall thickness was _____mm. No synthetic implants visualised.

There was _____cm of bladder neck descent on Valsalva, with a _____ retrovesical angle and ____degrees of urethral rotation. On valsalva, there is descent of the bladder to _____cm below the symphysis pubis (SP), the rectal ampulla descends to ____cm below the SP, and the rectocele depth measured _____. The vault/uterus descended to _____above/ below the SP.

3D: The puborectalis muscle was intact/ showed an avulsion on the right, and _____ on the left. The levator hiatal area measured _____cm^2, which is _____ enlarged/ implies _____ballooning. Mrs_____ was able to perform a fair, well coordinated levator contraction. Both EAS and IAS appeared normal/abnormal, with no/ a residual defect in _____ slices.

Interpretation: _____-compartment prolapse against the background of _____ puborectalis muscle and _____levator hiatal area ballooning.

A plan of management may include

_____

I hope to have been of assistance.

Kind regards