

Trans-pubic Voiding Sonography



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Hypothesis and Aims of study

Imaging can be used to target diagnosis and interventions for incontinence. Realtime ultrasound is now commonly used to image pelvic structures though not to visualise voiding. A **transabdominal** approach does not visualise the urethra or periurethral structures, and the **transperineal** approach inhibits voiding due to position of the transducer. A **transpubic** approach has been suggested.

Aim 1. to investigate the feasibility of transpubic ultrasound imaging to visualise the process of voiding and assess the dynamics of the vesicourethral sphincter, the urethra and pelvic floor muscles during initiation, duration and cessation of micturition.

Aim 2. to document voiding patterns at different stages throughout a single adult female subject's reproductive years and postpartum recovery - a visual template of physiological changes during pre-, peri- and post-partum period.

Study design, materials and methods

Study Design

Descriptive study
Exploring feasibility, and methodology for transpubic ultrasound to image the process of voiding.

Methods:

A single subject was used to reduce anatomical variation, over 11 years to document voiding during the pre-, peri- and post-partum periods.

A pre-scanning bladder filling protocol was used to ensure a moderately full bladder. Subject was seated in a voiding posture on an over-toilet seat and the sonographer seated to her side for scanning (Fig 1).

The subject gave informed consent at each time point.

A curved array transducer of 2-5 MHz. was placed in the mid-sagittal plane over the pubic symphysis to image through the hypochoic cartilage, with a footprint large enough to visualise:

- full cranio-caudal length of the fibrocartilaginous symphysis pubis (LFSP) as the only fixed reproducible landmark and to ensure a **midline plane**

- full length of urethra
- full bladder
- anterior and posterior vaginal walls
- lower uterine segment
- ano-rectal angle



Figure 1. Scanning position

Transducer was placed on the symphysis pubis without obstructing urine flow.

Videos were recorded and viewed in the radiological convention cranio-caudal inverted presentation.

Subject was requested to void and initiation, duration and cessation of voiding was imaged, plus a pelvic floor muscle contraction at end of the void.

Visual changes were noted and documented descriptively.

Measurements were taken of the angle between the LFSP and the bladder neck to measure urethral mobility (Figs 2a, 2b).

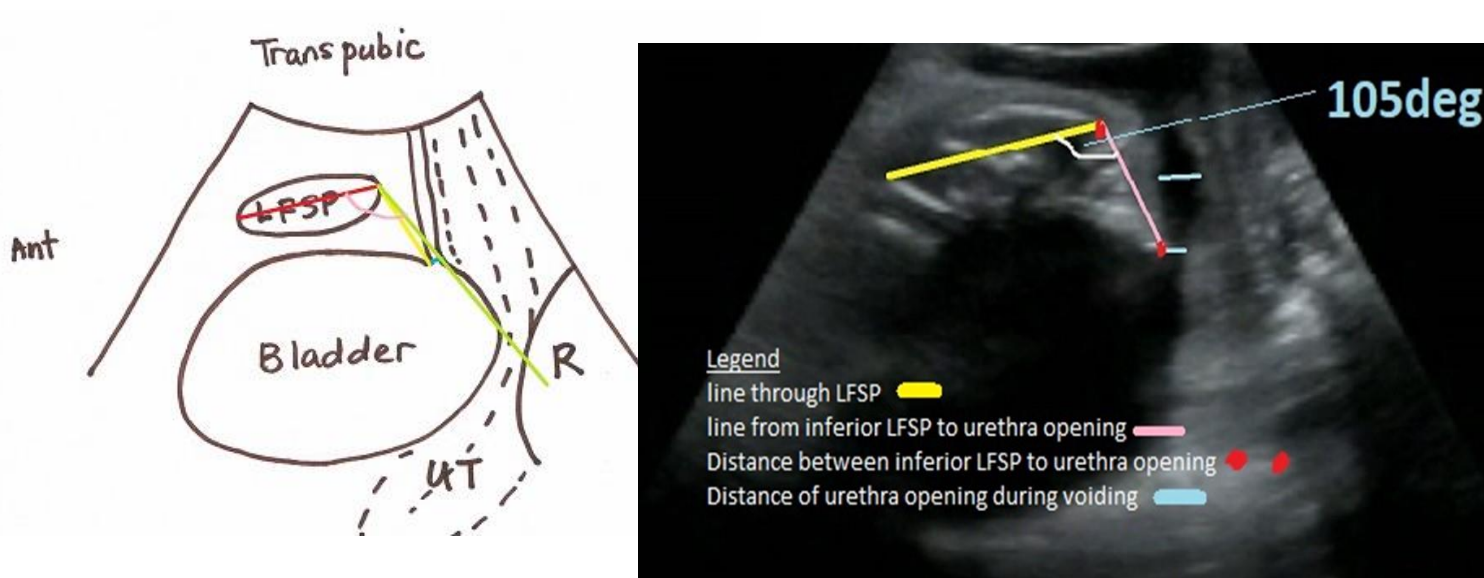


Figure 2a. Line drawing of anatomical landmarks

Figure 2b. Scanned image showing measurements for urethral mobility

The subject self-reported any pelvic floor dysfunction at each scan. After her final scan, the subject had a pelvic floor assessment by a pelvic floor physiotherapist.

Results

Subject:

Adult female, nulliparous, age 36 at start of study, G3P3, age 46 at end of study.

BMI 23.9 at start of study, 25.7 at end of study.

Results:

1. The videos of voiding indicate that this technique is feasible
This approach allowed voiding to occur in a functional voiding position
2. The methodology is reproducible over time
Critical criterion for reproducibility was to use the midline sagittal plane, by visualising the full LFSP at each scan
3. The measurements of the angle between the LFSP and bladder neck indicate differences in urethral mobility at pre-, peri-, and post-partum stages (Table 1). Scanned images indicate measurements at two stages during this study (Figures 3, 4).

Table 1. Angle measured at start (s), voiding (v) and end void (e)

Event	Baseline normal voiding	1 month After elective caesarean section	At 37 weeks gestation	14 days post-partum	13 weeks post-partum	5 years after birth of third child
s	110°	100°	120°	160°	155°	100°
v	105°	90°	115°	155°	150°	105°
E	80°	70°	70°	150°	135°	70°

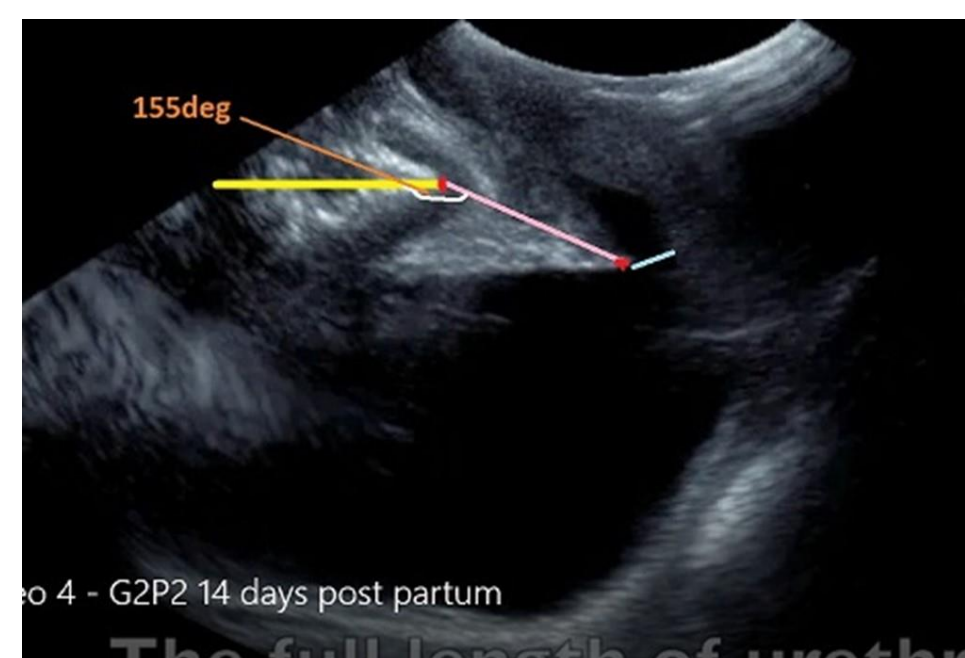


Figure 3. Voiding 14 days post partum.

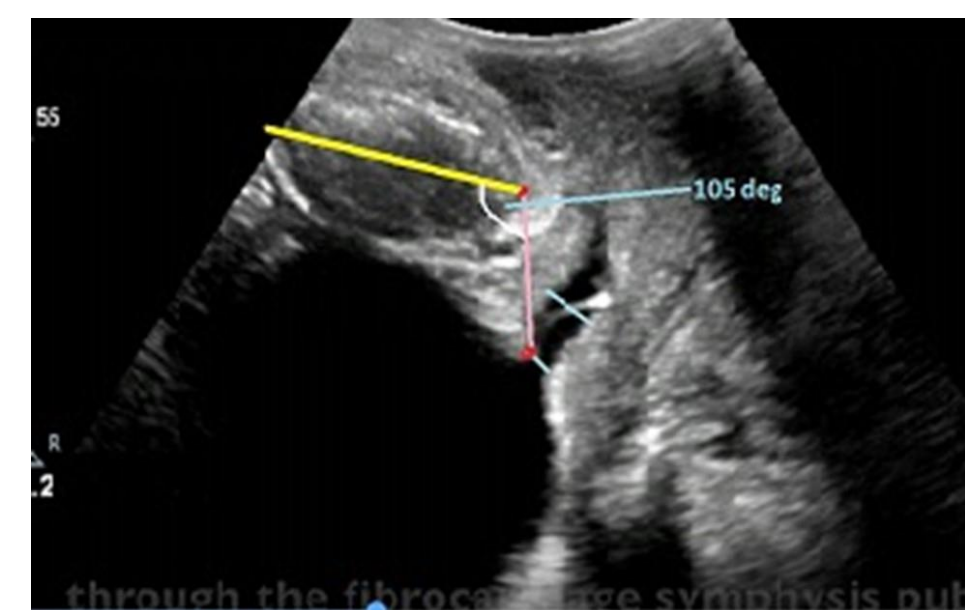


Figure 4. Voiding 5 years after birth of 3rd child

Conclusions

- ✓ Trans-pubic scanning technique is feasible
Can document dynamic and measurable data, consistent over time
- ✓ Reproducible on different ultrasound machines
Gives consistent data over time
Cost effective, convenient, and gives immediate visualisation of voiding to expand the assessment of patients with voiding dysfunction
- ✓ Further research will expand options for the use of this technique and refine options for measurement

Concluding message

To the best of the authors' knowledge, this descriptive voiding report is the first longitudinal case reported using transpubic voiding sonography.

Transpubic voiding sonography is a cost effective and convenient examination which can give an immediate visualisation of the process of voiding to expand the assessment of patients with pelvic floor or voiding dysfunction.