# W2: ICS CORE CURRICULUM (FREE) Physiotherapy Committee: Ultrasound Imaging of the Structure and Function of Pelvic Floor Muscles in Men and Women

Workshop Chair: Paul Hodges, Australia
23 October 2024 08:30 - 10:00

| Start | End | Topic | Speakers |
|---|---|---|---|
| 08:30 | 08:45 | Introduction to US imaging for assessment of morphology and structure of pelvic floor muscles | Linda McLean |
| 08:45 | 09:15 | Application of US for assessment of morphology and structure of the female pelvic floor: Practical demonstration and discussion | Grainne Donnelly |
| 09:15 | 09:45 | Application of US for assessment of morphology and structure of the male pelvic floor: Practical demonstration and discussion | Paul Hodges |
| 09:45 | 10:00 | Discussion | Paul Hodges<br>Grainne Donnelly<br>Linda McLean |

**Description**
This workshop is presented on behalf of the Physiotherapy Committee.

Background
Rehabilitation of pelvic floor muscle function is recommended as a first-line approach for the treatment of several conditions in which impaired pelvic floor function may be implicated. These include urinary incontinence, pelvic pain, pelvic organ prolapse, and bowel dysfunction. (NICE 2019; NICE 2021) Physiotherapists are at the forefront of providing conservative care for pelvic floor disorders and are trained to develop knowledge and skills for a standardized assessment of the pelvic floor muscles.

Assessment of pelvic floor muscle morphology and functions is most commonly evaluated in clinical practice using digital palpation. Although digital palpation is readily accessible and is not costly, it has limitations. For female anatomy, palpation is accurate for the assessment of levator avulsion when performed by a skilled evaluator, it is not reliable nor responsive when evaluating levator ani muscle strength or tone, and its measurement properties for the assessment of motor control are unknown. For assessment of male anatomy, digital palpation provides information regarding anal and levator ani control, but cannot provide information on the key mechanisms associated with urinary continence. Although dynamic function can be assessed with pressure and electromyography, these methods provide information that can be difficult to interpret.

To overcome those limitations, there is growing interest in using point of care ultrasound imaging to enhance the quality and the precision of the assessment of pelvic floor muscle morphology and function using objective and standardized measurements. In addition to its use as an evaluative tool, ultrasound imaging is increasingly used as a biofeedback tool for the visualization of pelvic floor muscle activity when performing pelvic floor muscle exercises. This application of ultrasound imaging supports the 2014 Consensus Statement (Dumoulin et al) for improving pelvic floor muscle training adherence by ii) offering accurate information to assist growing patient ‘‘knowledge,’’ ii) teaching the ‘‘physical skills’’ of a correct PFM contraction, then enhancing performance and developing patient confidence, iii) promoting positive ‘‘feelings about PFMT’’, iv) enabling constructive ‘‘cognitive analysis, planning and attention’’ to problem solve common barriers to and enhance PFMT facilitators in daily life and v) boosting the ‘‘prioritization’’ of PFMT in patients’ lives. Although ultrasound provides many opportunities to enhance care, its use can be intimidating to use because of the knowledge, skill and experience required to generate and interpret meaningful images. This workshop aims to provide clinicians with basic skills to understand the application and interpretation of ultrasound imaging and reduce the barriers to its use in practice.

Key learning points
After attending this workshop, the attendees will be able to describe:

- The equipment needed to perform 2D transabdominal and transperineal pelvic floor ultrasound imaging
- How to perform and interpret assessment of the morphology and function of female and male pelvic floor anatomy using 2D transperineal ultrasound imaging.
- The measures and terms used to describe assessment outcomes related to pelvic floor muscle morphology and function using 2D ultrasound imaging.
- The relationship between ultrasound imaging measures and other measures of pelvic floor muscle activity such as electromyography, and how a combination of methods is generally required to fully interpret findings.
- The current and potential clinical utility of using ultrasound imaging for the assessment and conservative treatment of pelvic floor muscle function.
- What can and cannot be interpreted from ultrasound imaging.
- The pros and cons of different imaging methods and tests.

- The scope of practice of physiotherapists related to the clinical use of point of care ultrasound imaging.

Key take-home messages:

- Ultrasound imaging is increasingly used for the assessment and treatment of pelvic floor dysfunction in conservative management, including physiotherapy practice. If conducted properly, ultrasound imaging has the potential to aid standardization and objective measurement of pelvic floor morphology and function. This workshop highlights the important considerations that must be considered when using this tool in clinical practice. The participants will gain an understanding of the clinical utility and the scope of practice using ultrasound imaging.

**Aims of Workshop**

This workshop aims to provide a detailed overview of the application of ultrasound imaging to the assessment of morphology and function of the pelvic floor in men and women. Emphasis will be placed on evaluation of muscle function and its utility in guiding conservative management of pelvic floor dysfunction, including the application of ultrasound imaging as a feedback tool for rehabilitation. The session will include live demonstrations of methods and opportunities for audience involvement in discussion. Presenters will discuss anatomy and imaging techniques for female and male anatomy and the level of evidence for its utilisation in clinical care.

**Educational Objectives**

- Health professionals, including physiotherapists and wider multidisciplinary team members will learn how Point of Care Ultrasound Imaging can be used and applied as an extension of their clinical assessment and conservative management of pelvic floor dysfunction. Delegates will experience live demonstration of imaging methods and the interpretation of findings. There will be substantial opportunity for discussion of the practical application.
- The session will commence with discussion of anatomy and function of pelvic floor muscles and how this can be interpreted with ultrasound imaging. The majority of the session will involve live demonstration of the application of US to assessment and training of pelvic floor muscles in male and female anatomy. The session will conclude with a panel discussion of developing competencies and scope of practice for different disciplines.
- Basic application skills will be immediately applicable to clinical practice while defined training and practice requirements will be highlighted. Relevant resources and references will be supplied to delegates to supplement their learning including first scope of practice framework for physical therapists engaging in point of care ultrasound imaging which will guide them through relevant considerations and steps towards developing competency.

**Learning Objectives**

1. How to use 2D ultrasound imaging (USI) to evaluate pelvic floor morphology and function in men and women.
2. How to interpret dynamic USI measures of pelvic morphology during functional tasks and how they relate to clinical pelvic floor assessment outcomes in men and women.
3. How 2D USI can be used to enhance pelvic floor muscle training for individuals with pelvic floor disorders.

**Target Audience**

Urology, Urogynaecology and Female & Functional Urology, Conservative Management

**Advanced/Basic**

Intermediate

**Suggested Learning before Workshop Attendance**


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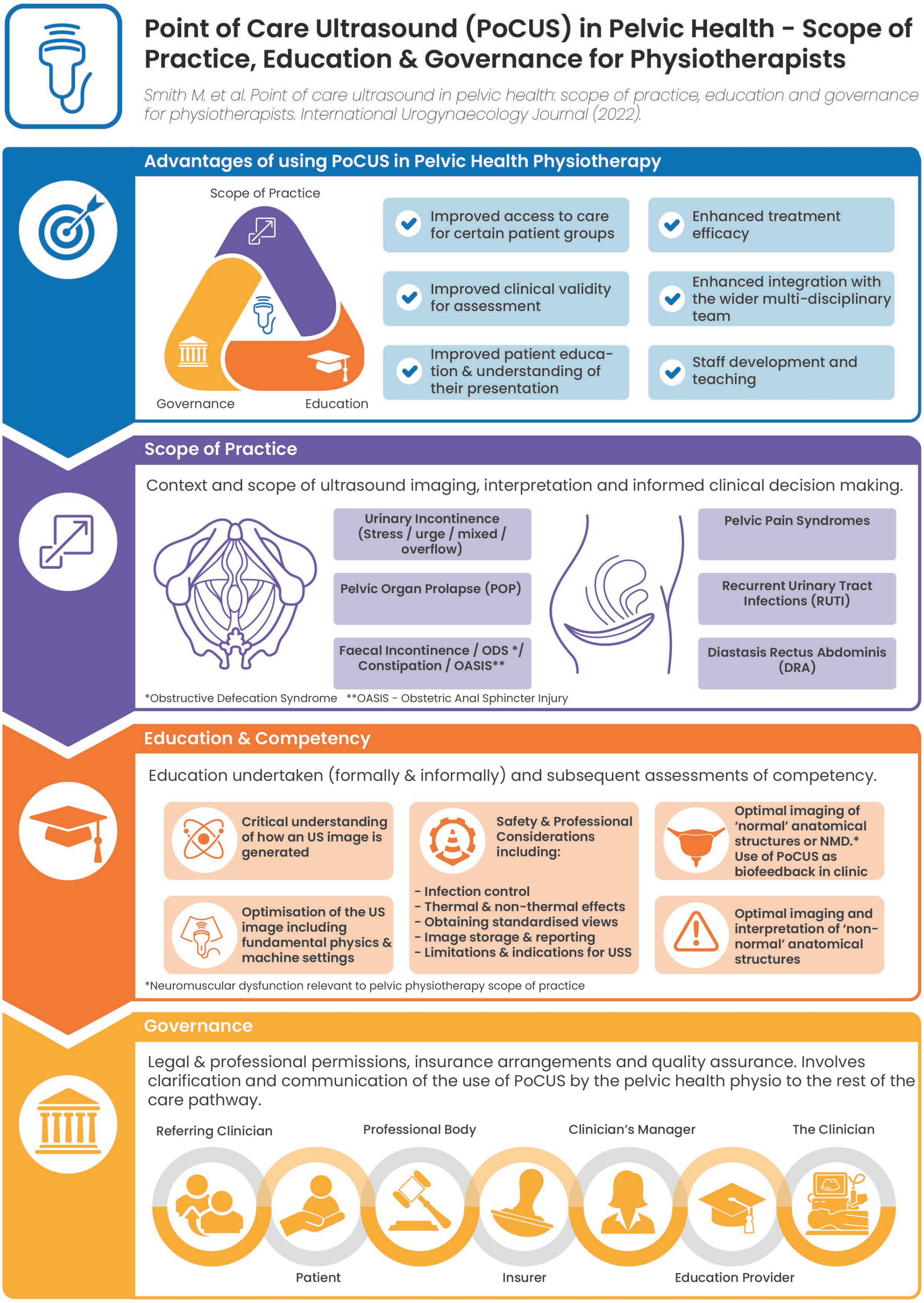
# PART 1: The role of ultrasound imaging in pelvic health



# Transperineal ultrasound provides the eyes to what you have already 'heard' and 'felt'

## What structures and function can we evaluate using 2-Dimensional transperineal PoCUS in women?

**What structures are we interested in following subjective and objective (digital vaginal or digital rectal) examination?**

i) Pelvic organ support
ii) Continence mechanism (urethral support, bladder neck closure)
iii) Pelvic floor muscle function (co-ordination, range of motion, speed of response, force production)
iv) Bladder filling, storage, emptying

### i) Anatomy and pelvic organ support

- Identify key pelvic floor landmarks – pubic bone, urethra, bladder neck, cervix, rectum
- Is the anterior, posterior and or vaginal apex supported as expected? What happens during activity e.g. cough, Valsalva or change of position?
- Ano-rectal junction position and shape - ? non-relaxing pelvic floor
- Functional evaluation – contract/relax pelvic floor?

### ii) Continence mechanism

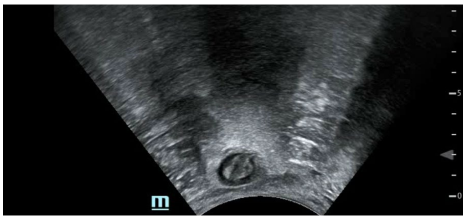
- Is there spatial movement of the bladder neck? Urethral hypermobility (retrovesical angle > 120 degrees under strain)? Urethral funneling during activities of higher intra-abdominal pressure
- Can *doppler application* confirm genuine stress urinary incontinence? *(see further information later)*

### iii) Pelvic floor muscle function

- Muscle activity in response to cue? Can varying the cue optimise the function? Full ROM through contraction and relaxation? Consider ano-rectal angle displacement in a cranioventral direction (levator ani). Consider superficial muscle activity in an anterior-posterior direction – look under the pubic bone.
- Is muscle function brisk and co-ordinated to cue?
- Does the urethra change shape in response to pelvic floor recruitment – does it straighten, lift higher, descend less on activity with the pelvic floor contracted?

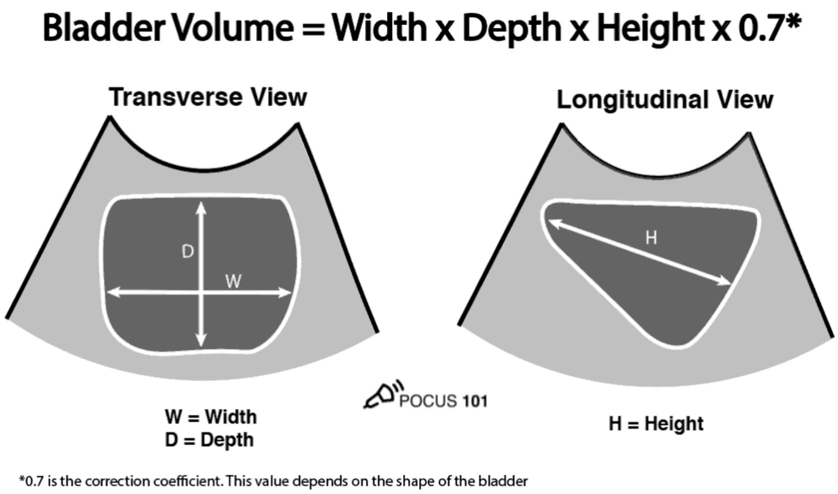
### iv) Superficial Anal Sphincter biofeedback

- By rotating the probe into the transverse plane and tilting back into the coronal plane on the perineum you can visualise the superficial anal sphincter structure including EAS, IAS and rectal mucosa.
- Can the patient achieve EAS closure to cue? Does the circular muscle close uniformly? Can visual feedback encourage them to achieve better closure?



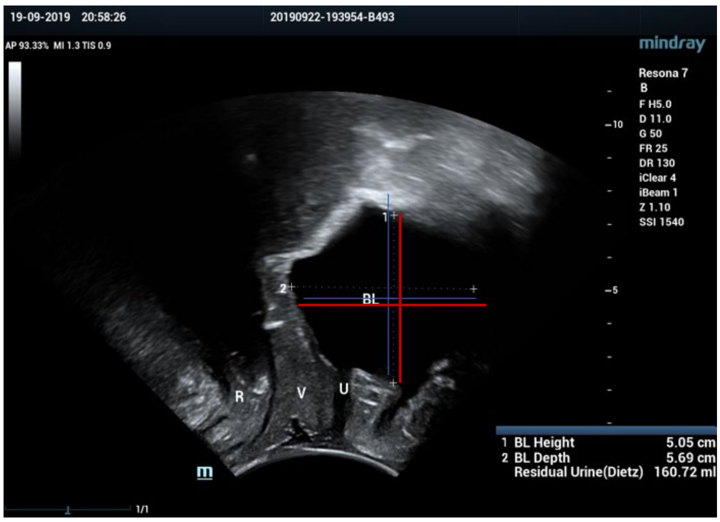
### v) Bladder filling, storage and emptying

- *Transabdominal* useful for assessing bladder shape, volume and emptying




(Bih et al., 1998)

- *Transperineal* – can assess bladder emptying here too with comparative accuracy (Dietz et al 2012)




Calculate bladder volume: H x W x 5.6 (Dietz et al., 2012 )

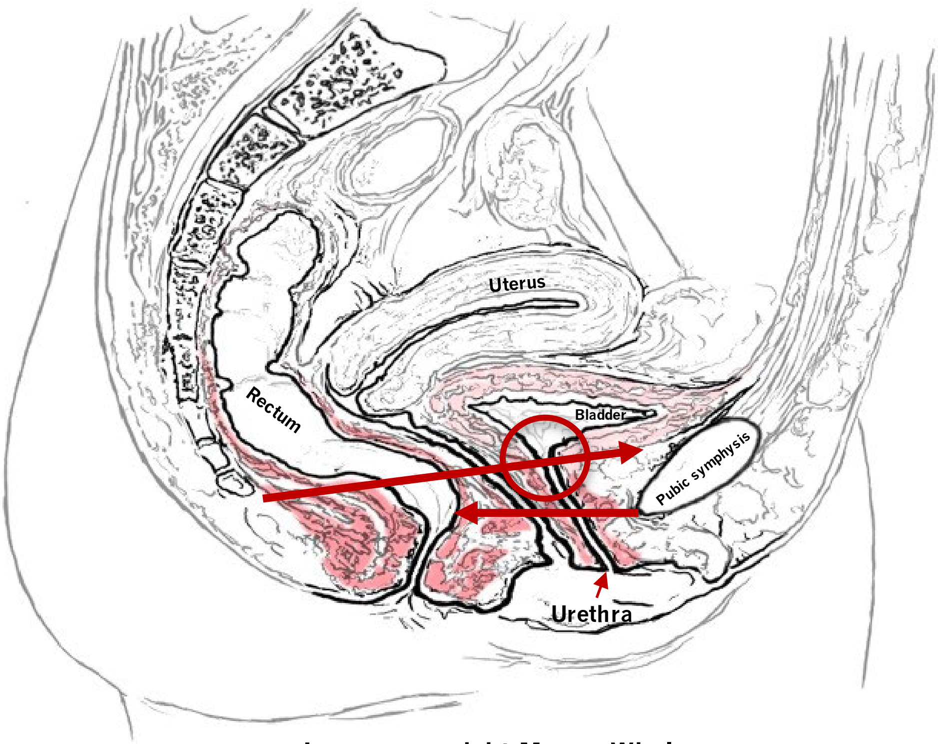
- Part of a series of information that builds from subjective examination, bladder diaries etc.

# PART 2 – APPLICATION TO PRACTICE. PELVIC FLOOR DYSFUNCTION IN WOMEN & THE INTEGRATED LIFESPAN MODEL

**Urinary continence in women is controlled by multiple mechanisms:**

- **Smooth muscle** of urethra/bladder neck. Also known as the *internal urethral sphincter*. Controlled by autonomic nervous system – tonic activity

- **Striated muscles** that act on the urethra: i) Striated urethral sphincter (also known as the rhabdosphincter, external urethral sphincter), ii) Levator ani (puborectalis, pubopubococcygeus, iliococcygeus), iii) superficial pelvic floor muscle - Bulbocavernosis (bulbospongiosus)

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- Continence mechanism is supported by connective tissues/structural support (pelvic organ support), levator ani integrity and function, contribution from striated muscles (particularly the striated urethral sphincter), vascular and neural innervation
- Potential damage during transitional and intervening life events *(DeLancey et al 2008, 2023)* e.g. vaginal childbirth, chronic straining, ageing including:
    - levator ani (tearing, avulsion, thinning, deconditioning)
    - striated urethral sphincter

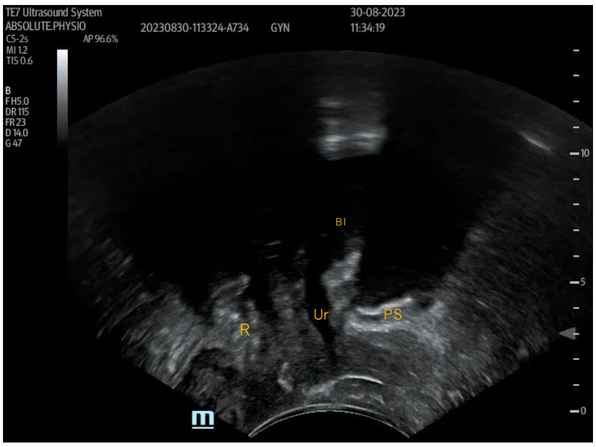
- pubocervical fascia
- potential perineal distensibility (may also be influenced by hypermobility presentations)
- potential neural compromise (pudendal)

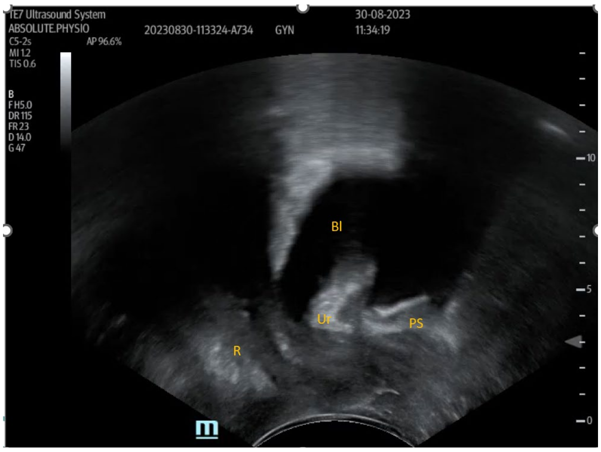
- **Mechanism for incontinence is multifactorial – no single cause**

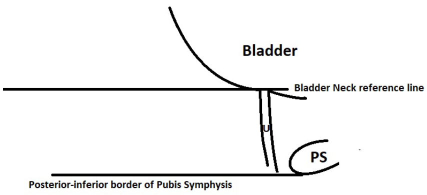
  - Urethral Sphincter injury – smooth and striated muscle
  - Nerve injury (pudendal)
  - Lower maximal urethral closure pressure relative to detrusor pressure
  - Urethral hypermobility
  - Compromised structural support following pregnancy, childbirth, age related changes or other intervening events
  - Genital hiatal distensibility contributing to some of the above factors
  - Wider biopsychosocial drivers e.g. REDs (Mountjoy et al 2023)

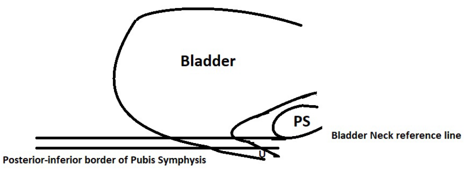
How can PoCUS assist you in the differential diagnosis of urinary incontinence?

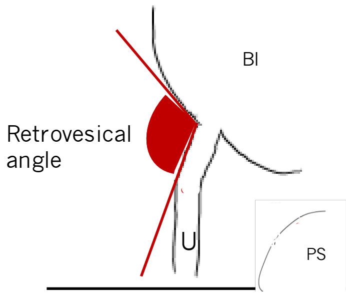
- **Visual example of spatial movement of urethra (urethral hypermobility)**

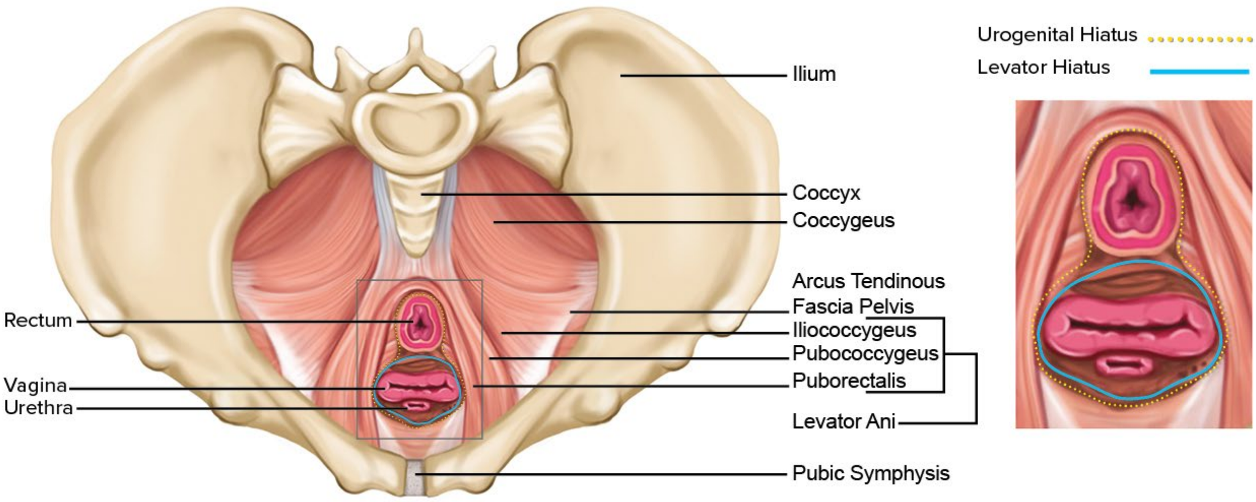





- **Bladder filling, storage and emptying**
    - DETRUSOR/BLADDER
        - Detrusor over-activity – frequency, urgency, incontinence, bladder filling and or emptying dysfunction
        - Shape of bladder on 2D abdominal ultrasound – what can it tell us? (Gray et al., 2019)

    – ABDOMINAL PRESSURE
        - Excessive activation of abdominal muscles <u>compared to the demands of the</u> task → excessive intra-abdominal pressure increases detrusor pressure which may overpower urethral closure pressure
        - Compromise to the ability to achieve enough urethral closure pressure due to other factors (structural support defect, urethral funneling, atrophy)
        -

- **Recovery of continence requires;**
    - *Compensation by* striated muscle, e.g. “the Knack”
    - Consideration and management of *bladder health/function* – detrusor over-activity; low compliance
    - Consideration and management of excessive recruitment of abdominal muscles <u>in excess of what is necessary for a task. Teach ‘other’ strategies</u>

How can PoCUS assist this?

- **Conservative rehabilitation potential**
    - Like any area of rehabilitation, not everyone will achieve symptom resolution via conservative rehabilitation. Ongoing, persisting symptoms

may exist for complex or multifactorial reasons, including but not limited to:

- Significant structural support compromise/defect beyond what the striated muscles and strategies can compensate for
- > grade 2 pelvic organ descent -> will require consideration for structural support either via pessary or surgical management
- Bladder neck (funnelling)
- Daily tasks/sports that require excessive abdominal pressure and may continue to challenge continence and provoke symptoms
- Adherence or compliance challenges during rehabilitation
- Undertraining the pelvic floor – not meeting the principles of strength and conditioning (Specificity, overload, progression)

*(Giagio and Donnelly – under review)*

# PART 3: TRANSPERINEAL ULTRASOUND IMAGING IN WOMEN: Technique and interpretation

## Ultrasound device considerations

- **Cart based versus portable handheld devices**

Portability and lack of wires make functional scanning easier. Trade off in image quality, functionality of the unit and batter life – requires regular charging.

- **Frequency** – single curve-linear (convex) transducer to image anterior to posterior structures: pubic symphysis, urethra and bladder, rectum. Usually 2-5Hz
- **Cost** – entry level units from £3.5K – higher specification and image quality means higher cost.

### Selecting probe and pre-set

Select the curved-linear probe if multiple probe options available on the machine. Choose gynae pre-set if available. If not, manipulate the machine settings to optimise the transperineal image. This typically involves a lower frequency 2-5Hz, targeting focus point(s) towards the level of the structures you are aiming to view, e.g., bladder neck, and adjusting the gain to preferable level for image interpretation.

### Ultrasound transducer preparation

- Cleaning
  - Clean with specified cleaning agent
- Cover
  - Apply small amount of gel to transducer
  - Apply cover and spread gel to ensure no bubbles between transducer and cover

  - Fix cover to transducer with tape/bands
- Gel – consider National Patient Safety Alert (UK Health Security Agency)
  NB some probe covers come pre-gelled and activate once applied to the probe. Only gel on the outside is needed in such cases.

**Workspace set up**

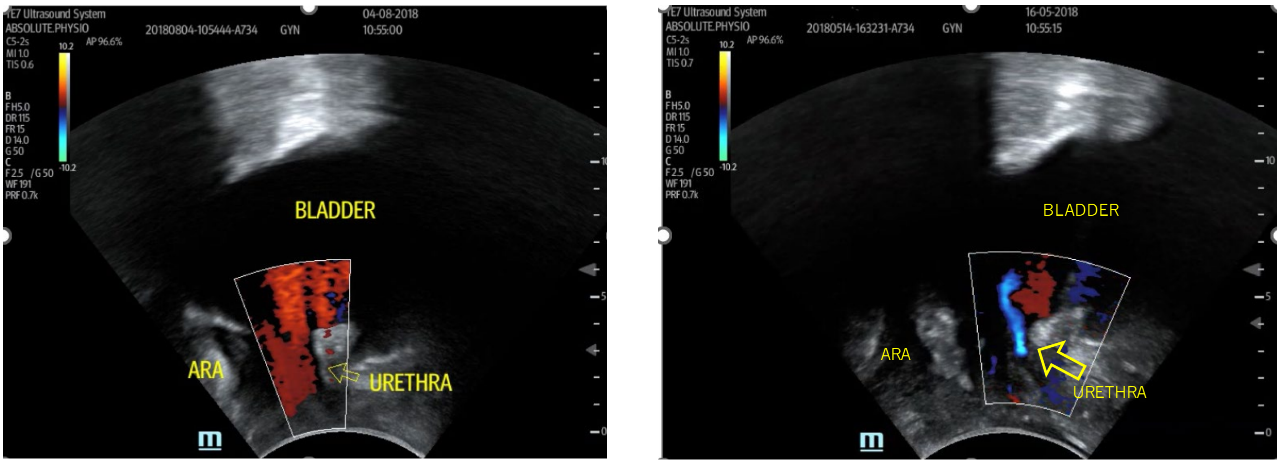
Consider room set up and orientation of ultrasound unit, therapist 'reach' to machine to alter image settings and visibility for practitioner and patient. If using a portable scanning device, consider position, access to tablet, how tablet will be held/used? Reach to sockets for cart based devices.

**Patient preparation and position**

- Underwear removed with privacy maintained via tissue roll/towels/clinical skirts
- Patient positioned in elevated supine on treatment couch

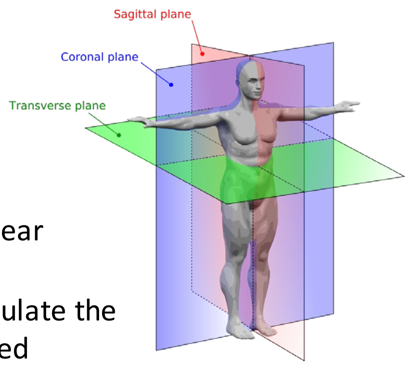
**Optional machine application and functionality**

Some machines may offer doppler functionality. This can be used to visualise the flow of movement within tissues and therefore symbolize movement of urine down the urethra. This is a potential way to confirm genuine stress urinary incontinence and avoid more invasive investigatory procedures.




*Normal versus incontinent example during doppler application via transperineal approach under cue to cough. Normal 'noise' of doppler visualised in left image. Solid blue visual of urine loss in right image.*

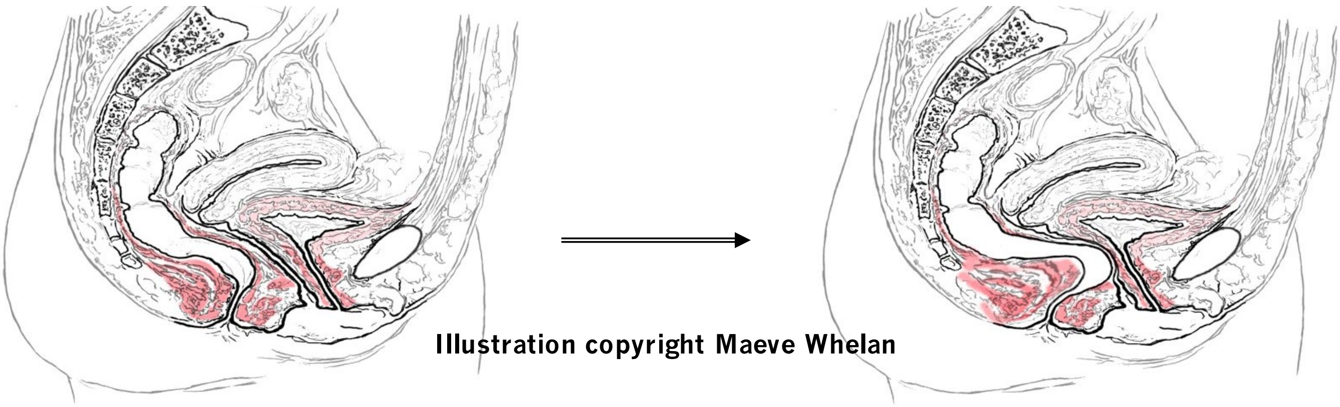
## Transperineal Imaging procedure




- Patient positioned as above, or may be imaged in functional, upright positions e.g., standing
- Transducer placed sagittal along perineum / over labia
- Consideration of pressure – enough to make contact and offer clear image without manipulating the tissues or creating discomfort
- Begin by searching for key structures in image - drive and manipulate the probe, don't stay static, move to optimise the view of the intended

structures. Move transducer front-back, side-side, tilt from side to side, rotate (Hall et al, 2022)

- Aim to observe the following in a single image – pubic symphysis, urethra/bladder and rectum
- Optimise ultrasound settings
- Change depth to optimise image of structures of interest
- Change position of focus to correspond to regions of interest
- Adjust gain to visual preference
- Optimise image before each assessment task to ensure that the structures of interest are identified and can be followed



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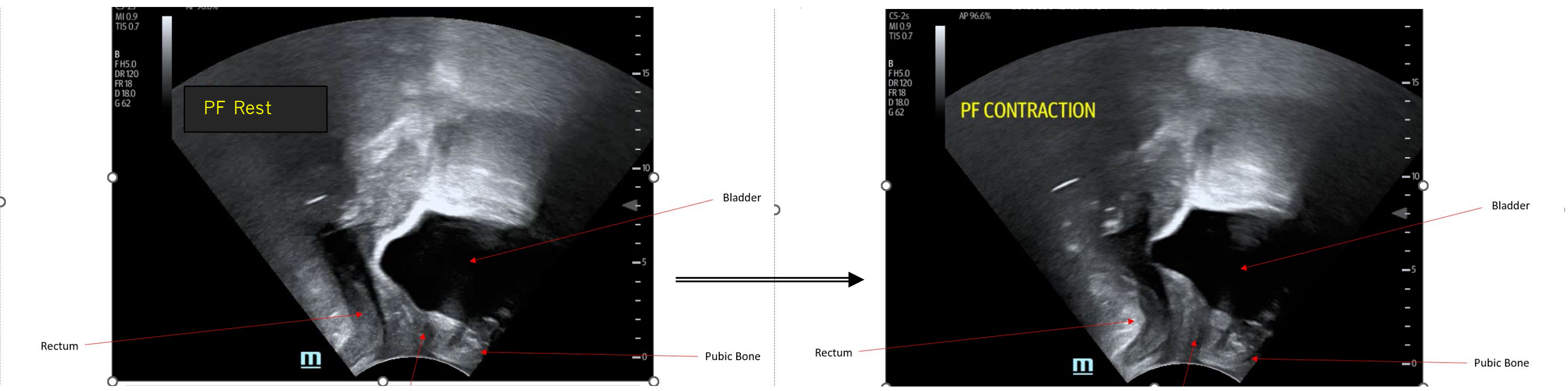


**Identifying and interpreting key structures relevant to pelvic floor morphology and function of the pelvic floor (within scope of practice)**

- Ano-rectal angle becomes acute (cranioventral shift Levator Ani) (Dietz, 2004)
- Bladder may deform from tissues moving cranioventral
- Urethral height may increase
- Pubic symphysis = static bony landmark – no movement. Movement of pubic symphysis signifies probe slippage by operator

- Consider the ROM of the pelvic floor during contract/relax/Valsalva
- Speed of contract/relax
- Co-ordination to cue
- Reps to fatigue?
- Sustained hold?
- Abdominal pressure from above?
- Cough – consider bladder neck support. Any funnelling noted? Any anterior wall or urethral descent? What does this information add to your subjective and objective examination and clinical reasoning?
- Record the approach of imaging, the machine and probe used, what you observed within a physiotherapy evaluation lens. PoCUS is an extension of our physiotherapy evaluation. Consider write up similar to how physiotherapists describe a manual musculoskeletal evaluation or auscultation.
- **Ensure the patient understands that this is PoCUS and not a medical or diagnostic ultrasound image.**

****PRACTICAL LAB****

## PART 4: REFERENCES

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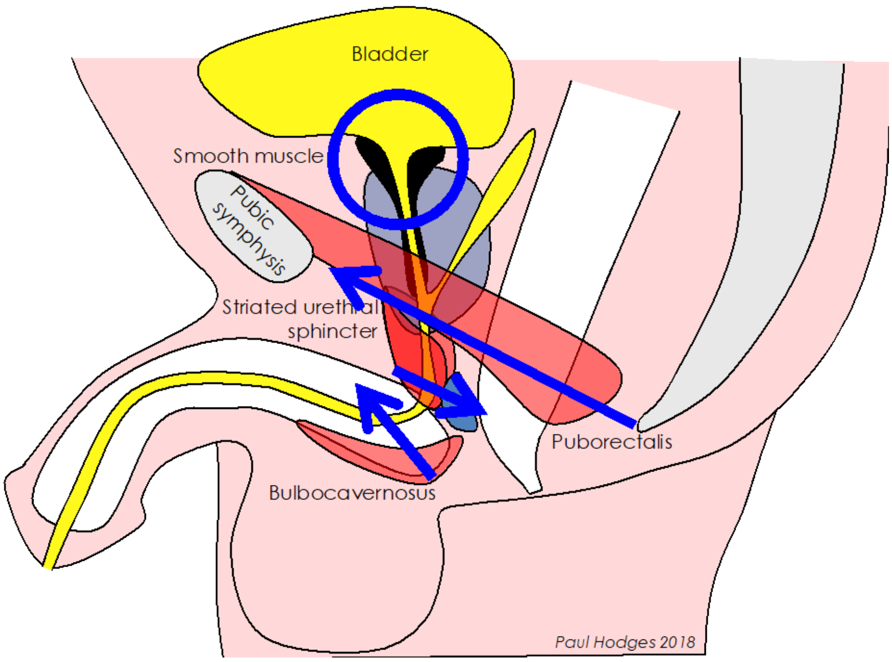
# PART 1: URINARY CONTINENCE IN MEN & IMPACT OF PROSTATECTOMY

- **Urinary continence in men is controlled by multiple mechanisms:**
  - **Smooth muscle** of urethra/bladder neck
    - Also known as the Internal urethral sphincter/ lissosphincter
    - Controlled by autonomic nervous system – tonic activity
  - **Striated muscles** that act on the urethra
    - Striated urethral sphincter (also known as the rhabdosphincter, external urethral sphincter)
    - Levator ani (puborectalis, pubovisceralis)
    - Bulbocavernosis (bulbospongiosus)




- **Radical prostatectomy removes some of the mechanisms of continence + potential damage of others;**
  - Removal of prostate, prostatic/proximal urethra (including smooth muscle)
    →Continence depends on greater contribution from striated muscles (particularly the striated urethral sphincter)
  - Potential damage to striated urethral sphincter
  - Potential damage to neurovascular supply (SUS innervation 0.3-1.3 cm from apex of prostate)
  - Potential damage to bladder – innervation and function

- **Multifactorial mechanisms for incontinence**
  - SPHINCTER
    - Sphincter incompetence

        - Sphincter injury – smooth and striated muscle
        - Nerve injury
        - Lower maximal urethral closure pressure
      - Short urethral length <12 mm is related to worse outcome
      - Post-operative stricture (anastomosis) → reduced elasticity of urethra and striated urethral sphincter
  - DETRUSOR/BLADDER
      - Detrusor over-activity
        - Pre-/post-operative
        - Vascular/nerve injury or inflammation
        - Rare as sole cause of incontinence
        - Common with sphincter insufficiency – activation of vesicourethral reflex
      - Impaired detrusor compliance/capacity – surgical or reduced perfusion from obstruction
  - ABDOMINAL PRESSURE
      - Additional activation of abdominal muscles <u>above</u> what is necessary for a task → excessive intra-abdominal pressure increases bladder pressure.
      - Although abdominal pressure increases as a part of function and must be compensated by urethral muscle contraction, this can be a problem if unnecessary demand is imposed by maintenance of higher pressure than is required for a task, secondary to an exaggerated abdominal muscle activation.
- **Recovery of continence requires;**
  - *Compensation* for loss of automatic smooth muscle contribution to continence
  - *Compensation by* striated muscle
      - Change in function of striated muscle from "phasic" to "tonic" activation
      - Change from "automatic" to "manual" drive and then eventually back to "automatic"
      - Change in muscle activation pattern and likely change in muscle fibre types
  - Consideration of *bladder health/function* – detrusor over-activity; low compliance
  - Consideration of *muscle activation "above" the pelvic floor* – excessive recruitment of abdominal muscles <u>in excess of what is necessary for a task</u>; forced breathing (excessive forced expiration)
  - Consideration of surgical trauma and scaring
- **Not all men will recover continence with pelvic floor muscle rehabilitation**
  - Some possible reasons for continued incontinence, despite training are;
      - Surgical trauma to SUS or its innervation
      - Scaring of urethra that stiffens the urethra and prevents closure
      - Shape of bladder neck (funnelling)

- Short length of urethra – not enough urethra over which to generate pressure
- Orientation of anorectal junction/PR behind bladder – in this case contraction could increase bladder pressure
- Excessive abdominal pressure in excess of what is required may continue to challenge continence
- Inability to transfer from voluntary pelvic floor muscle activation to tonic sustained holding

## Abbreviations

- ARJ – anorectal junction
- BP – bulb of penis
- BC – Bulbocavernosus/bulbospongiosus muscle
- MU – Mid urethra
- PR – puborectalis muscle
- SUS – striated urethral sphincter muscle
- TPUS – transperineal ultrasound imaging
- TAUS – transabdominal ultrasound imaging
- US – ultrasound imaging
- UVJ – urethrovesical junction

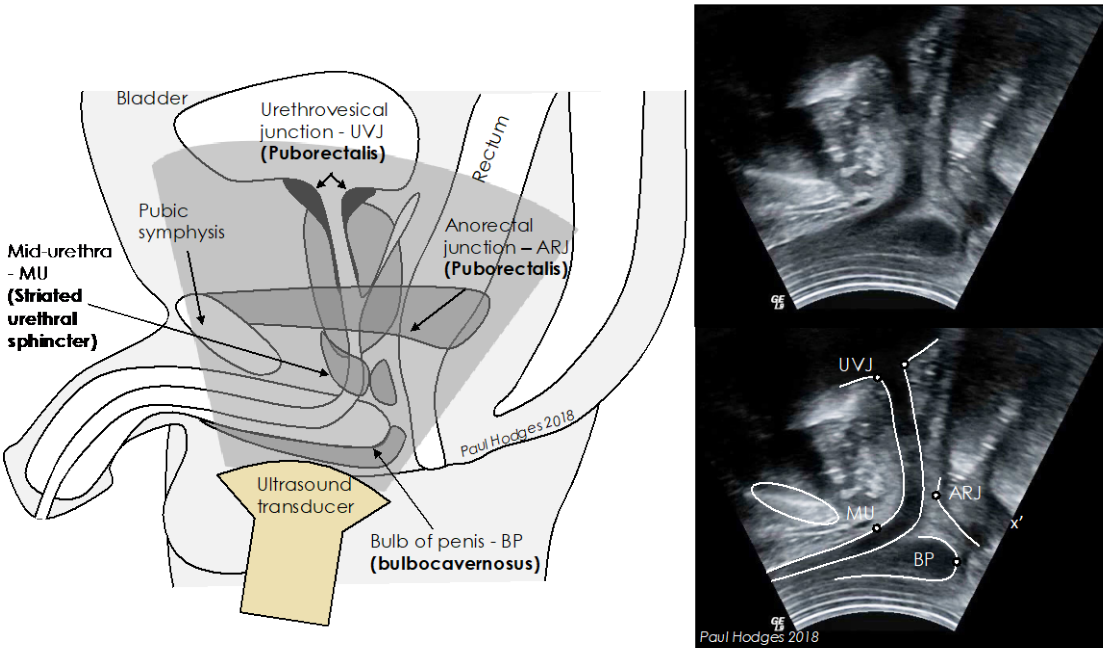
# PART 2: ASSESSMENT OF PELVIC FLOOR MUSCLE FUNCTION (including transperineal ultrasound imaging)

## 1. Continence status

- Subjective assessment
  - Pad usage
  - Ability to stop flow mid-stream
  - Episodes of stress incontinence – when, what tasks/activities
  - Frequency of voiding
  - Continence at night
- Diary
  - (patient guide includes diary to complete for 1-3 days per week)

## 2. Assessment of pelvic floor muscle anatomy and activation with transperineal ultrasound (TPUS) imaging

### 2.1 Anatomical assessment with transperineal ultrasound imaging – features to document and consider




i. Bladder neck position and shape
   1. Funnel shaped bladder neck may be less ideal for continence
   2. Very low bladder position may make continence recovery more difficult

ii. Ano-rectal junction position and shape
   1. Observe for anorectal junction location relative to bladder → if behind bladder contraction may compress bladder
   2. Angle very acute or short distance between anorectal junction and pubic symphysis may indicate over-activity of puborectalis

iii. Mid-urethra shape

1. Straighter mid urethra may be more difficult to control with sphincter

iv. Urethral length

1. Short distance from bladder neck to penile bulb may indicate reduced potential for recovery

## 2.2 Voluntary activation

- **Task:**

***i. Instruction:***

1. First assessment with minimal instruction to test "raw" strategy. Basic instruction should be limited "gently contract the muscles of the pelvic floor as if you are trying to "hold on" to delay urination"
2. Second identify best strategy to activate urethral mechanisms, particularly striated urethral sphincter. See "Part 5: Training Goal 1" for more detail. Example instructions are; "Stop flow of urine" or "Retract the penis"

***ii. Effort:***

1. Gentle contraction at 5-20% with emphasis on ***precision*** rather than intensity

***iii. Duration:***

1. Up to ~3 breaths or ~10 s

***iv. Patient position:***

1. Generally long sitting with the trunk supported and thighs slightly abducted. May consider assessment in sitting, standing, lying – as some men may achieve a contraction in a specific position.

- **Ideal response:**

i. 2 common patterns have been observed in healthy men – SUS dominant & PR dominant

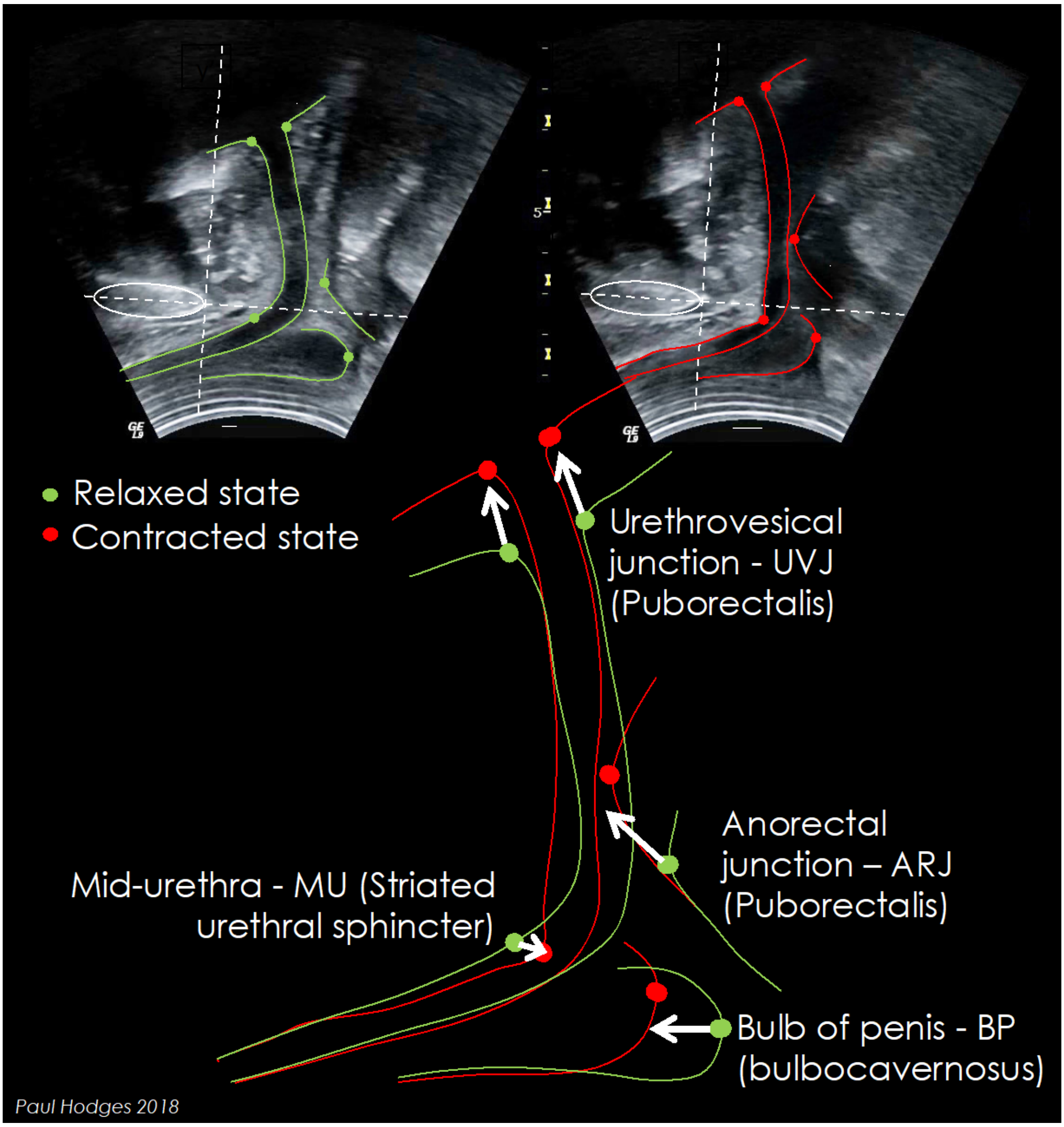
ii. Features in ***order of importance***

2. Striated urethral sphincter (SUS)
    1. TPUS - Dorsal motion of mid-urethra
    2. Other assessment possibility - Observation of retraction of penis
3. Bulbocavernosus (BC)
    1. TPUS - Compression of bulb of penis
    2. Other assessment possibility - Palpation of tension in perineum behind scrotum
4. Puborectalis (PR)
    1. TPUS - Bladder neck elevation + ventral motion of anorectal junction
5. Relaxed superficial/upper abdominal (obliquus externus abdominis and rectus abdominis) and leg muscles. Activation of deep/lower abdominal muscles (e.g. transversus abdominis) is acceptable, but should be gentle.
    1. Observation/palpation abdominal muscles

iii. Smooth and sustained

- **Suboptimal features:**

i. UVJ/ARJ depression/abdominal pressurisation
ii. No MU motion
iii. No BP compression (no "pinch" of urethra)
iv. Bias to anal/PR contraction
v. Inability to relax (particularly puborectalis)
vi. Inability to breathe while holding contraction



## 2.3 Repeated rapid contraction x 10

- **Task:**
  i. Rapid contraction and *relaxation*
  ii. Effort – moderate
  iii. Duration – 10 repetitions, instantaneous holds
- **Instruction**:
  i. "*<insert best instruction to contract the pelvic floor muscles>* as quickly as possible for 10 repetitions"
- **Ideal response:**
  i. Rapid contraction and rapid complete relaxation
- **Suboptimal features:**
  i. Depression of UVJ/ARJ
  ii. Slow/incomplete contraction
  iii. Slow/incomplete relaxation

## 2.4 Cough

- **Instructions**: "Do a single cough with moderate effort"
- **Task:**
  i. Effort – moderate
- **Ideal response:**
  i. Rapid/early dorsal displacement of MU before expulsion
  ii. Sustained dorsal displacement of MU during expulsion
  iii. Mild depression of UVJ/ARJ is expected during the expulsion phase, but not before
- **Suboptimal features:**
  i. Excessive depression of UVJ/ARJ
  ii. Absence/clearly delayed MU motion

## 2.5 Cough with pre-activation

- **Instructions**: ""*<insert best instruction to contract the pelvic floor muscles>*, hold this and do a single cough with moderate effort"
- **Task:**
  i. Effort – gentle pre-contraction and moderate effort cough
- **Ideal response:**
  i. Pre-activation of SUS (dorsal displacement of MU)
  ii. As for cough, but less depression of UVJ/ARJ
- **Suboptimal features:**
  iii. Excessive depression of UVJ/ARJ
  iv. Absence of dorsal displacement of MU

## 2.6 Sustained hold 30s

- **Instructions**: "gently *<insert best instruction to contract the pelvic floor muscles>* and build up to as hard as you can, then sustain that for 30s"
- **Task:**
  ii. Effort – Maximum
  iii. Provide strong encouragement throughout the task
  iv. Duration – 30 s

- **Ideal response:**
  1. Dorsal motion of MU
  2. Compression of BP
  3. Elevation of UVJ
  4. Ventral motion of ARJ
  5. Sustained hold
- **Suboptimal features:**
  1. Inability to hold
  2. Flickering contraction – particularly SUS
  3. Release and regain (“drop” and “catch”)
  4. Depression of UVJ/ARJ

# PART 3: TRANSPERINEAL ULTRASOUND IMAGING IN MEN: Technique and interpretation

## Ultrasound device considerations

- **Frequency** – single transducer may enable imaging of both muscles, or separate transducers with different frequencies may be required to observe the 2 main regions
  - SUS/BC
    - 7-12 MHz optimal (high resolution/limited penetration)
    - Linear transducer, virtual convex (trapezoid shaped image) will increase view
  - PR
    - 5-7 MHz optimal (high penetration/lower resolution)
    - Curved/convex transducer

## Ultrasound transducer preparation

- Cleaning
  - Clean with specified cleaning agent
- Cover
  - Apply small amount of gel to transducer
  - Apply cover and spread gel to ensure no bubbles between transducer and cover
  - Fix cover to transducer with tape/bands

## Patient preparation and position

- Underwear removed with towel/sheet around waste
- Patient positioned in supine with head elevated on 2 pillows to see screen or reclined sitting
- Patient requested to hold penis and testes up/out of the way
- Transducer placed sagitally along perineum between the anus and scrotum – Patient or therapist can place the transducer on perineum, but then therapist should hold for orientation and measurement
  - Ensure that the orientation of the transducer (front/back) is known before placement

### Imaging procedure

- Begin by searching for key structures in image (bulb of penis or pubic symphysis)
  - Start with large motion of transducer for initial identification and then fine adjustments to optimise placement
  - Note that pubic symphysis is fibrous and allows some US penetration (grey area), whereas the pubic rami are bone and produce complete US reflection (sharp white line at superficial edge)
- Optimise image to search for urethra
  - Move transducer front-back, side-side, tilt from side to side, rotate - Note that the urethra may not follow a perfect midline sagittal path

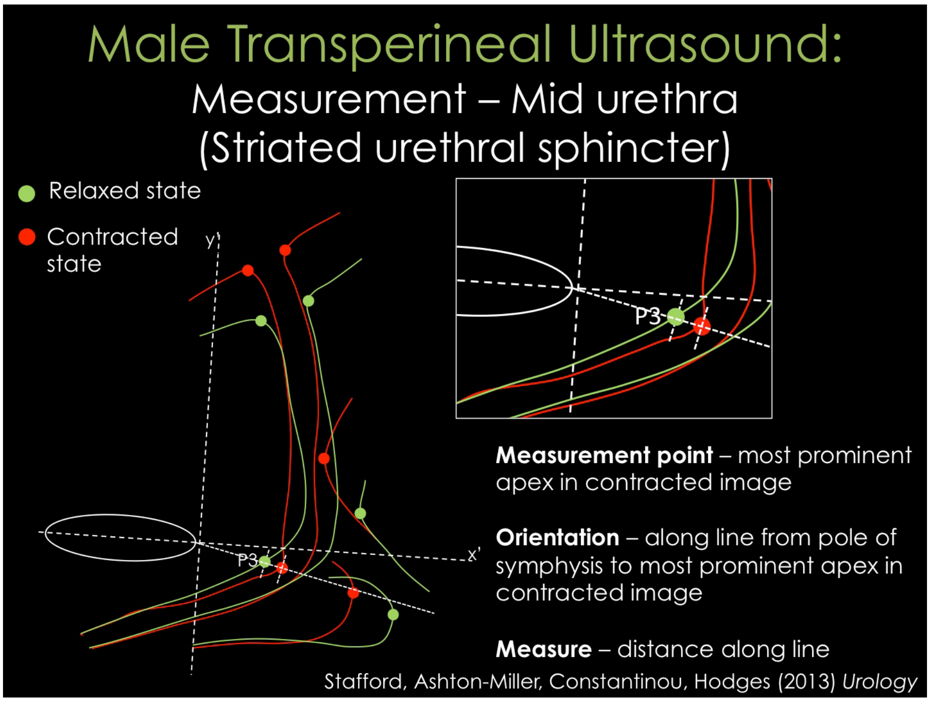
- Aim to observe the following in a single image
  - MU
  - BP
  - ARJ
  - UVJ - Note that it may not be possible to observe ARJ/UVJ in same image as MU/BP due to difference in depth (limitations of US transducer) and these structures may need to be observed separately
- Optimise ultrasound settings
  - Change depth to optimise image of structures of interest
  - Change position of focus to correspond to regions of interest
  - Can use multiple focal positions (note – speed of image updating slows as number of focal zones is increased)

## Assessment

- Optimise image before each task is commenced to ensure that the structures of interest are identified and can be followed
- Observe for the following motions;

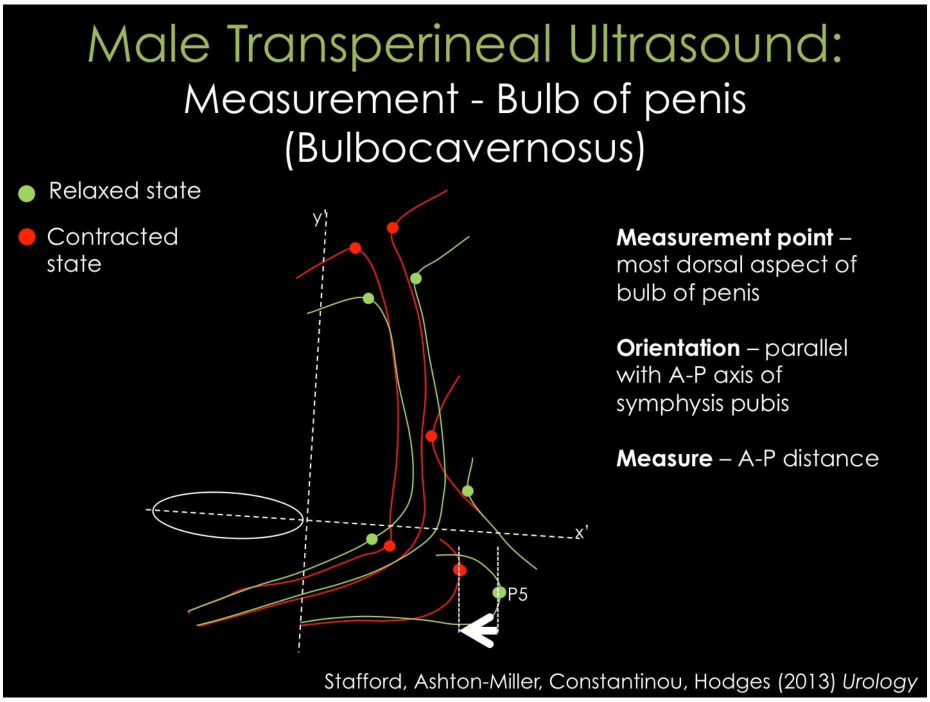
### *Striated urethral sphincter - Mid urethra*

- **Measurement point** – most prominent apex in contracted image
- **Orientation** – along line from pole of symphysis to most prominent apex in contracted image
- **Measure** – distance along line



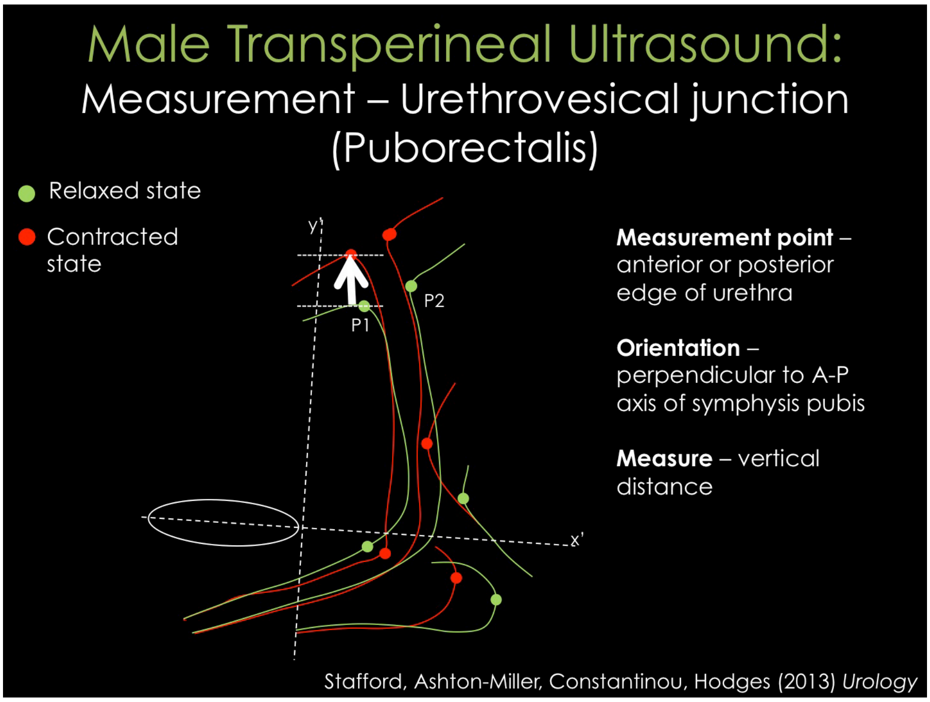
*Bulbocavernosus - Bulb of penis*

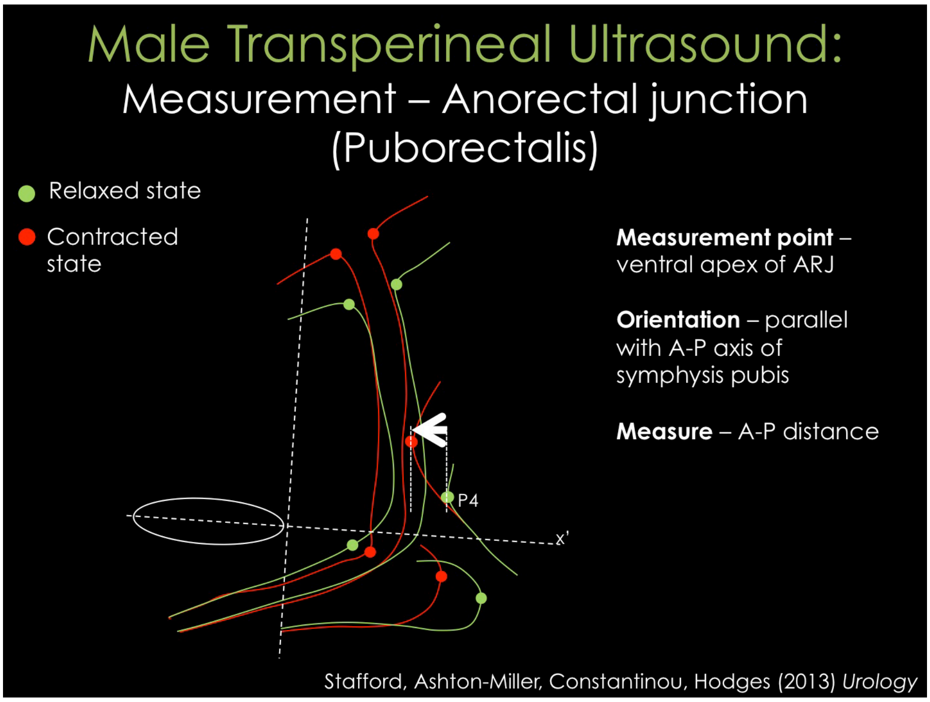
- **Measurement point** – most dorsal aspect of bulb of penis
- **Orientation** – parallel with A-P axis of symphysis pubis
- **Measure** – A-P distance




*Puborectalis - Urethrovesical junction*

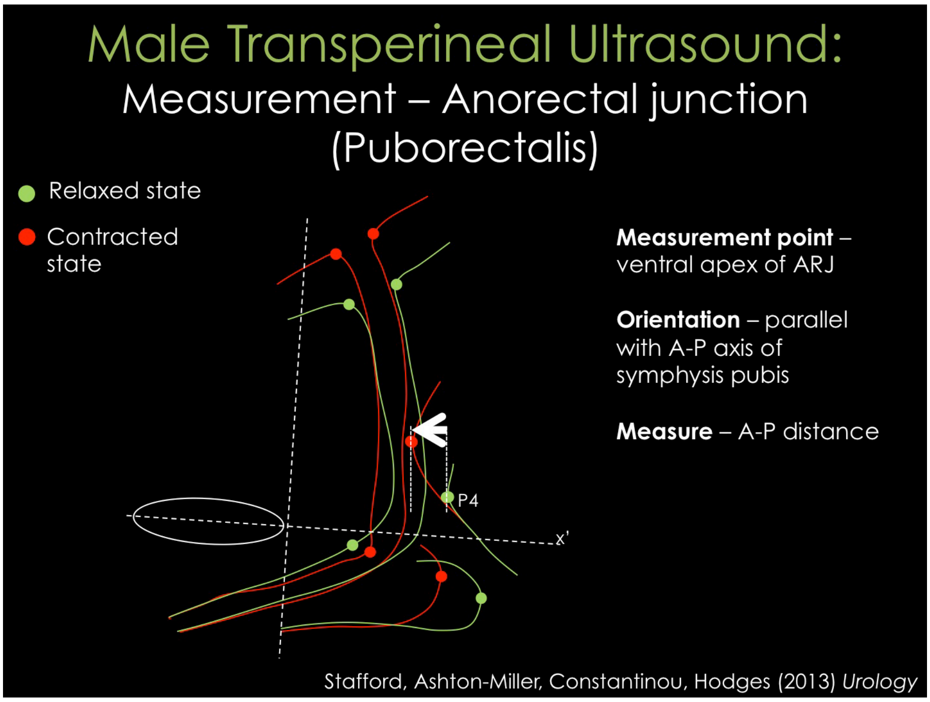
- **Measurement point** – anterior or posterior edge of urethra
- **Orientation** – perpendicular to A-P axis of symphysis pubis
- **Measure** – vertical distance






*Puborectalis - Anorectal junction*

- **Measurement point** – ventral apex of ARJ
- **Orientation** – parallel with A-P axis of symphysis pubis
- **Measure** – A-P distance


Male Transperineal Ultrasound:
Measurement – Anorectal junction (Puborectalis)
Relaxed state
Contracted state
P4
x'
Measurement point – ventral apex of ARJ
Orientation – parallel with A-P axis of symphysis pubis
Measure – A-P distance
Stafford, Ashton-Miller, Constantinou, Hodges (2013) Urology

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