Pelvic Floor Muscle Evaluations: From digital palpation to imaging

W22, 15 October 2012 14:00 - 18:00

Start	End	Topic	Speakers
14:00	14:10	Introduction	• Chantale Dumoulin
14:10	14:35	Digital evaluation	• Chantale Dumoulin
14:35	14:40	Questions	All
14:40	14:55	Manometry	• Mélanie Morin
14:55	15:00	Questions	All
15:00	15:20	EMG	• Petra Voorham - van der Zalm
15:20	15:30	Questions	All
15:30	16:00	Break	None
16:00	16:20	Dynamometry	• Mélanie Morin
16:20	16:30	Questions	All
16:30	16:50	US	• Jenny Kruger
16:50	17:00	Questions	All
17:00	17:20	MRI	• Chantale Dumoulin
17:20	17:30	Questions	All
17:30	18:00	Discussion	All

Aims of course/workshop

Aim: To review evidence-based literature on pelvic floor muscle evaluation tools, from digital evaluation to imaging.

Objectives:

1. To highlight the importance of undertaking a thorough evaluation of pelvic floor musculature in women with urinary incontinence, pelvic organ prolapse and vulvo-vaginal pain

2. To present evidence-based approaches to the evaluation process, using valid and reliable clinical tools: digital evaluation, pressure, EMG, dynamometry and US

3. To present the relationship between pelvic-floor morphological deficit and dysfunction, and their symptomatology and diagnosis

4. To present correlations between pelvic-floor morphological deficit or dysfunction and pelvic-floor rehabilitation prognosis

Educational Objectives

This workshop is a crucial component in promoting the educational value and the need for clinicians and researchers to learn effective, evidence-based clinical skills for pelvic floor muscle assessments. An evidence-based and thorough assessment of the pelvic floor musculature in women with urinary incontinence, pelvic organ prolapse and vulvo-vaginal pain in women informs the appropriate choice of treatment and its application; hence, this topic is of great benefit to all clinicians working with this clientele.

The workshop will present the scientific and clinical value of current PFM assessment methods (four in total), focussing on their psychometric properties and clinical advantages and disadvantages, in addition to their relevance and effectiveness in terms of symptoms, diagnosis and predictive value.

To facilitate comprehension for non-English speakers, the presentations will be accompanied by multiple visual aids and videos.

Workshop # 22, 2 – 6 pm, Mon 15 Oct 2012

Pelvic Floor Muscle Evaluations: From digital palpation to imaging

Target Audience: Clinicians and researchers interested in updating their knowledge of pelvic floor muscle (PFM) evaluations and the types of information that can be obtain using current PFM assessment tools

Aims & Objectives: Aim: To review evidence-based literature on pelvic floor muscle evaluation tools, from digital evaluation to imaging. Objectives: 1. To highlight the importance of undertaking a thorough evaluation of pelvic floor musculature in women with urinary incontinence, pelvic organ prolapse and vulvo-vaginal pain 2. To present evidence-based approaches to the evaluation process, using valid and reliable clinical tools: digital evaluation, pressure, EMG, dynamometry and US 3. To present the relationship between pelvic-floor morphological deficit and dysfunction, and their symptomatology and diagnosis 4. To present correlations between pelvic-floor morphological deficit or dysfunction and pelvic-floor rehabilitation prognosis

Educational Value: This workshop is a crucial component in promoting the educational value and the need for clinicians and researchers to learn effective, evidence-based clinical skills for pelvic floor muscle assessments. An evidence-based and thorough assessment of the pelvic floor musculature in women with urinary incontinence, pelvic organ prolapse and vulvo-vaginal pain in women informs the appropriate choice of treatment and its application; hence, this topic is of great benefit to all clinicians working with this clientele. The workshop will present the scientific and clinical value of current PFM assessment methods (four in total), focussing on their psychometric properties and clinical advantages and disadvantages, in addition to their relevance and effectiveness in terms of symptoms, diagnosis and predictive value. To facilitate comprehension for non-English speakers, the presentations will be accompanied by multiple visual aids and videos.

Topic: Digital evaluation to measure pelvic floor muscle function:

Presenter: Chantale Dumoulin, PhD, PT. Associate Professor, School of rehabilitation, Faculty of medicine, University of Montreal
Researcher and laboratory director, Research Center, Montreal Geriatric Institute, Canada
Chantal.dumoulin@umontreal.ca

This section presents the morphological palpation technique (digital evaluation) and the use of PFM scales to assess passive and active strength.[1,-3] Discussion on the psychometric properties, clinical advantages and limitations of a digital evaluation, how it correlates with other PFM assessment tools, and its predictive value are presented.[3,4]

A digital evaluation demonstration is provided through a video.[5] Using the video we discuss communication and patient consent, as well as infection control procedures. The assessments is presented by anatomical regions: perineal evaluation, vaginal evaluation (morphological integrity and functional assessment) and anal evaluation. In each region, sensation, pain, neurological function and both voluntary and automatic PF muscle function are evaluated and discussed.

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Topic: Manometry

Presenter: Mélanie Morin, PT, PhD, Sherbrooke, Canada

Aims of this topic:

1. To describe the constituents and the methodology associated with different manometric instruments.
2. To present the psychometric properties of the manometry including reliability and validity.
3. To outline the clinical recommendations associated with the uses of manometry. The advantages and limitations of manometry will be discussed.
4. To discuss the clinical applications in terms of symptoms, diagnosis and predictive value.

Constituents and methodology associated with manometry

In 1948, Dr. Kegel (1948) developed an intravaginal device, the perineometer, to assess the PFM strength. The vaginal pressure probe was connected to a manometer in order to measure the intravaginal pressure from the PFM in millimeters of mercury (mmHg). Since then, several types of pressure probes with different shapes and technical properties have been developed and studied (Dougherty et al. 1986; Bo et al. 1990b; Laycock et al. 1994). These tools can measure pressure in mmHg or cm H_2O.

Reliability

Good intra-rater (test-retest) reliability has been demonstrated for maximal squeeze pressure and resting pressure (tone) (Bo et al. 1990b; Kerschan-Schindl et al. 2002; Hundley et al. 2005; Frawley et al. 2006b; Frawley et al. 2006a; Khan et al. 2010). Regarding the endurance, Frawley et al. (2006b), found the endurance measurement to be unreliable. Contrarily, Rahmani demonstrated good reliability when assessing the endurance during a sustained 60% maximal contraction (Khan et al. 2010). One advantage of the pressure measurement is the possibility to perform the assessment in different positions (lying, sitting and standing). Overall, the parameters proved to be reliable in these positions with the exception of the resting pressure, which was less reliable in the sitting and standing positions. Acceptable inter-rater reliability was found by Ferreira et al. (2011).

Validity and clinical uses

The validity of the measurement was studied by comparing the maximal squeeze pressure to other measurements. It was correlated with vaginal palpation, for instance, using the Oxford scale (r=0.703-0.814) (Isherwood et al. 2000; Riesco et al. 2010) and the Brink scale (r=0.68-0.71) (Kerschan-Schindl et al. 2002; Hundley et al. 2005). The correlation was good (ICC=0.72-0.81) when comparing the maximal pressure to the bladder base movement evaluated with transabdominal US (Chehrehrazi et al. 2009; Riesco et al. 2010) but moderate when comparing the maximal pressure to bladder neck movement assessed by transperineal ultrasound (r=0.43) (Thompson et al. 2006). The validity of the measurement is also supported by the capacity of the measurement to detect changes following treatment (Aksac et al. 2003) and to discriminate between groups, e.g. continent and incontinent women (Thompson et al. 2006).

Recommendations

There are a few known precautions to bear in mind regarding the uses of the pressure perineometry. Increases in intra-abdominal pressure, occurring if a patient co-contracts the abdominal muscles (rectus abdominis), or strain instead of contracting the PFM can interfere with pressure measurements. Some recommendations can be applied to ensure the validity of the measurement: 1-performing vaginal palpation before using the perineometer to make sure the patient is able to correctly contract her PFM; 2-observing the cranial movement of the vaginal probe during measurement of the muscle contraction; 3- not considering the contractions associated with the Valsalva manoeuver or retroversion of the hip (Bo et al. 1990a; Bump et al. 1996). It should be pointed-out that the use of perineometry is therefore difficult when a patient has a really low PFM strength, because no inward movement of the probe is possible in this case. The size of the probe and the brand of the device were also demonstrated to influence the measurement (Bo et al. 2005; Barbosa et al. 2009). The placement of the probe is another factor reported to be important. It was recommended to position the probe at the level of the PFM which corresponds to the high-pressure zone within the vagina (Guaderrama et al. 2005; Jung et al. 2007).

This presentation will draw upon these references:

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Topic: Electromyography to Assess the Pelvic floor Muscles

Presenter: Petra J. Voorham- van der Zalm, PhD, Associate Professor, Pelvic Floor Physiotherapy, Leiden University Medical Center, Department of Urology, J3-P. Po box 9600, 2300 RC Leiden, The Netherlands

Introduction

The pelvic floor comprises several layers, including the pelvic diaphragm (levator ani and coccygeus muscles) and the urogenital diaphragm. Each diaphragm has its own three dimensional shape and position with regard to the internal pelvic organs. The urogenital diaphragm consists of a deep layer, the perineal membrane, and a superficial layer, consisting of the bulbospongiosus muscle and the ischiocavernosus muscle. The levator ani muscle is made up of the iliococcygeus, pubococcygeus, and puborectalis muscles. Together with the urethral and anal sphincters, these muscles play an important role in preventing complaints of micturition, defecation, sexual function, prolapse and/or pelvic floor pain. The development of one of these complaints is referred to as Pelvic Floor Dysfunction (PFD) (1-4).

Pelvic Floor Muscle (PFM) function can be qualitatively defined by grading both the tone at rest and the strength of a voluntary or reflex contraction as strong, normal, weak or absent, or by using a validated grading symptom. By measuring PFM based on signs and symptoms, the following conditions can be determined: normal, overactive, underactive or non-functioning pelvic floor muscles (5;6).
A voluntary PFM contraction is described as a squeeze around the pelvic opening and an inward lift. Contraction of the pelvic floor is thought to involve contraction of all, or some of, the muscle groups (7;8). Evaluation of such a contraction involves assessment of the ability to elevate the pelvic floor, as well as assessment of muscle strength, endurance and coordination. Various clinical methods, each with its own advantages and disadvantages, have been used for the assessment of PFM contraction or function. These methods include observation, palpation, electromyography (EMG), ultrasound, magnetic resonance imaging (MRI), manometers and dynamometers (9;10).

Electromyography (EMG) is a tool currently used in clinical and research settings and in daily practice to assess the PFM. This handout will give an overview what is discussed in the presentation; “Electromyography to Assess the Pelvic floor Muscles”. It will discuss the constituents and the methodology associated with EMG registration. Available research evidence about the psychometric properties of the currently available instruments will be reviewed. Their respective advantages and limitations will be discussed in order to enable clinicians and researchers to better select the appropriate tool and analyze the pelvic floor dysfunctions evaluated.

What is EMG registration?

EMG is defined as a graphic representation of the electrical activity of one or more motor units within a given muscle or muscle group (11). The motor unit is the functional unit of all skeletal muscles in the body, including the pelvic floor muscles. It consists of an anterior horn cell within the spinal cord, a myelinated axon, a neuromuscular

junction, and a muscle cell. Activation of the muscle occurs during a process called depolarization, resulting in a very low voltage that can be measured by conductive electrodes as EMG (12). The EMG represents the difference in voltage between two electrodes near or in the target muscle or muscle group (a bipolar EMG) or the difference between an electrode near or in the target muscle or muscle group and a reference electrode (a monopolar EMG). The order of magnitude of the EMG in the PF is in microvolt (μV, millionths of one Volt).
There are two types of electrodes used for assessing the EMG of PFM; needle electrodes or surface electrodes. With needle or wire EMG the electrodes are placed directly in the target muscle by puncturing them through the skin and/or other tissues surrounding the muscle. Podnar and Vodusek recommended concentric needle EMG as the most informative test to detect PFM denervation or reinnervation (13). Wire EMG and concentric needle EMG, therefore, are recommended for scientific purposes. Because this is an invasive and uncomfortable procedure it has fallen into relative disuse and is not suitable for use in daily practice in pelvic floor physiotherapy. Due to the disadvantages of many neurophysiologists have allied surface EMG recordings to sophisticated signal analysis hardware and software in an attempt to improve patient acceptability (12;14). In surface EMG the electrodes are place near a target muscle or muscle group. The EMG activity is measured through the skin and/or other surrounding tissues, making it less invasive and more easy to apply then wire or needle EMG.

What is it used for in PFM

EMG registration of the PFM is used for Biofeedback. Biofeedback is the process of becoming aware of various physiological functions using instruments that provide information on the activity of those same systems, with a goal of being able to manipulate them at will. This process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brainwaves, heart function, breathing, muscle activity, and skin temperature. These instruments rapidly and accurately 'feedback' visual, auditory or sensory information to the user. The presentation of this information — often in conjunction with changes in thinking, emotions, and behaviour — supports desired physiological changes. Over time, these changes can endure without continued use of an instrument. Biofeedback has been found to be effective for the treatment of pelvic floor dysfunction (PFD). For this needle or surface electrodes are placed in or near the target muscle or muscle group of the pelvic floor.
Biofeedback (BF) is one physical therapy adjunct that might be useful in the treatment of pelvic floor dysfunction (3;7;15-36)

A short history

In the 1950s, Kegel first used a device to evaluate PFM contraction. This device, called a perineometer, was a vaginal probe connected to a manometer and measured vaginal air pressure (37). However, his studies presented no data about the sensitivity, reliability or validity of this method. Nowadays, surface EMG with electrodes embedded on vaginal and anal probes is more widely used to assess PFM function and to increase our understanding of pelvic floor function.

Heitner concluded that surface EMG was superior to vaginal palpation in assessment of all variables other than lift, and it was showed that PFM activity can be measured reliably with surface EMG. However, when surface EMG is used clinically, interpretation of the signals must be done with caution because the risk of cross talk from other muscles is high and because of variability in electrode placement within the vagina (7). Many EMG devices developed to record intra-vaginal and intra-anal biofeedback during the treatment of PFD. The devices come in various shapes and sizes, and most comprise large plates or rings. Therefore, comparison of results from one device to another is not recommended (38). These devices have all been developed empirically and are not specifically designed with the pelvic floor anatomy in mind. Consequently, the electrode covers multiple pelvic floor muscles and registers other muscles in the proximity, such as the abdominal muscles. Thus, current devices are not optimized for biofeedback registration of the pelvic floor musculature since they are not capable of registering the activity of a single component of the PFM. In addition, there is no scientifically validated standard for normal pelvic floor function measured with these devices.

Recent developments

One of our investigations was performed in order to validate the anatomical positioning of commonly used commercially available probes, positioned according to standard protocol as used in daily practice by pelvic floor physiotherapists. Based on our findings we conclude that the electrodes of the probes, as we use them now during electro stimulation and biofeedback training in the treatment of pelvic floor dysfunction, are not optimal for the structures we want to register (39).

A new multiple array electrode probe (the MAPLe) has been developed for biofeedback registration of the individual (sides of the) pelvic floor muscles. A study was performed to determine the reliability and reproducibility of electromyography signals measured with the MAPLe in healthy volunteers(40)The conclusions of this study are that MAPLe appears to be very effective in measuring EMG values for individual muscular components at different sides of the pelvic floor men and women with different menopausal status, nulliparous or parous. It is the first time that the individual activity of the complex pelvic floor musculature has been measured and the results suggest that the MAPLe can be used to generate a healthy baseline data for the diagnosis and treatment of patients with pelvic dysfunction.

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Topic: Dynamometry

Presenter: Mélanie Morin, PT, PhD, Sherbrooke, Canada

Aims of this topic:

1. To describe the constituents and the methodology associated with different pelvic floor dynamometers.
2. To present the psychometric properties of dynamometers including reliability and validity.
3. The advantages and limitations of dynamometry will be discussed.
4. To discuss the clinical applications in terms of symptoms, diagnosis and predictive value.

Constituents and methodology

In the past 20 years, several versions of PFM dynamometers have been developed (Caufriez 1993; Rowe 1995; Ashton-Miller et al. 2002; Dumoulin et al. 2003; Verelst et al. 2004; Constantinou et al. 2007; Saleme et al. 2009; Kruger et al. 2011; Nunes et al. 2011). They differ in terms of size and shape, the force vector recorded (anteroposterior force, latero-lateral or multi-directional) and other technical issues. Overall, during a PFM contraction, the lengthening or shortening of strain gauges glued on the speculum causes its electrical resistance to change. Voltage values from the strain gauge are then amplified, digitized and converted into units of force.

In vitro properties

Dynamometers have shown good linearity, repeatability and ability to measure the resultant force independently of its point of application on the branch of the speculum in in-vitro calibration studies (Rowe 1995; Dumoulin et al. 2003; Verelst et al. 2004). Some versions offer the advantage of evaluating multidirectional forces originating from the PFM (Constantinou et al. 2007; Saleme et al. 2009). Other dynamometers can be adjusted to measure the PFM function at different vaginal apertures (Dumoulin et al. 2003; Verelst et al. 2004; Morin et al. 2010; Kruger et al. 2011).

Reliability

The test-retest reliability of PFM strength was found to be good (ICC=0.83-0.89) (Dumoulin et al. 2004; Verelst et al. 2004; Miller et al. 2007; Nunes et al. 2011). Other parameters such as endurance, speed of contraction and tonicity (passive forces and stiffness) of the PFM also showed good test-retest reliability (Morin et al. 2007; Morin et al. 2008).

Validity and clinical applications

Dynamometers have been shown to discriminate between stress urinary incontinent and continent women (Morin, 2004b; Dumoulin 2004). Various studies have been conducted to support the validity of dynamometric measurements. The maximal strength recorded with the dynamometer was correlated to vaginal palpation (Oxford scale, r=0.727) (Morin et al. 2004b). Moreover, dynamometric measurements have proven to be minimally influenced by increases in intra-abdominal pressure (Morin et al. 2006). Discriminant validity was also demonstrated because the dynamometer was able to distinguish between continent and incontinent women (Morin et al. 2004a). Furthermore, good sensitivity to detect changes following treatment was also demonstrated (Dumoulin et al. 2011).

The main limitation associated with PFM dynamometers is their lack of accessibility because these devices are mostly used by their designers and not commercially available.

This presentation will draw upon these references:

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Topic: Pelvic floor MRI to measure PFM morphology and function:

Presenter: Chantale Dumoulin, PhD, PT. Associate Professor*,* School of rehabilitation, Faculty of medicine, University of Montreal
Researcher and laboratory director, Research Center, Montreal Geriatric Institute, Canada
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This section presents PFM MRI, a relatively new imaging technique which provides an excellent visual image of the PFM, the bladder and urethral anatomy in women.[1-2] Discussion on the psychometric properties, clinical advantages and limitations of the MRI morphological measurements, how it correlates with other PFM assessments are presented.[1-6] MRI has been used to study normal and abnormal female PFM morphology at rest, during a PFM contraction and during Valsalva manoeuvres. Parameters such as PFM volume, shape, integrity and displacement have been shown to differ between continent and incontinent young and middle-aged women and this will be reviewed. Additionally, changes in PFM morphology following PFM rehabilitation are presented.[7,8]

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Use of ultrasound for the assessment of the pelvic floor muscles

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Why ultrasound?

- Allows quantification of morphology and function
- Uses validated biometry of the muscles and the area bounded by the muscles to assess static and dynamic changes eg. Pre and post rehabilitation
- Easy to use
- No ionizing radiation
- Relatively inexpensive
- Off line analysis of images
  - Share with colleagues or second opinion
- Biofeedback for the patient

Types of ultrasound for PF assessment

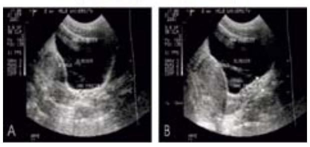
- 2D/B mode imaging
  - Abdominal/supra-pubic ultrasound
  - Transvaginal
  - Transperineal
- 3D/4D imaging
  - Transperineal
  - Transvaginal

2D Abdominal/supra-pubic

- Advantages
  - Easy to use
  - Less 'invasive' than transperineal or transvaginal
  - Effective for biofeedback
  - Visualise effective lift of the bladder base during contraction(Sherburn M,.2005;51(3):167-70.)
  - Reliable
  - Curved array abdominal probe is adequate(3.5 MHz)
- Disadvantages
  - limited by lack of bone reference
  - No access to axial plane
  - Not as reliable in assessing valsalva manouevres as transperineal ultrasound (Thompson JA, 2005)

Abdominal ultrasound

- **Procedure**
  - Assessed supine, knees flexed
  - Bladder comfortably full
  - Probe positioned supra-pubically
  - Bladder base marked at rest at contraction on the screen



Bo, K. and M. Sherburn, Evaluation of female pelvic-floor muscle function and strength. *Physical therapy, 2005. 85(3): p. 269-82, Mar.*

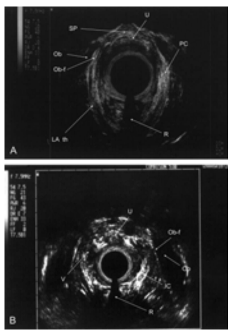
Transvaginal imaging

Advantages

- Only 2D imaging which is able to show the levator hiatus
- Probe close to the tissue – good discrimination
- Correlates well with some measures of TPUS ie levator hiatal area

Disadvantages

- distortion of the vaginal anatomy, distension of the levator hiatus with the probe
- More invasive than the other methods
- Not routinely used in rehabilitation context



Athanasiou, S., et al., Direct imaging of the pelvic floor muscles using two-dimensional ultrasound: a comparison of women with urogenital prolapse versus controls.BJOG: *An International Journal of Obstetrics and Gynaecology,* ***2007. 114(7): p. 882-888.***

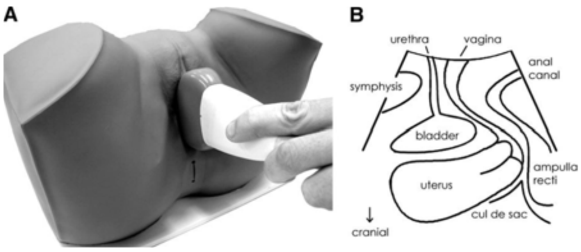
2D Transperineal ultrasonography (TPUS)

- **Advantages**
  - Able to see puborectalis sling
  - Symphysis pubis is a standard bony reference
  - Good visualisation of the bladder, urethra and bladder neck
  - Cineloop capabilities show real time movement
- **Requirements:**
  - Convex transducer (3-6MHz)
  - Field of view at least 70°
  - Cineloop capability

Assessment on 2D TPUS

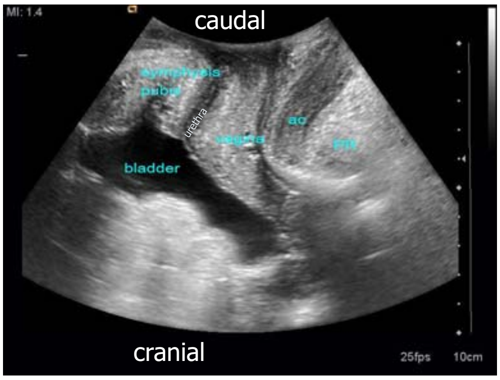
- **Procedure:**
  - Bladder is empty or standarised filling
  - Patient is supine, knees comfortable flexed
  - Probe is covered (glove/condom)
  - Probe placed firmly on the perineum
- **Biometric assessment parameters**
  - Activation of the muscles prior to cough
  - Movement of the bladder neck caudally during voluntary valsalva. (Dietz HP. Am J Obstet Gynecol. 2010).
  - Urethral rotation during valsalva
  - Movement of the rectal ampulla
  - Narrowing, lengthening of the anterior-posterior diameter on contraction (measurement taken from edge of symphysis pubis to ano-rectal angle)
  - These measurements found to be repeatable and reliable Braekken et al (2008;2009)

Transducer placement for TPUS



Transducer placement on perineum and B, schematic representation of imaging in midsagittal plane.
Dietz. Pelvic floor ultrasound: a review. Am J Obstet Gynecol 2010.

Typical 2D TPUS of the pelvic floor muscles at rest



Clinical use of 2D ultrasound

- Still widely used
- Bladder, uterine and rectal descent.
- Bo, K. and M. Sherburn, *Evaluation of female pelvic-floor muscle function and strength. Physical therapy, 2005.* ***85(3): p. 269-82, Mar.***
  - ***Abdominal ultrasound***
- Athanasiou, S., et al., *Direct imaging of the pelvic floor muscles using two-dimensional ultrasound: a comparison of women with urogenital prolapse versus controls.*BJOG: *An International Journal of Obstetrics and Gynaecology,* **2007. 114(7): p. 882-888.**
  - **Endovaginal probe**
- Costantini, S., et al., *Perineal ultrasound evaluation of the urethrovesical junction angle and urethral mobility in nulliparous women and women following vaginal delivery. Int Urogynecol J Pelvic Floor Dysfunct, 2005.* ***16(6): p. 455-9.***
  - ***2D Transperineal ultrasound***
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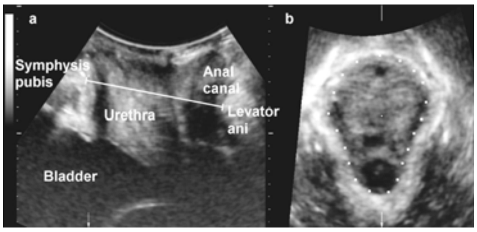
3/4D TPUS

- Advantages:
  - Integration of 2D sectional images into volume images
  - Acquisition of volume images allow access to the axial plane – previously domain of magnetic resonance imaging
  - Use of tomographic or multislice imaging. Assess the attachment site of the puborectalis muscle to the inferior ramus of the pubis
  - Access to LA hiatal area measures as well as diameters
- Requirements:
  - 3D abdominal probe used for obstetric scanning ie curved array (RAB 8-4MHz)
  - Wide angle of acquisition 85° if possible
  - Ultrasound machine capable of 3 dimensional imaging
  - Proprietary software for off-line analysis

3D pelvic floor imaging – assessing function

- Unique plane of acquisition for levator hiatal area: 'plane of minimal dimensions'
  - Smallest distance from the inferior edge of the symphysis pubis to the anal rectal angle
  - Levator hiatal area bounded by the symphysis pubis anteriorly, anal rectal angle posteriorly, puborectalis/pubococcygeus laterally.
  - Hiatal area measures – pelvic floor function
    - Rest
    - Maximum pelvic floor muscle contraction
    - Maximum valsalva
  - Good repeatability and reliability of these biometric measures of function.(Yang SH. et al 2009; Braekken et al 2009;.

Defining the 'plane of minimal dimensions'



A mid-sagittal image. Line indicates plane of minimal dimensions

B corresponding axial image showing entire levator hiatus (dotted area)

3D pelvic floor imaging

A standard acquisition screen of pelvic floor imaging as captured with a Voluson 730 expert system. The orthogonal views are seen at the top left (A plane), top right (B plane), and bottom left (C plane). The bottom right image shows a rendered volume image of the entire levator hiatus. (Dietz et al 2005)

Tomographic ultrasound

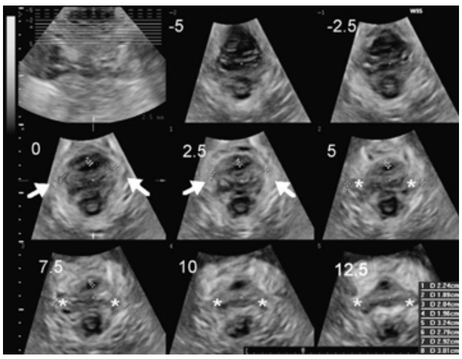
- Tomographic imaging allows visualisation of the entire insertion site of the puborectalis muscle, in a slice by slice manner
- Identification of muscle/bone injury – or avulsion injury.
- Significantly associated with development of prolapse(Model AN et al. 2010; Heilbrun ME et al

Procedure

- Assessment is performed on volume images – on a maximum contraction.
- Region of interest is from 5 mm below to 12.5 mm above the plane of minimal dimensions
- A slice interval of 2.5mm is optimal
- three central tomographic slices to be abnormal.
- Levator-urethra gap > 2.5mm considered abnormal(Dietz HP, 2010 Nov 24).

Identifying avulsion

Large bilateral partial trauma (indicated by asterisk) sparing the inferior aspects of the insertions of the puborectalis muscle (arrows). The numbers indicate the location of the slice relative to the reference plane (the plane of minimal hiatal dimensions, identified by '0'). The numerical measurements (bottom right hand corner) give the 'levator–urethra gap' which is useful in doubtful cases. A measurement of over 2.5 cm is regarded as abnormal. (Dietz et al Int Urogynecol Journal 2011)



Conclusions

- Use of ultrasound is extremely useful to quantify morphology and function
- Some training required but off-line analysis makes verification of images easier
- Dont always need fancy u/s machines
- 2D images gives lots of information
- Really useful as a biofeedback for both contraction and relaxation training
- Need to make the leap and practice, practice practice!

Notes

Record your notes from the workshop here