W19: Integrated Total Pelvic Floor Ultrasound in Pelvic Floor Dysfunction

Workshop Chair: Alison Hainsworth, United Kingdom
12 September 2017 13:30 - 16:30

Start	End	Topic	Speakers
13:30	13:40	Introduction and know your machine	Alison Hainsworth/ Andrew Williams
13:40	13:55	Pelvic floor anatomy	Andrew Williams
13:55	14:10	Normal ultrasound pelvic floor anatomy with the integrated approach	Guilio Santoro
14:10	14:20	When to perform integrated total pelvic floor ultrasound	Sophie Pilkington
14:20	14:30	How to perform integrated total pelvic floor ultrasound	Alexis Schizas
14:30	15:00	Interactive workstations - Small groups with ultrasound workstations – the interpretation of normal and pathological scans	All
15:00	15:30	Break	None
15:30	16:00	Interactive workstations - Small groups with ultrasound workstations – the interpretation of normal and pathological scans	All
16:00	16:10	The report - Drawing all the images together to report integrated total pelvic floor ultrasound	Alexis Schizas
16:10	16:25	Quiz – Test your skills – Interpretation of integrated total pelvic floor ultrasound	Guilio Santoro Andrew Williams
16:25	16:30	Questions	All

Speaker Powerpoint Slides

Please note that where authorised by the speaker all PowerPoint slides presented at the workshop will be made available after the meeting via the ICS website www.ics.org/2017/programme Please do not film or photograph the slides during the workshop as this is distracting for the speakers.

Aims of Workshop

The aim is to learn how to perform and interpret integrated total pelvic floor ultrasound (transperineal, transvaginal, endovaginal) as part of your assessment of pelvic floor dysfunction.

This tool is used in clinic to detect anatomical (rectocoele, enterocoele, intussusception, cystocoele, bladder neck descent, uterine descent) and functional (dyssynergy, poor propulsive effort) abnormalities. You will know how to perform integrated total pelvic floor ultrasound and understand normal and pathological findings. This hands-on workshop allows you to practice image interpretation so that you can begin to use ultrasound in your clinical practice.

Learning Objectives

Understand how to perform integrated total pelvic floor ultrasound (transperineal, transvaginal and endovaginal).

Recognise normal anatomical findings on integrated total pelvic floor ultrasound.

Identify pathological features on integrated total pelvic floor ultrasound (rectocoele, enterocoele, intussusception, rectal prolapse, uterine descent, cystocoele, bladder neck descent, dyssynergy, poor propulsion, levator plate injury).

There will also be some discussion surrounding anal canal anatomy and the use of endoanal ultrasound to examine the integrity of the anal sphincters.

Learning Outcomes

Understand the basic ultrasound machine and ultrasound probes used for integrated total pelvic floor ultrasound

Understand how to perform integrated total pelvic floor ultrasound (including indications, patient preparation, position)

Understand basic pelvic floor anatomy

Recognise normal findings on integrated total pelvic floor ultrasound (transperineal, transvaginal and endovaginal)

Interpret pathological findings on integrated total pelvic floor ultrasound -

1) Transperineal – rectocoele, enterocoele, rectal prolapse, cystocoele, uterine descent, dyssynergy,
2) Posterior transvaginal – rectocoele, enterocoele, intussusception, rectal prolapse, dyssynergy, propulsive effort,
3) Anterior transvaginal – cystocoele, bladder neck support, propulsive effort,
4) Endovaginal – levator plate injuries.

Target Audience

Surgeons, physicians, nurses, physiotherapists, clinical scientists

Advanced/Basic

Advanced

Conditions for Learning

This is an interactive workshop with a combination of lectures and then breaking off into small groups to interpret ultrasound images; the maximum number of delegates is 30.

Workshop Outline

Introduction and Know your Machine

Miss Alison Hainsworth - UK

Integrated total pelvic floor ultrasound is a dynamic, easily accessible, cost effective and safe tool which can be used to screen for anatomical and functional abnormalities in a one stop clinic.

It can be used alongside clinical history and examination to highlight those patients who may need further investigations for possible surgical correction of anatomical abnormalities or those who will primarily benefit from conservative treatments. It is user dependent and so requires training and experience. This workshop will equip you with the tools needed to begin to understand how to perform and interpret integrated total pelvic floor ultrasound.

Mr Andrew Williams - UK

Integrated total pelvic floor ultrasound can be performed using a standard ultrasound machine. Transvaginal ultrasound scan and endovaginal or endoanal scanning is performed using a rotating single crystal probe. Transperineal ultrasound is performed using a conventional curved array probe with frequencies of 3 – 6 MHz and a field of view of at least 70 degrees. We will outline how to set up and use the ultrasound machine though we recommend that you engage your local ultrasound machine representatives to go through the optimal settings for integrated total pelvic floor ultrasound with you.

Pelvic Floor Anatomy

Mr Andrew Williams - UK

An outline of the pelvic floor anatomy in terms of the bony pelvis, the musculature of the pelvic floor and the contents of the pelvis.

The pelvic cavity is bound by the anterior pelvic wall (the posterior surfaces of the bodies and rami of the pubic bones and pubic symphysis) the lateral pelvic walls (hip bones covered with the obturator internus) and posterior pelvic wall (the sacrum, coccyx, the piriformis muscles and covering parietal fascia).

The pelvic floor is a muscular structure which stretches between the pubis anteriorly, the coccyx posteriorly and from one lateral pelvic side wall to the other. The levator ani is the most important muscle (a group of muscles often described as a single structure) and is divided into two major components; iliococcygeus and pubococcygeus (includes the Puborectalis and Pubovaginalis).

The pelvic cavity consists of the posterior, middle and anterior cavities.

The posterior cavity contains the rectum and sigmoid colon. Peritoneum covers the upper third of the rectum at the front and sides and the middle third only at the front. The peritoneum reflects forwards on to the upper vagina to form the pouch of Douglas (rectouterine pouch, lower most limit of the peritoneal cavity). The rectum ends where the muscle coats are replaced by the sphincter muscles of the anal canal at the anorectal junction, slung in the U loop of the Puborectalis at the level of the pelvic floor.

The internal anal sphincter surrounds the anal canal and is an involuntary, smooth muscle formed from the circular layer of the rectum. The external anal sphincter is composed of three parts (subcutaneous (encircles the lower end of the anal canal, no attachments), superficial (attached to the coccyx behind and perineal body in front) and the deep (encircles the upper end of the anal canal without bony attachments)) but can be considered one muscle. The deep part is continuous with the puborectalis sling muscle causing the acute anorectal angle.

The middle pelvic cavity contains the uterus, cervix and vagina. The upper third of the vagina lies in front of the pouch of Douglas, the middle and lower third are below the peritoneal reflexion. The rectovaginal septum separates the vagina from the rectum.

The anterior pelvic cavity holds the bladder and bladder neck.

Normal ultrasound pelvic floor anatomy with the integrated approach

Professor Santoro Guilio - Italy

An explanation of the normal anatomical appearances to expect when performing integrated total pelvic floor ultrasound.

Transvaginal Ultrasound

Anterior Views: An anterior transvaginal view allows anatomical visualisation of the bladder, muscle layers of the bladder (usually < 5mm), bladder neck, urethra, rhabdosphincter and pubic bone. The bladder neck is a highly reflective, hyperechoic funnel and the urethra is hypoechoic, which contrasts sharply with the surrounding peri-urethral tissue. The pubic symphysis is consistently seen (identification rate 100%) as a hypoechoic oval in front of the bladder reflecting the fibro-cartilagineous disc which connects the bony structures of pubic arch. During Valsalva manoeuvre the bladder neck should not descend more than 2 cm in relation to the pubic symphysis.

Posterior Views: Posterior transvaginal ultrasound enables visualisation of the following structures in the midline: the rectum, anorectal junction and anal canal, the posterior midline portion of the puborectalis sling muscle (a hypoechoic bundle of fibres lying behind the anorectal junction) and the perineal body (a hypoechoic structure anterior to the anal canal).

Three-Dimensional Cross Sectional View: The four anatomical levels demonstrated by transvaginal scanning are as follows. At the highest level the rectum lies posteriorly and bladder neck sits anteriorly. As the scan moves caudally the upper part of the urethra (anterior) and levator ani (lateral) are visualised. The pubic bone comes in to sight at 12 o'clock and is attached to the levator ani, which runs laterally in continuity with the puborectalis muscle sling muscle in the posterior portion. The levator ani are visible as a multi-layer hyperechoic sling at this level. The most caudal portion of the scan reveals the superficial perineal muscles, the perineal body and lower anal canal. Alignment of the pelvic organs (bladder neck or urethra, vagina and rectum or anal canal) indicates that the levator plate is intact and the arched symmetrical appearance pubic bone is a useful landmark to check that scan has been performed in a neutral position.

Transperineal Ultrasound

Sagittal transperineal scanning allows simultaneous visualisation of the anterior (pubic symphysis, urethra and bladder), middle (vagina, uterus, perineal body) and posterior (rectovaginal septum, rectum, anorectal junction) compartments in the midline. The anorectal angle is measured between the posterior wall of the rectum and the longitudinal axis of the anal canal and should open during straining.

Endoanal Ultrasound

Endoanal ultrasound allows visualisation of the internal and external anal sphincters.

When to perform integrated total pelvic floor ultrasound

Sophie Pilkington - UK

Integrated total pelvic floor ultrasound is useful for investigating causes of defaecatory dysfunction with the added advantage of being able to assess causes of vaginal and urinary symptoms.

The anatomy of the pelvic floor is complex and understanding how it functions is difficult to assess.

Surgical management of pelvic floor disorders depends on accurate assessment of the structure and function of the pelvic floor.

Ultrasound is proving to be an excellent modality for assessing the pelvic floor because it is:

- Quick and easy to perform
- Well tolerated by patients
- Assesses all 3 compartments
- No ionising radiation
- Inexpensive
- Easily accessible

Patients with pelvic floor disorders present with symptoms from pelvic organ prolapse (including rectal prolapse), incontinence (urinary and/or anal), pelvic pain or rectal evacuatory problems. Integrated total pelvic floor ultrasound enables assessment of 3-dimensional anatomy and dynamic movements of the pelvic floor to build up a complete understanding of the pelvic floor.

Many patients with pelvic floor disorders do not benefit from surgical intervention. Selecting patients for surgery is challenging and current diagnostic modalities include clinical examination, anorectal physiology, urodynamics, proctography with Barium or Magnetic Resonance Imaging. Pelvic floor ultrasound is a useful addition to the clinical examination and allows the clinician to visualise structures below the surface anatomy.

There is a high rate of failure with recurrent symptoms amongst patients undergoing pelvic floor surgery and 30% of these patients are undergoing repeat surgery. It is difficult to know whether this is due to the nature of the disease and that there is a high inherent failure rate or whether this is due to poor patient selection for procedures. Improved surgical techniques and better patient selection is likely to provide the key for reducing failure rates.

Complete pelvic floor ultrasound has important advantages over conventional methods for imaging the dynamics of the pelvic floor. No ionising radiation is involved. The technique is performed by the clinician and can be carried out quickly and easily in a normal clinic setting without the need for additional appointments. It is particularly suitable for a one stop clinic environment facilitating collection of all structural and functional information at the first appointment. There is minimal patient discomfort and no preparation is necessary. Information is acquired from the anterior, middle and posterior compartments with a series of

3-dimensional and dynamic sequences. The complete sequence of scans provides additional information to confirm and document the physical findings. The complete pelvic floor dataset can then be reviewed at the pelvic floor multidisciplinary meeting. Following surgical intervention, the anatomical outcomes can be assessed by comparing appearances on complete pelvic floor scanning before and after surgery.

How to perform integrated total pelvic floor ultrasound

Mr Alexis Schizas - UK

An outline of the patient preparation and position which we have adopted as well as instructions for the sequence in which we perform integrated total pelvic floor ultrasound.

Patient Preparation: Some advocate the use of an enema and recommend urination in order to empty the rectum and bladder prior to the examination and allow the patient to bear down freely. However, the presence of stool in the rectum may aid in visualisation of a rectocoele. The use of small bowel contrast (50 mls Gastrografin® diluted 1:1 with tap water is ingested one hour prior to examination) and vaginal and rectal filling with ultrasound gel have also been described.

Patient Position: The patient lies supine with the legs drawn up and flexed, the feet together and the legs apart. The dorsal lithotomy position with the legs in stirrups may also be adopted. Endoanal ultrasound can either be performed with the patient in the dorsal lithotomy position or supine. Each probe is covered with ultrasound coupling gel, a latex sheath and further coupling gel, ensuring there are no air bubbles between them. The probes are decontaminated between each patient, including the use of an anti-sporicidal agent.

Transvaginal Ultrasound: Initially, the probe is held still (facing anteriorly) to obtain two dimensional anterior views during squeezing, relaxing, bearing-down and coughing. The probe is kept in the same position whilst the patient is at rest to obtain a 360-degree cross sectional image. Next, the probe is rotated within the vagina to face posteriorly and the patient is again asked to squeeze, relax, bear-down and cough.

Transperineal Ultrasound: The transducer is rested on the perineum to obtain dynamic mid sagittal views whilst the patient is squeezing, relaxing, bearing down and then squeezing, relaxing and coughing.

Endoanal Ultrasound: The probe is held still and a 360-degree cross sectional image is obtained.

Interactive Workstations

A series of workstations examining dynamic images from anterior transvaginal, endovaginal, posterior transvaginal and transperineal in both pathological and healthy cases.

The pathology that you may encounter include the following:

Transvaginal Ultrasound

Anterior Views: Though there is no definition of 'normal', bladder neck decent over 2cm is indicative of pelvic floor insufficiency. Hypermobility of the bladder neck may indicate urinary incontinence and bladder wall thickness may represent detrusor instability.

Ultrasound scanning is useful for the visualisation of synthetic mesh implants from previous surgeries, which is helpful for the evaluation of complications and recurrence.

Posterior Views: Posterior transvaginal scanning during Valsalva manoeuvre may demonstrate infolding of the rectal wall, with or without subsequent reverberation echoes, which indicates the presence of intussusception. It is not yet known how to accurately grade the severity of intussusception based on ultrasound scanning alone and assessment with defaecatory imaging (proctography or MRI) can further delineate functional anatomy. During the Valsalva manoeuvre a rectocoele is the protrusion of the anterior rectal wall with impingement onto the perineal body. The ultrasound probe will splint any rectocoele and therefore underestimate the size of the rectocoele. An enterocoele may also be visualised between the rectum and the probe during Valsalva.

Three Dimensional Cross Sectional View: A levator plate injury appears as a complete or partial loss of normal muscle which may result in a mal-alignment of the pelvic floor organs. The integrity of the levator ani muscle can be scored according the system described by Shobeiri and colleagues to the quality of the puboanalis, the puborectalis and the pubovisceralis. Each subgroup is analysed in an axial plane scored (0 = no defect, 1 = minimal defect with <50% muscle loss, 2 = major defect with >50% muscle loss, 3 = total absence of the muscle). Each muscle pair is scored from 0 (no muscle loss) to 6 (total absence). For the entire levator plate a cumulative score (maximum 18) is calculated and categorised as normal (0), mild (< 6), moderate (7 – 12) and severe (>13)**Error! Reference source not found.**.

Transperineal Ultrasound

Rectocoele: During sagittal transperineal scanning a rectocoele appears as an out-pouching of the anterior rectal wall, into the vagina, which may be present at rest but become more evident during straining. The rectovaginal septum cannot be reliably identified and so its' assessment is not considered clinically relevant. A rectocoele usually contains faecal material and associated bowel gas, resulting in specular echoes and reverberations and the distension of the rectocoele on ultrasound may depend upon the presence of trapped stool.

Enterocoele/ Sigmoidocoele: An enterocoele or sigmoidocoele characteristically appear as a hyperechoic mass descending from above the rectal ampulla into the vagina or rectovaginal space on transperineal scanning. The small bowel may be visible due to peristalsis but it is not possible to distinguish between the two entities or demonstrate their functional implications during ultrasound and defaecation proctography can be used for additional assessment. Enterocoele may be graded according to severity (grade I when the most distal part descends into the upper third of the vagina, grade II when the distal part descends

into the middle third and grade III when the distal part descends into the lower third). A peritoneocoele is defined as an enlarged rectovaginal space (more than 2cm).
Cystocoele: A cystocoele may be graded (I – III). A grade I cystocoele is defined as the prolapse of the bladder onto the vagina, grade II is where the bladder falls into the vagina and grade three is when the bladder prolapses through the vagina.

Endoanal Ultrasound
Thickened or paucity of internal anal sphincter. Obstetric anal sphincter injury and evidence of previous repair may also be visualised.

The report - drawing all the images together to report integrated total pelvic floor ultrasound
Mr Alexis Schizas - UK
An outline of how to identify the salient positive and negative findings on integrated total pelvic floor ultrasound to write a meaningful and clinically relevant report.

Quiz
Mr Andrew Williams - UK and Professor Guilio Santoro - Italy
A series of dynamic images from integrated total pelvic floor ultrasound to test what you've learnt from the workshop.

Suggested Learning before Workshop Attendance
BK Medical: Guide to Multicompartmental Pelvic Floor Scanning

Suggested Reading
- Total pelvic floor ultrasound for pelvic floor defaecatory dysfunction: a pictorial review. Hainsworth AJ, Solanki D, Schizas AM, Williams AB. Br J Radiol. 2015;88(1055):20150494. doi: 10.1259/bjr.20150494. Review.

- The Dynamic Transperineal Ultrasound Era of the Evaluation of Obstructed Defecation Syndrome. Dis Colon Rectum. 2016 Aug;59(8):800-3. Martellucci J, Brusciano L.

- Integrated Total Pelvic Floor Ultrasound in Pelvic Floor Defaecatory Dysfunction. Colorectal Dis. 2016 Nov 24. doi: 10.1111/codi.13568. [Epub ahead of print]. Hainsworth AJ, Solanki D, Hamad A, Morris SJ, Schizas AM, Williams AB.

- Accuracy of integrated total pelvic floor ultrasound compared to defaecatory MRI in females with pelvic floor defaecatory dysfunction. Br J Radiol. 2016 Dec;89(1068):20160522. Hainsworth AJ, Pilkington SA, Grierson C, Rutherford E, Schizas AM, Nugent KP, Williams AB.

- State of the art: an integrated approach to pelvic floor ultrasonography. Ultrasound Obstet Gynecol. 2011 Apr;37(4):381-96. doi: 10.1002/uog.8816. Santoro GA1, Wieczorek AP, Dietz HP, Mellgren A, Sultan AH, Shobeiri SA, Stankiewicz A, Bartram C.

- Pelvic floor disorders: role of new ultrasonographic techniques. World J Urol. 2011 Oct;29(5):615-23. doi: 10.1007/s00345-011-0708-x. Wieczorek AP, Stankiewicz A, Santoro GA, Wozniak MM, Bogusiewicz M, Rechberger T. PMID:21671056

- Perineal body anatomy seen by three-dimensional endovaginal ultrasound of asymptomatic nulliparae. Colorectal Dis. 2016 Apr;18(4):400-9. doi: 10.1111/codi.13119. PMID: 26382090. Santoro GA, Shobeiri SA, Petros PP, Zapater P, Wieczorek AP.

- Translabial ultrasound in the assessment of pelvic floor and anorectal function in women with defecatory disorders. Tech Coloproctol. 2014 May;18(5):481-94. doi: 10.1007/s10151-013-1117-5. Epub 2014 Feb 11. Dietz HP1.

- Interrater reliability of assessing levator ani deficiency with 360° 3D endovaginal ultrasound. Int Urogynecol J. 2014 Jun;25(6):761-6. doi: 10.1007/s00192-013-2286-5. Epub 2013 Dec 13. Rostaminia G1, Manonai J, Leclaire E, Omoumi F, Marchiorlatti M, Quiroz LH, Shobeiri SA.

Other Supporting Documents, Teaching Tools, Patient Education etc
Handouts
- Clinical uses of pelvic floor ultrasound: A colorectal surgeon's view. Marianne Starck, Pelvic Floor Centre, Malmo University Hospital, Sweden, BK ultrasound
- Use of the pelvic floor multicompartment scanning in clinical practice. Elizabeth R. Mueller, M.D., M.S., FACS, Assisstant Professor, Medical Director of Female Pelvic Medicine and Reconstructive Surgery, Loyola University, Chicago, Chicago Stritch School of Medicine, USA

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Affiliations to disclose†:

BK ultrasound

† All financialties (over the last year) that you may have with any business organisation with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- [x] Self-funded
- [ ] Institution (non-industry) funded
- [ ] Sponsored by:

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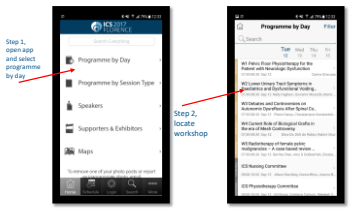

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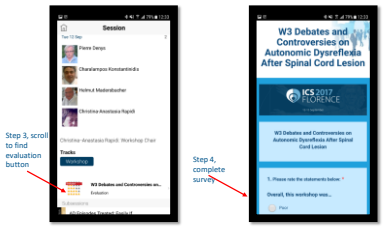

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- A full handout for all workshops is available via the ICS website.
- Please silence all mobile phones
- Please refrain from taking video and pictures of the speakers and their slides. PDF versions of the slides (where approved) will be made available after the meeting via the ICS website.

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Integrated Total Pelvic Floor Ultrasound W19 Introduction

Alison Hainsworth
Colorectal Surgical Trainee
Research Fellow Pelvic Floor Ultrasound
St Thomas' Hospital, London

Faculty

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Mr Andrew Williams
Consultant Colorectal Surgeon,
St Thomas' Hospital, London, UK
Chairman of The National Pelvic Floor Society (ACPGBI)

Professor Guilio Santoro

Mr Alexis Schizas
Consultant Colorectal Surgeon, St Thomas' Hospital, UK
Standardised Steering Committee

Ms Sophie Pilkington
Consultant Colorectal Surgeon,
Southampton University Hospital, UK

Ms Samantha Morris
Clinical Scientist,
St Thomas' Hospital, UK

Ms Deepa Solanki
Clinical Scientist,
St Thomas' Hospital, UK

What is Total Pelvic Floor Ultrasound?

Anterior transvaginal
Endovaginal
Posterior transvaginal
Transperineal
Endoanal

Dynamic assessment
Entire pelvic floor

Learning Objectives

- Understand **when and how** to perform integrated total pelvic floor ultrasound (transperineal, transvaginal and endovaginal).
- Recognise **normal** anatomical findings on integrated total pelvic floor ultrasound.
- Identify **pathological** features on integrated total pelvic floor ultrasound (rectocoele, enterocoele, intussusception, rectal prolapse, uterine descent, cystocoele, bladder neck descent, dyssynergy, poor propulsion, levator plate injury).
- There will also be some discussion surrounding anal canal anatomy and the use of **endoanal ultrasound** to examine the integrity of the anal sphincters.

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Know Your Machine

Andrew Williams

13:30 – 13:40

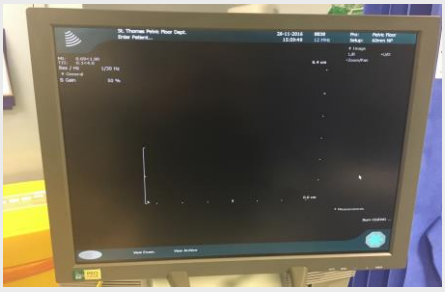
Total Pelvic Floor Ultrasound

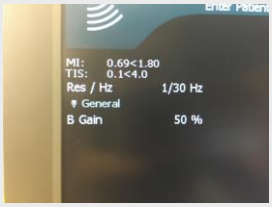
- Spend time with company to familiarise yourself with equipment
- Settings

The Machine

Probes

Dashboard





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Pelvic Floor Anatomy

Andrew Williams

13:40 – 13:55

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Anatomy of the Anal canal and Pelvic Floor

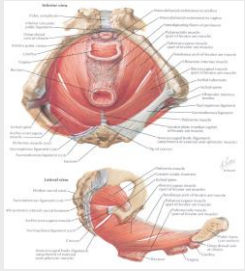
Andrew B Williams
St Thomas' Hospital UK

Pelvic floor anatomy

- Levator ani
- Perineum
- Sphincters

Levator Ani Muscles

- Ischiococcygeus
- Iliococcygeus
- Pubococcygeus
- Puborectalis



Levator ani

Anterior - pubis + anterior part of tendinous arch

- muscle>fascia
  - superficial
  - deep - puborectalis

Posterior - tendinous arch, anococcygeal ligament and coccyx

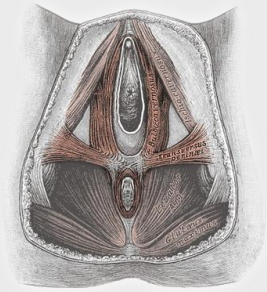
- fascia>muscle

Puborectalis

- U-shaped, medial most located levator ani muscle
- Pulls the anorectal junction anteriorly, forming the anorectal angle
- Pelvic floor muscle vs. sphincter muscle?

Perineal Anatomy

Perineal Muscles



Bulbospongiosus
Transverse Perinei
Puboanalis
Perineal Body
Anal Sphincters

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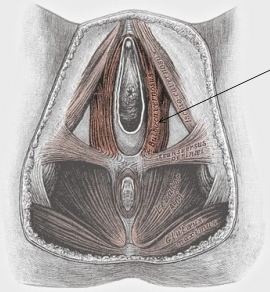
Perineal Muscles



Bulbospongiosus

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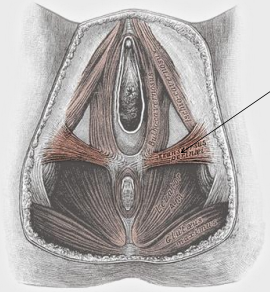
Perineal Muscles



Transverse perinei

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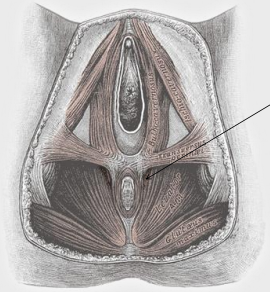
Perineal Muscles



Puboanalis

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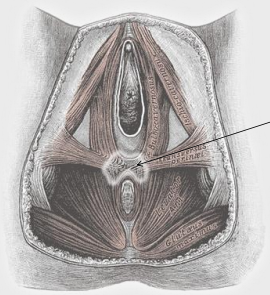
Perineal Muscles



Perineal body

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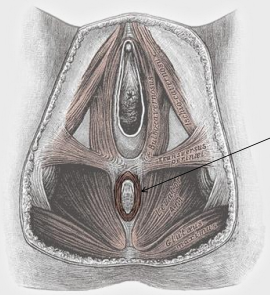
Perineal Muscles



Internal and External anal sphincter

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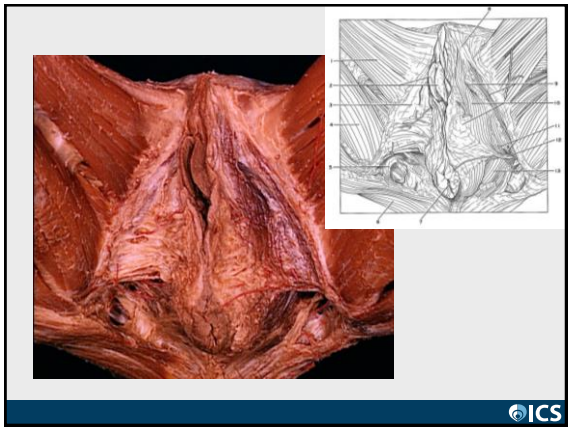
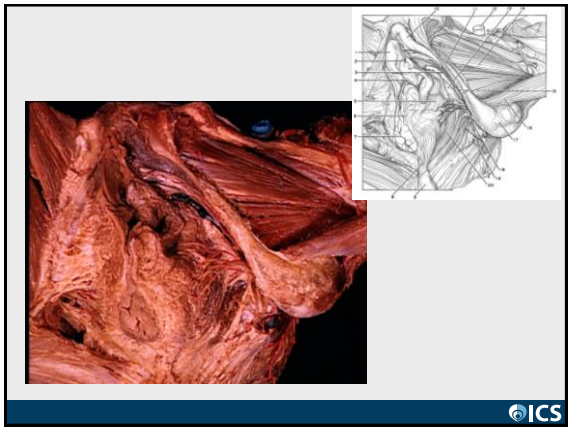
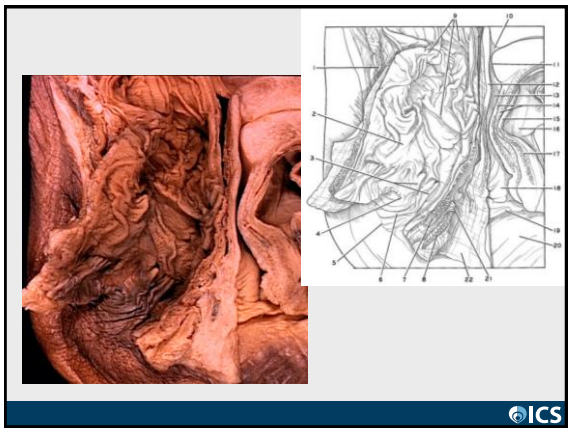
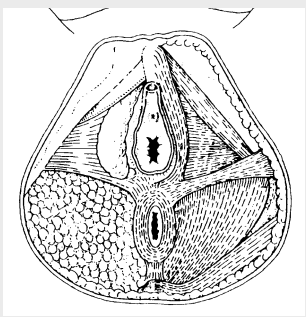
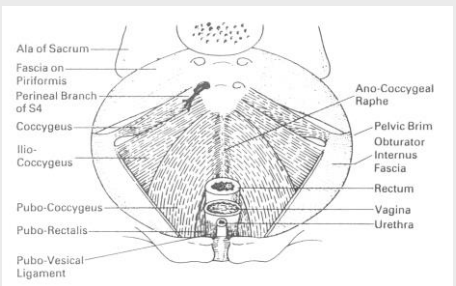


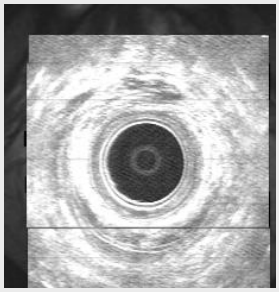






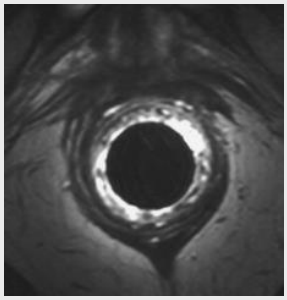

Ala of Sacrum
Fascia on Piriformis
Perineal Branch of S4
Coccygeus
Ilio-Coccygeus
Pubo-Coccygeus
Pubo-Rectalis
Pubo-Vesical Ligament
Ano-Coccygeal Raphe
Pelvic Brim
Obturator Internus Fascia
Rectum
Vagina
Urethra

MALE PERINEAL BODY



ICS

MALE PERINEAL BODY



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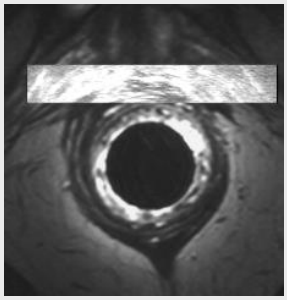

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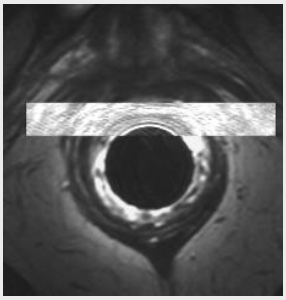

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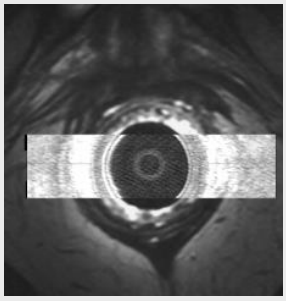

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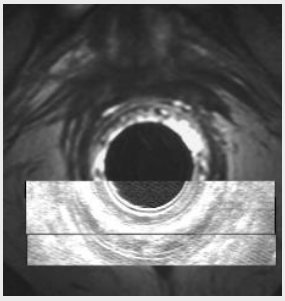
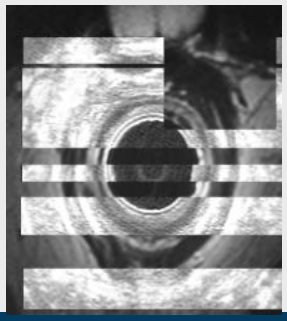
MALE PERINEAL BODY



ICS

MALE PERINEAL BODY



ICS

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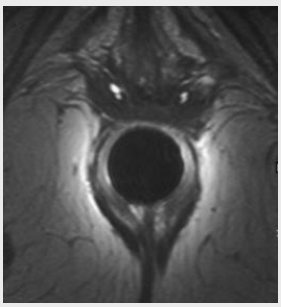

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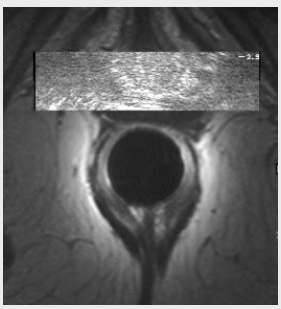

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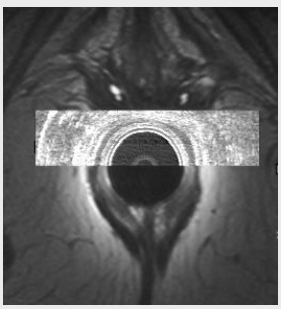

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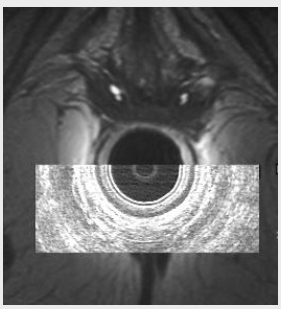
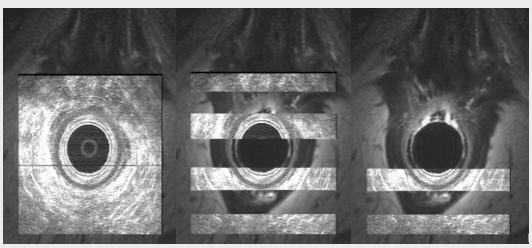


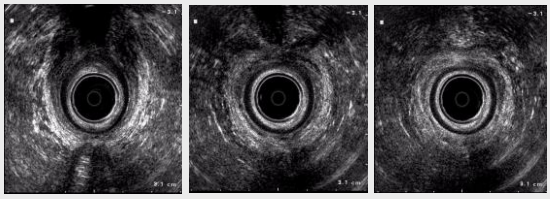
ICS

Perineal Body



ICS

Normal Female

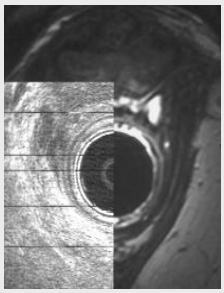


high upper mid mid

Anterior ring intact

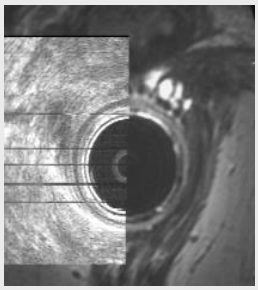
ICS

Puboanalis



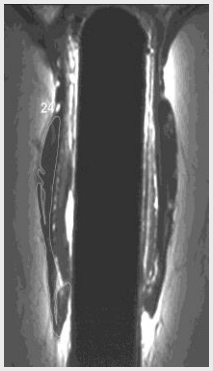
ICS

Transverse Perineii (Female)



ICS

EAS area in mid coronal section



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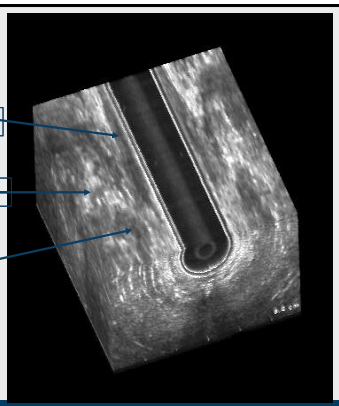


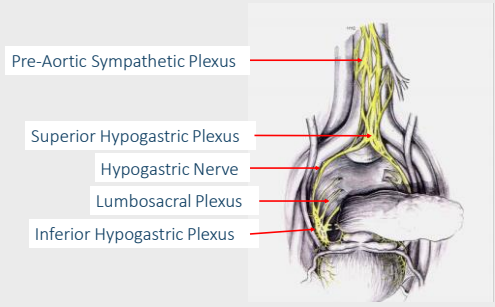
ICS

ICS

Posterior Levator Ani

Anterior Levator ani

Pelvic Autonomic Nerve Supply



Rectal nerve supply

- Sympathetic from hypogastric nerve plexuses
- Parasympathetic from S2,3,4 in Pelvic splanchnics (motor too)
- Pain fibres accompanying both

Perianal Area

ICS

Anal Canal

- Approx. 2-4cm long
- Commences at level of puborectalis muscle
- Upper canal - mucous membrane
  - anal sinuses/valves
  - anal glands at bottom of sinuses (crypts)
- Dentate Line is junction between upper and lower canal
- Lower Canal
  - anal skin or pecten
  - ends at junction between perianal skin and buttock

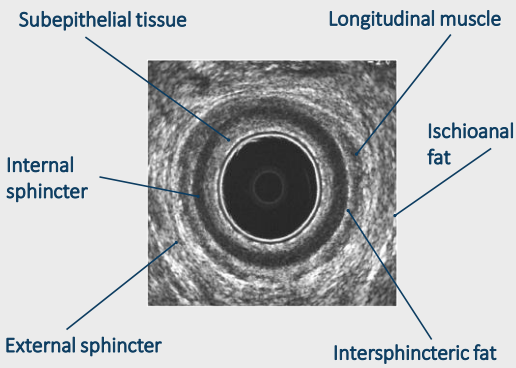
ICS

Normal Anatomy

The basic 4 layer pattern

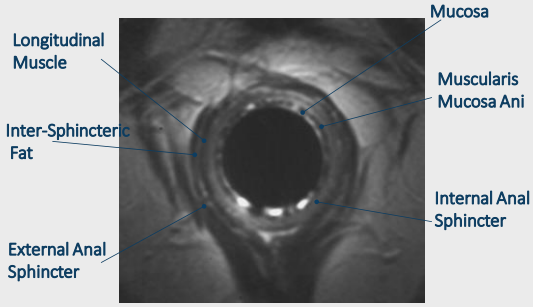
- subepithelium
- internal sphincter
- longitudinal muscle
- external sphincter

ICS



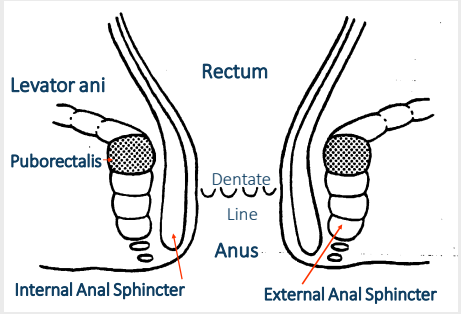
ICS

Endocoil MRI



ICS

PELVIC FLOOR - ANATOMY



ICS

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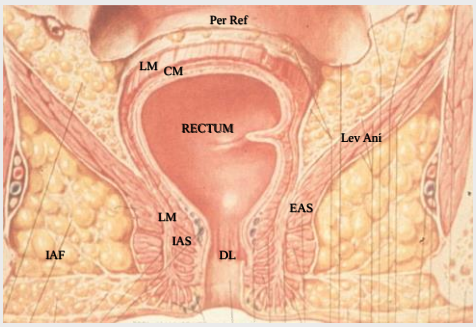
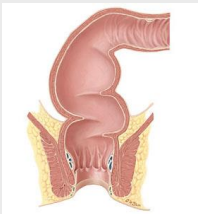


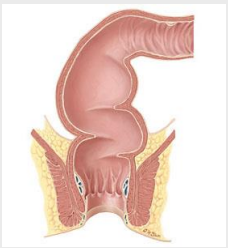
Internal Anal Sphincter

- Extension of the circular muscle layer of the rectum
- Constant maximal contraction
- 50-85% of resting anal tone
- Autonomic innervation
  - Parasympathetic.....S2-4
  - Sympathetic.....thoracolumbar ganglia (L5)



External Anal Sphincter

- Multiple layers of striated muscle
- Voluntary contractions to prevent fecal leak
- 25-30% of resting anal tone
- Somatic innervation from the inferior rectal branch of the pudendal nerve (S2-3) and the perineal branch of S4

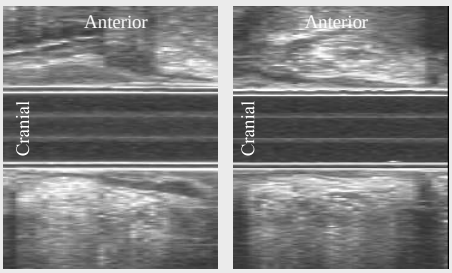


Male : Female

EAS symmetric cylinder

EAS shorter anteriorly forming anterior ring in perineum

Gender differences in canal anatomy



Results: Canal Anatomy

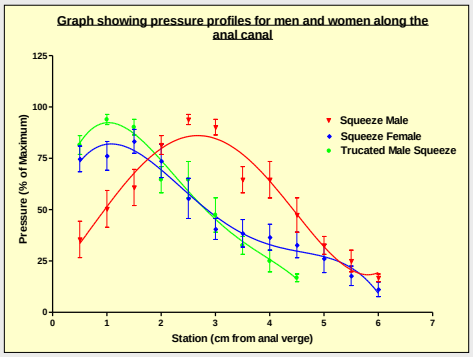
MUSCLE LENGTHS	MALE	FEMALE	Mann-Whitney U
Canal Length	50.2mm (14.4)	42.2mm (24.2)	P = 0.019
PR Length	23.9mm (22.8)	27.1mm (9.2)	P=0.49
EAS (Anterior)	30.1mm (12)	15.6mm (29.2)	P<0.001
EAS (Coronal)	31.6mm (10.2)	19.5mm (22)	P<0.001
EAS (Posterior)	29.3mm (13.3)	16.5mm (31.6)	P=0.0015
IAS (Coronal)	34.4mm (6.8)	33.2mm (18.8)	P=0.72

Female EAS Anterior length vs Posterior Length (paired t testing) P = 0.27

Male EAS Anterior length vs Posterior Length (paired t testing) P=0.42

Results: Canal Anatomy

	MALE (% of anatomical canal)	FEMALE (% of anatomical canal)	Significance MWU testing
Puborectalis (Sagital Posterior)	45% (35% - 65%)	61% (37% - 73%)	P=0.02
EAS Anterior (Sagital)	58% (49% - 63%)	38% (22% - 62%)	P<0.001
EAS Posterior (Sagital)	58% (49% - 64%)	37% (25% - 69%)	P=.003
IAS Coronal	67% (55% - 77%)	73% (57% - 91%)	P=0.12



Results: Canal Pressures

Anatomical Level	Both sexes: % of Max Squeeze, Median (Range)
Rectum	12% (0%-39%)
Puborectalis	62% (32%-100%)
Puborectalis & External Sphincter	93% (47%-100%)
External with Internal Sphincter	91% (51%-100%)
External Sphincter alone	65% (4%-100%)

Gender Differences

- The anal canal is longer in men than women
- This difference is due to men having a longer external anal sphincter
- Puborectalis occupies a greater proportion of the anal canal length in women
- The muscular components of the anal canal contribute to resting and squeeze pressure to the same extent in men and women

Nerves involved in continence

- External Sphincter:
  - Pudendal nerve S2,3,4
- Internal sphincter:
  - sympathetic contraction
  - parasympathetic relaxation
- Puborectalis:
  - S3,4, direct
  - pudendal, too
- Sensation:
  - pudendal nerve

Functional Anatomy

- Puborectalis and the anorectal angle allow for gross fecal continence
- Relieves pressure from the sphincter process
- The sphincter complex is responsible for gas and liquid continence
- Defecation
  - Relaxation of the puborectalis
  - Contraction of the other levator muscles

ICS

Anal Canal Pressure

- Maximal squeeze pressure is associated with the overlap of the puborectalis and external anal sphincter
- Puborectalis, where present on its own, is associated with the same squeeze pressure as the pressure where the external sphincter is present on its own
- Puborectalis plays an important part in the development of squeeze pressure in normal individuals

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Sophie Pilkington

Colorectal Surgeon
University Hospital Southampton
UK

ICS

Sophie Pilkington

Affiliations to disclose: None

Consultant Colorectal Surgeon

University Hospital Southampton
UK

Funding for speaker to attend:

Enter X in appropriate box

	Self-Funded
X	Institution (non-industry) funded
	Sponsored by: Enter Company Name

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Many patients with pelvic floor disorders do not benefit from surgical intervention

Diagnostic modalities:

- History and physical examination
- Anorectal physiology & urodynamics
- Proctography with Barium or MRI
- Integrated total pelvic floor ultrasound

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Pelvic Floor Disorders

- Complex
- Interaction
  - Anatomy
  - Function
- 3-dimensions
- Dynamic

Pelvis
PELVIC FLOOR
Perineum

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Extension of the physical examination

Structure and function

In addition to pelvic floor surface anatomy

Outpatient clinic

Document physical findings

Facilitates review at Pelvic Floor Multidisciplinary Team Meeting

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Assessment of Pelvic Floor Disorders
Ultrasound

- Quick and easy to perform
- Well tolerated by patients
- Easily accessible
- Immediately available
- Assesses all 3 compartments
- No ionising radiation
- Inexpensive

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Indications

- Incontinence
- Pelvic organ prolapse
- Rectal evacuatory disorders
- Pelvic Pain

WHEN to perform Integrated Total Pelvic Floor Ultrasound

EXCLUDE anal or colorectal cancer and inflammatory bowel disease

Colonoscopy

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Anal Incontinence

Urinary incontinence

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Anal Incontinence

- Anal sphincter defects
  - External
  - Internal

Urinary incontinence

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Anal Incontinence

- Anal sphincter defects
  - External
  - Internal
- Rectal intussusception

Urinary incontinence

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Anal Incontinence

- Anal sphincter defects
  - External
  - Internal
- Rectal intussusception
- Rectocoele

Urinary incontinence

WHEN to perform Integrated Total Pelvic Floor Ultrasound

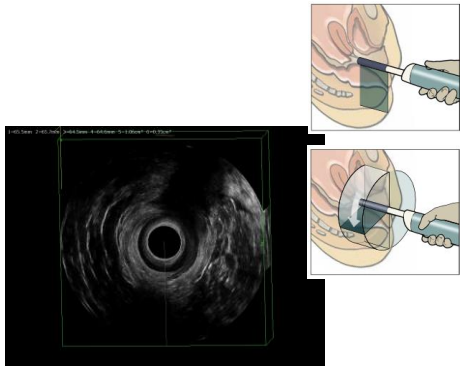
Anal Incontinence

- Anal sphincter defects
  - External
  - Internal
- Rectal intussusception
- Rectocoele

Urinary incontinence

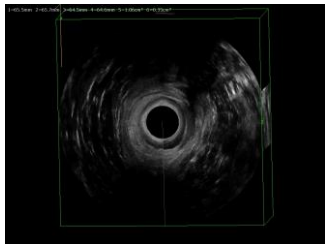
- Cystocoele
- Bladder neck descent

ICS



ICS

ICS



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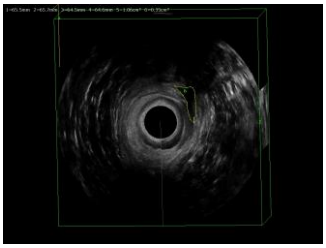

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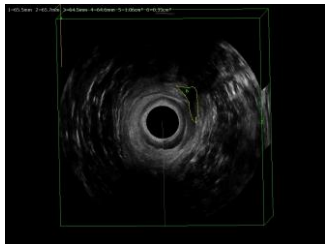

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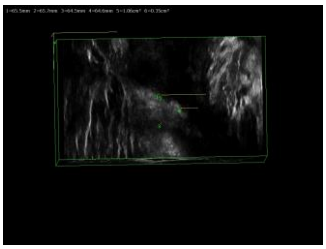
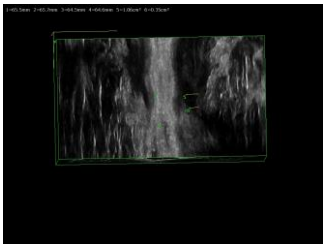
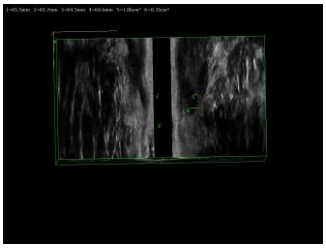
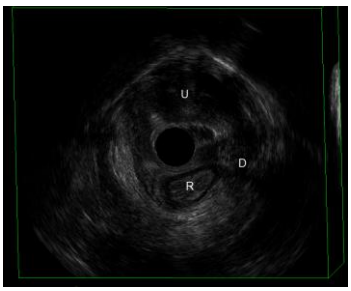


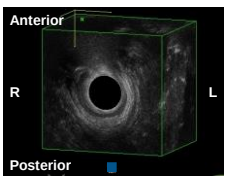




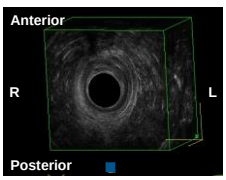
Levator defect



Surgical outcome

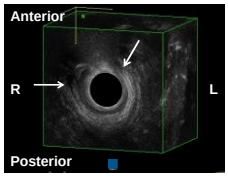


Anterior external anal sphincter defect

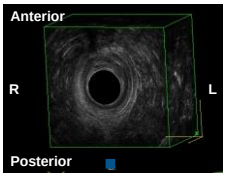


Immediate postoperative appearances

Surgical outcome



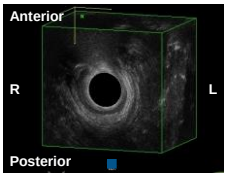
Anterior external anal sphincter defect



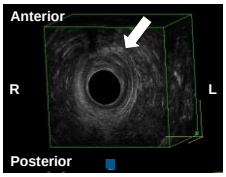
Immediate postoperative appearances

ICS

Surgical outcome



Anterior external anal sphincter defect



Immediate postoperative appearances

ICS

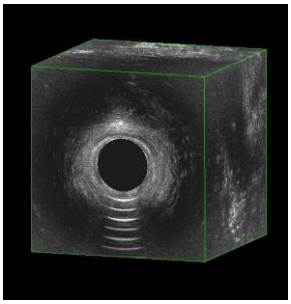
WHEN to perform Integrated Total Pelvic Floor Ultrasound

Pelvic organ prolapse

- Cystocoele
- Rectocoele
- Rectal intussusception
- External rectal prolapse
- Enterocoele

ICS

ICS



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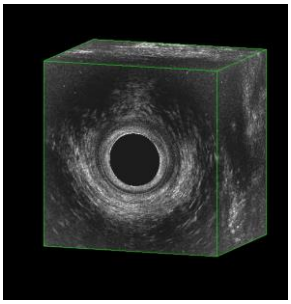

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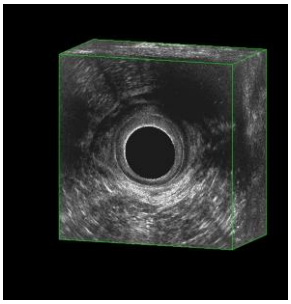
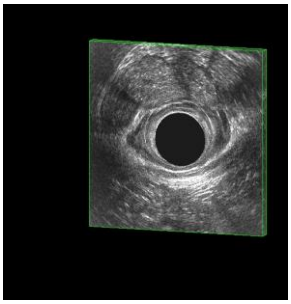
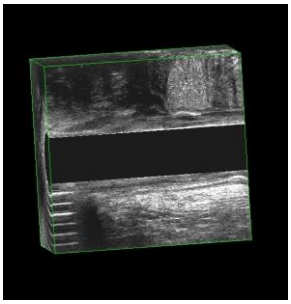
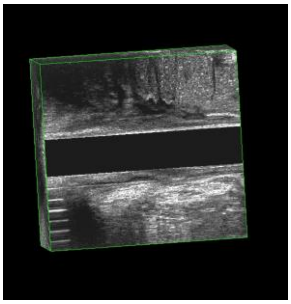
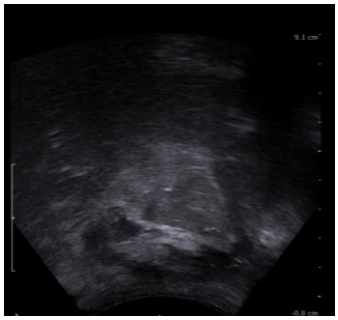


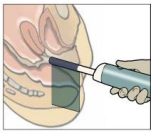


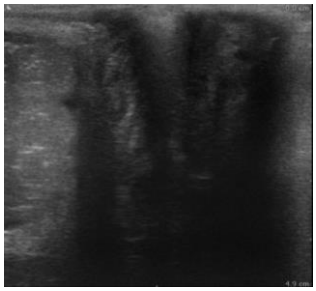




Enterocoele



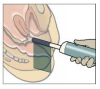


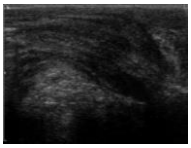


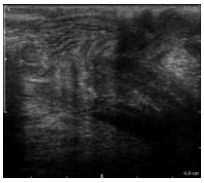
WHEN to perform Integrated Total Pelvic Floor Ultrasound

Indications

- Rectal evacuatory disorders
  - Anatomical abnormality
  - Functional cause



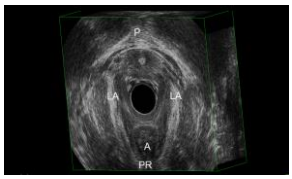




WHEN to perform Integrated Total Pelvic Floor Ultrasound

Pelvic Pain

- Normal anatomy



WHEN to perform Integrated Total Pelvic Floor Ultrasound

The Evidence

Increasingly adopted

Established role within pathway

Growing body of evidence

WHEN to perform Integrated Total Pelvic Floor Ultrasound

The Evidence

Increasingly adopted

Established role within pathway

Growing body of evidence

- Integrated total pelvic floor ultrasound in pelvic floor defaecatory dysfunction

  Hainsworth *et al* Colorectal Disease 2016

- Accuracy of integrated total pelvic floor ultrasound compared to defaecatory MRI in women with pelvic floor defaecatory dysfunction

  Hainsworth *et al* British Journal of Radiology 2017

The Evidence

Integrated total pelvic floor ultrasound in pelvic floor defaecatory dysfunction

Hainsworth *et al* Colorectal Disease 2016

Analysis 323 women undergoing integrated total PF USS and Barium proctography

Useful to detect (positive predictive value)

- Rectocoele (73%)
- Intussusception (79%)
- Enterocoele (99%)

The Evidence

Accuracy of integrated total pelvic floor ultrasound compared to defaecatory MRI in women with pelvic floor defaecatory dysfunction

Hainsworth *et al* British Journal of Radiology 2017

Analysis 68 women undergoing integrated total PF USS and MRI proctography

High negative predictive values for

- Rectocoele (74%)
- Intussusception (79%)
- Enterocoele (63%)

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Where should Integrated Total PF USS sit in the management pathway for PF patients?

Selecting patients for surgery is difficult

- Symptoms
- Refractory to conservative treatment
- Correctable anatomical abnormality

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Where should Integrated Total PF USS sit in the management pathway for PF patients?

Selecting patients for surgery is difficult

- Symptoms
- Refractory to conservative treatment
- Correctable anatomical abnormality

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

- Extension of physical examination on all patients
- Replace proctography
- Select patients for proctography

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

WHEN…

Diagnose cause of pelvic floor symptoms

Assess for multiple pathologies

Select patients for pelvic floor surgery

Replace proctography

Assess outcome of surgery

Facilitate multidisciplinary team discussion

ICS

WHEN to perform Integrated Total Pelvic Floor Ultrasound

Conclusions

- Clinically relevant technique
- Under utilised
- Patient "friendly"

ICS

How to perform integrated total pelvic floor ultrasound

Alexis Schizas

14:20 – 14:30

Patient Preparation

Bladder
- Full (easier visualisation)
- Urination (allow the patient to bear down freely)

Rectum
- No preparation (may aid visualisation of rectocoele)
- Enema (allow the patient to bear down freely)

Contrast
- Small bowel (Gastrografin one hour prior)
- Rectal/ Vaginal sonographic gel

Patient Position

Supine
- legs drawn up and flexed
- feet together and the legs apart

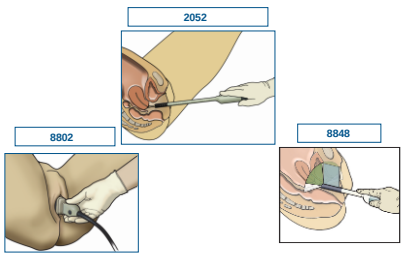
Dorsal lithotomy

Probe Preparation

Each probe is covered with ultrasound coupling gel, a latex sheath and further coupling gel.

No air bubbles between them.

The probes are decontaminated between each patient, including the use of an anti-sporicidal agent.



The Patient

Squeeze, relax, bear down

Squeeze, relax and cough

Endovaginal & Transvaginal Scan

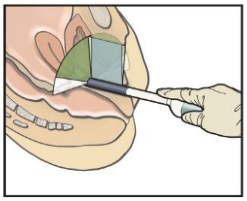
Transvaginal Scan

A rotating single crystal probe

Transvaginal scanning - 8848

2D: Hi-resolution imaging of functional anatomy (squeeze and valsalva)

3D: Hi-resolution 3D acquisition, with precise electromagnetic mover control (UA0513, UA0510)

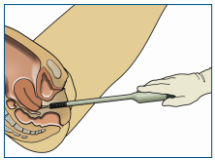


Transvaginal scanning - 2052

2D: Hi-resolution imaging

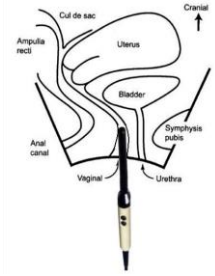
3D: Very precise Hi-resolution 3D acquisition with built-in mover control

Precise anatomical assessment in axial, sagittal, coronal, and oblique planes



Transvaginal Scan

Neutral position - avoid excessive pressure on structures and distortion anatomy

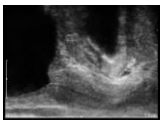


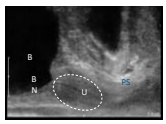
Anterior Transvaginal Scan

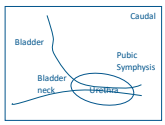
Probe is held still (facing anteriorly)

Two dimensional anterior views

Squeezing, relaxing, bearing-down and coughing.





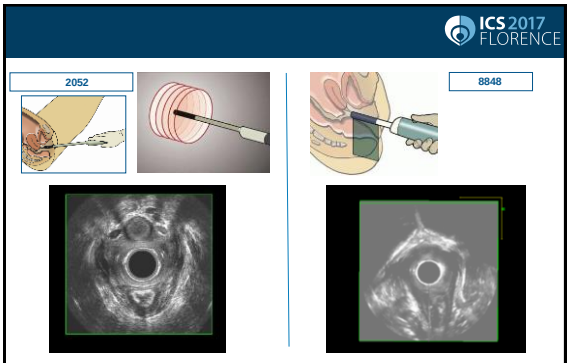


Probe in vagina

Endovaginal Scan

The probe is kept in the same position whilst the patient is at rest to obtain a 360 degree cross sectional image.

A single element multi-frequency transducer with a built in two dimensional mover may also be used to acquire the cross sectional images.

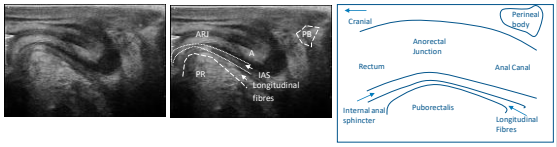


Importance of neutral probe position

Posterior Transvaginal Scan

Next, the probe is rotated within the vagina to face posteriorly

Patient is again asked to squeeze, relax, bear-down and cough.



Transperineal Scan

Conventional curved array probe

- Frequencies 3 – 6 MHz
- Field of view at least 70 degrees

Transperineal Scan - 8802

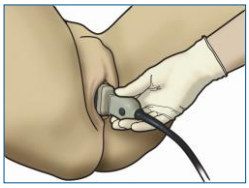
2D: Provides preliminary diagnosis of normal, abnormal, and overview of functional information (valsalva & squeeze)

3D: Possible only - freehand technique

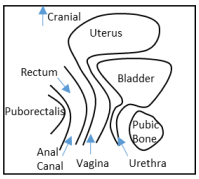
Avoid pressure on perineum

Still maintain tissue contact

Improve pelvic tilt –heels as close together as possible, draw heels toward buttocks



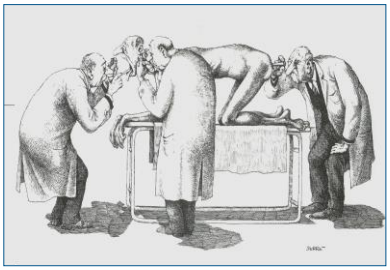
Transperineal Scan



Transperineal scanning - 8802

Rectocele

Cystocele



Interactive workstations

14:30 – 15:00

Coffee

15:00 – 15:30

Interactive workstations

15:30 – 16:00

The report - Drawing all the images together to report integrated total pelvic floor ultrasound

Alexis Schizas

16:00 – 16:10

Integrated total pelvic floor ultrasound

All information for all scans

3D Endovaginal scans

Dynamic anterior scans

Dynamic posterior scans

Dynamic perineal scans

Integrated total pelvic floor ultrasound

Report on each scan

Important to bring all the scans together

Conclusion to summarise all the findings

Quiz – Test your skills – Interpretation of integrated total pelvic floor ultrasound

Andrew Williams & Guilio Santoro

16:10 – 16:25

HA - Presentation

•56 year old female nurse

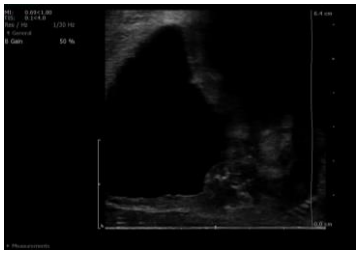
•PC/ Defaecation difficulties
•HPC/ Incomplete evacuation, 20 minutes on loo, bulge in the vagina,
•PR digitates, perineal support

•Also stress urinary incontinence
•TVT 2008
•G2P2

•Otherwise fit and well

HA – Total pelvic floor ultrasound

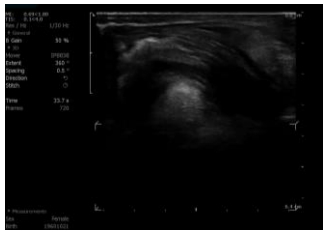
Anterior transvaginal picture



HA – Total pelvic floor ultrasound

ICS 2017 FLORENCE

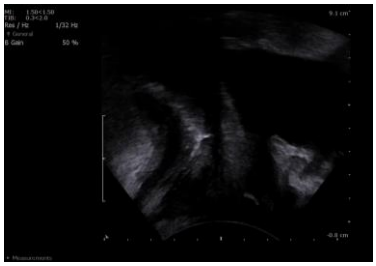
Posterior transvaginal picture



HA – Total pelvic floor ultrasound

ICS 2017 FLORENCE

Transperineal picture



HA – Total pelvic floor ultrasound

ICS 2017 FLORENCE

- Report
- Anterior scans - Poor bladder neck support and TVT
- Posterior scans - rectocoele and intussusception
- Transperineal scans - rectocoele and grade II cystocoele

FT – Presentation

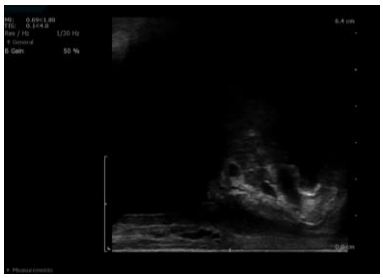
ICS 2017 FLORENCE

- 71 year old female, retired head teacher
- PC/ rectal prolapse, passive and urge faecal incontinence
- HPC/ 5 years, urgency, defaecation difficulties, straining, rectal prolapse, passive faecal leakage on walking and gardening
- Urinary symptoms (stress incontinence)
- G2P2 (vaginal)
- PMHx/ OA, high cholesterol
- PSHx/ hysterectomy 1985

FT – Total pelvic floor ultrasound

ICS 2017 FLORENCE

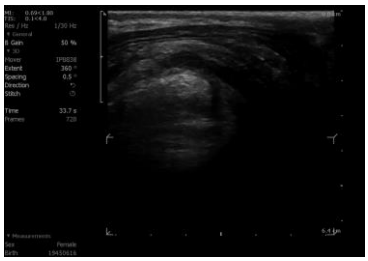
Anterior transvaginal picture



FT – Total pelvic floor ultrasound

ICS 2017 FLORENCE

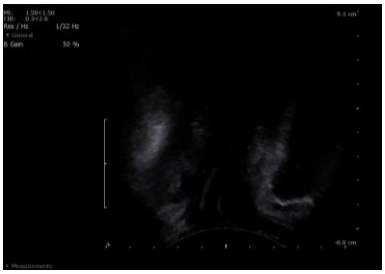
Posterior transvaginal picture



FT – Total pelvic floor ultrasound

ICS 2017 FLORENCE

Transperineal picture



FT – Total pelvic floor ultrasound

ICS 2017 FLORENCE

- Report
- Anterior scans - good bladder neck support
- Posterior scans - rectal prolapse
- Transperineal scans – rectal prolapse and rectocoele

TS – Presentation

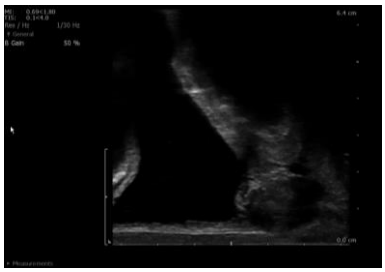
ICS 2017 FLORENCE

- 61 year old female, receptionist
- PC/ constipation
- HPC/ bowels open 2 – 3 times per week, defaecation difficulties, always incomplete evacuation, always PR digitates, strains, rectal pain
- G2P2
- Overactive bladder (nocturia, occasional urge and stress urinary incontinence)
- PMHx/ high cholesterol, hypertension, reflux, anxiety
- PSHx/ TAH and BSO 1996, vaginal anterior repair 1980's, TVT 2013

TS – Total pelvic floor ultrasound

ICS 2017 FLORENCE

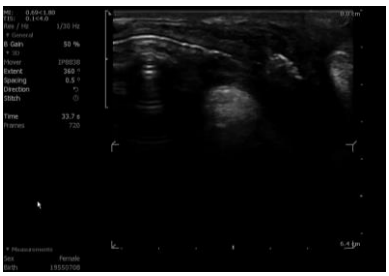
Anterior transvaginal picture



TS – Total pelvic floor ultrasound

ICS 2017 FLORENCE

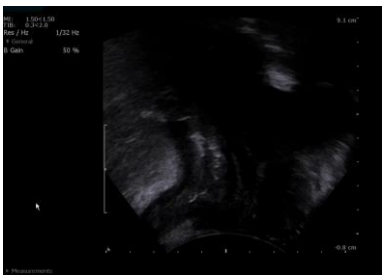
Posterior transvaginal picture



TS – Total pelvic floor ultrasound

ICS 2017 FLORENCE

Transperineal picture



TS – Total pelvic floor ultrasound

- Report
- Anterior scans - poor bladder neck support, TVT
- Posterior scans – poor propulsion and coordination,
- Transperineal scans – rectocoele, grade III cystocoele

Questions and close

16:25 – 16:30