Anatomy of the Pelvis

Presented by Julie Peterson, PT, DPT, WCS, BCB-PMD
Acknowledgements: Ruth M. Maher, PT, PhD, DPT, WCS, BCB-PMD

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Objectives

• Understand pelvic anatomy – male/female
  – Osteology
  – Ligamentous
  – Viscera
  – Blood supply/lymphatics
  – Musculature/fascia
  – Innervation – lumbo sacral plexus, branches and structures innervated
The Politics of the Pelvis
Who’s looking after this system?
Osteology

Pelvic (hip) girdle

Hip bone

Sacrum

Coccyx

Pubic symphysis

Sacrotubal joint

Sacral promontory

Pelvic brim

Acetabulum

Obturator foramen

Anteroposterior view of pelvic girdle

Figure 06.08 Tortora - FAP 12/e
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Pelvic (Hip) Girdle

• Each coxal (hip) bone consists of three bones that fuse together: ilium, pubis, and ischium.

• The two coxal bones are joined anteriorly by the pubic symphysis (fibrocartilage).

• Joined posteriorly by the sacrum forming the sacroiliac joint (SIJ).
• The os coxa (hip bone) initially begins life as three individual bones:
  – Ilium
  – Ischium
  – Pubis
The Ilium

• Largest of the three hip bones

• Ilium is the superior part of the hip bone

• Consists of a superior *ala* and inferior *body* which forms the acetabulum (the socket for the head of the femur)

• Superior border - iliac crest

• Greater sciatic notch - allows passage of sciatic nerve
Ischium and Pubis

- **Ischium** - inferior and posterior part of the hip bone

- Most prominent feature is the ischial tuberosity, it is the part that meets the chair when you are sitting

- **Pubis** - inferior and anterior part of the hip bone

- Superior and inferior rami and body
Anterior Pelvis
Posterior Pelvis
Superior View

- **Pubic Symphysis**
- **Pubis**
- **Coccyx**
- **Iliac Fossa**
- **Ischial Spine**
- **Sacrum**
- **Iliac Crest**
- **Anterior Superior and Inferior Iliac Spines**
False and True Pelves

- Pelvic brim/inlet - a line from the sacral promontory to the upper part of the pubic symphysis
- False pelvis - lies above this line
- Contains no pelvic organs except urinary bladder (when full) and uterus during pregnancy
- True pelvis - the bony pelvis inferior to the pelvic brim, has an inlet, an outlet and a cavity
- Pelvic axis - path of baby during birth
Pelvic Inlet
Pelvic Outlet

[Image of the pelvic outlet with labeled bones and structures such as pubic symphysis, pubic tubercle, obturator foramen, anterior superior iliac spine, ischiopubic ramus, acetabulum, sacrum, sacrotuberous ligament, coccyx, and margin of pelvic outlet.]
True and False Pelves

(a) Anterosuperior view of pelvic girdle

Pelvic brim landmarks:
- Sacral promonory
- Arcuate line
- Pectineal line
- Pubic crest
- Pubic symphysis

Midsagittal plane

(b) Midsagittal section indicating locations of true and false pelves

Sacral promonory
FALSE PELVIS
Plane of pelvic brim
TRUE PELVIS
Coccyx
Pelvic axis
Plane of pelvic outlet
Pubic symphysis
Comparison of Male and Female Pelvic Structure

A: Circular pelvic inlet
- 80–85°

B: Heart-shaped pelvic inlet
- 50–60°

Prominent medially projecting ischial spines
Prominent projecting promontory
Comparison of Male and Female Pelvic Structure
# Comparison of Male and Female Pelvic Structure

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone thickness</td>
<td>Lighter, thinner, and smoother</td>
<td>Heavier, thicker, and more prominent markings</td>
</tr>
<tr>
<td>Pubic arch/angle</td>
<td>80°–90°</td>
<td>50°–60°</td>
</tr>
<tr>
<td>Acetabula</td>
<td>Small; farther apart</td>
<td>Large; closer together</td>
</tr>
<tr>
<td>Sacrum</td>
<td>Wider, shorter; sacral curvature is accentuated</td>
<td>Narrow, longer; sacral promontory more ventral</td>
</tr>
<tr>
<td>Coccyx</td>
<td>More movable; straighter</td>
<td>Less movable; curves ventrally</td>
</tr>
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</table>
Pelvis anchors roots of genitalia

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Function of the Pelvis

• Pelvis support terminal parts of the gastrointestinal, urinary, and reproductive systems

• Provides a means of dissipating loads through the lumbo-pelvic area
Ligaments
Ligaments

- **The sacrospinous and the sacrotuberous ligaments** are important architectural elements of the walls because they link each pelvic bone to the sacrum and coccyx.

- These ligaments also convert two notches on the pelvic bones—the greater and lesser sciatic notches—into foramina on the lateral pelvic walls.
Ligaments – provides Uterine support

• Round ligament:
  – Originates at uterine horns (where fallopian tubes enter the uterus), enters the pelvis via deep inguinal ring, through the inguinal canal and attaches to the labia majora

• Broad Ligament:
  – Double reflection of the peritoneum, draped over the round ligaments.

• Cardinal ligament:
  – Located at the base of the broad ligament
  – It attaches the cervix to the lateral pelvic wall by its attachment to the endopelvic fascia, Obturator fascia of the Obturator internus muscle
  – Provides main support for uterus and cervix
Ligaments

• Uterosacral Ligaments:
  – Provide minor cervical support.
  – Originate from the upper posterior cervix, travel around the rectum bilaterally, and fan out to attach to the 1st - 5th sacral vertebrae.
Ligaments
Effects of pregnancy on Round Ligament

https://drericaheppe.com
Endopelvic fascia

• It consists of a sheet of fascia that lines the walls and floor of the pelvis.

• It covers the obturator internus, piriformis, levator ani and coccygeus muscles and is continuous with the transversalis fascia. It is fused to the periosteum of the hipbones.
Fig. 5. Volume of the endopelvic fascia from inferior lateral view. The attachment to the pubic bone (A), anterior perineal membrane (B), superior fascia of the levator ani muscle (C), and perineal body (D) are depicted. ATFP, arcus tendineus fasciae pelvis; CL, cardinal ligament; USL, uterosacral ligament; RVF, rectovaginal fascia; ATFR, arcus tendineus fasciae rectovaginalis; PRM, puborectalis muscle; V, vaginal outlet; U, urethral outlet. Illustration: Ivan Helekal.

Fascia

Excerpted from: Strolling under the skin by Dr. JP Guimberteau.
https://www.youtube.com/watch?v=eW0lvOVKxDxE
Urethral Support System

- Endopelvic fascia
- Levator ani muscles
  - Pubococcygeal
  - Illiococcygeal
  - Coccygeus
- Neural innervation – Sacral plexus (S3- S5 - pudendal nerve??)
Bladder and Rectum

• Don’t forget they are close by…

  – Ureters originate in the renal calyces and insert into the inferior bladder at the trigone.

  • Careful attention to the ureters path in the pelvis is essential for dissection in gynecologic surgery.
Key Points of the Ureter

• In the pelvis the ureter runs medial to and parallel with the internal iliac artery.

• Uterine artery crosses over the ureter (water under the bridge).

• The remaining 2-3cm of the ureter passes through the cardinal ligament into the bladder.
The Urethra

- Females more prone to UTI and cystitis
- Bacteria may continue up ureter to kidney
Lower Urinary Tract Function

Bladder filling and storage phase:
  – Urine stored at low pressure with no sensation to void
  – Bladder outlet closed until need to void

Voiding phase:
  – Detrusor muscle contracts
  – Bladder outlet relaxes
The Bladder
The Bladder
The Detrusor - Bladder

• Unique – its muscle characteristics are unlike any other organ in the body.

• The muscle bundles of the bladder can slide, one over another, allowing the bladder to increase in capacity without increasing the pressure within.
The Detrusor - Bladder

- 2 sphincters – internal and external
- Normal capacity 300 – 600ml
- First urge to void 150 – 300ml

- CNS Control
  - Pons facilitates
  - Cerebral cortex inhibits
Rectum & Anus

- Lies posterior to the uterus following the curvature of the sacrum.
IAS tone is chiefly responsible to keep anal canal closed at rest along with EAS, anal mucosal folds, and puborectalis muscle.

EAS has lesser role in maintaining resting anal tone but contracts to augment anal tone if continence is threatened.

Puborectalis tone (Type 1 – tonic fibers) also helps to maintain the resting anorectal angle and contracts during rise in intra-abdominal pressure to reduce anorectal angle preserving continence.
Ano-Rectal Angle (ARA)

- Continence is maintained by sphincters and tonic contraction of the puborectalis which maintains the ARA @ 80° - 100°.

- During defecation the pelvic floor muscles (incl puborectalis) and EAS relax reducing ARA by ~ 15° (65° - 85°).

Blood Supply......there’s a lot!
Blood Supply

• Majority originates from the internal iliac artery (aka: hypogastric artery).

  – Additional supply comes from the ovarian arteries, the inferior mesenteric artery, and the external iliac artery.
Blood Supply

• Common iliac --> external and internal iliac
  – External becomes the femoral artery
  – Internal iliac --> anterior and posterior divisions

• Posterior division - rarely seen in pelvic surgery, has three branches that supply the gluteal region:
  – Superior gluteal
  – Iliolumbar
  – Lateral sacral arteries
Lymph Drainage

Lymphatic drainage pathways – 8
Sharing same main terminal route

Comprise 3 lateral, intermediate and medial chains

Pass to lacunar, external iliac and common iliac nodes

Lateral Aortic and Lumbar trunks

Entering the cisterna chyli
Lymph Drainage

• Cervical Cancer:
  – Drains 1st to the parametrial nodes --> obturator nodes --> pelvic nodes --> para-aortic

• Uterine Cancer:
  – Drains 1st to the pelvic nodes or para-aortic.

• Ovarian Cancer:
  – Can metastasize to either the pelvic or para-aortic nodes.
Surface Anatomy - Female
Surface Anatomy - Male

http://doctorlib.info/medical/anatomy/13.html
3 layers of muscle & their innervation

- **Superficial layer: (Urogenital Triangle)**
  - Bulbospongiosus
  - Ischiocavernosus
  - Superficial transverse perineal
  - External anal sphincter (EAS)

- **Deep urogenital layer: (Urogenital diaphragm)**
  - Urethra
  - Urogenital sphincter complex:
    - Uretrovaginal sphincter & Compressor Urethrae
  - Deep transverse perineal

- **Pelvic diaphragm: (Pelvic floor)**
  - Levator ani:
    - pubococcygeus (pubovaginalis, puborectalis) Illiococcygeus,
    - Coccyxgeus (lies over sacrospinous ligament)
  - Piriformis - Ventral rami S1-S2 n. roots
  - Obturator internus – n. to obturator internus L5 – S2
Nerve supply – great variability
Innervation - Variability

Literature has shown great variability in innervation of the pelvic floor muscles (levator ani).

- **Shoberi et al (2005)** reported:
  - the Levator ani nerve (LAN) derived from S2 – S4 ventral foramina innervated the pelvic floor muscles but not the anal sphincter
  - the pudendal nerve derived from S2 – S4 and *did not* demonstrate innervation of the levator ani muscles

- **Timoh et al (2016)** reported 3 nerves innervating the Levator Ani:
  - Pudendal n. (somatic & autonomic) supplying innervation to the inferior aspect of the levator ani muscle
  - Levator ani n. (somatic) supplying innervation to the superior aspect of the levator ani muscle
  - inferior hypogastric plexus nerve fibers supplying innervation to the medial portion of the levator ani muscle.
Innervation - Variability

Literature has shown great variability in innervation of the pelvic floor muscles (levator ani).

- Piochochi et al (2015) reported:
  - 89.2% of their sample (n=43 cadavers) the inferior rectal nerve emerged as a branch of S3 and S4 distinct from the pudendal nerve and innervated only the subcutaneous EAS
  
  - Branches of the perineal nerve innervated bulbospongiosus and the superficial EAS and Levator ani n. innervated the deep EAS
Innervation - Variability

Literature has shown great variability in innervation of the pelvic floor muscles (levator ani).

- Loukas et al (2016) reported variability in the source of the Levator ani n.
  - 50% (n = 100) originated from S4 and S5 (type I);
  - 19% (n = 38) originated from S5 (type II);
  - 16% (n = 32) originated from S4 (type III);
  - 11% (n = 22) originated from S3 and S4 (type IV);
  - 4% (n = 8) originated from S3, S4, and S5 (type V).
Pelvic Floor Muscles

- Vagina
- Pubic symphysis
- Posterior fourchette
- Perineal body
- Acetabulum of the hip joint
- Ischial tuberosity
- External anal sphincter
- Anococcygeal ligament
- Coccyx
- Ischiocavernosus
- Bulbospongiosus
- Superficial/deep transverse perineal
- Obturator internus (muscle and fascia)
- Piriformis
- Pubococcygeus
- Puborectalis
- Iliococcygeus
- Coccygeus
- Levator Ani

Superficial PFM
Deep PFM

© Primal Pictures 2009
Muscles – Layer 1 – Superficial layer

- Bulbospongiosus/
  Bulbocavernosus
- Ischiocavernosus
- Superficial transverse perineal
Muscles – Layer 2 – Deep urogenital

Urethra

Urethrovaginalis sphincter

Levator Ani

Deep transverse perineal
Muscle – Layer 3 – Pelvic Diaphragm

Pubococcygeus

Puborectalis

Iliococcygeus
Muscles – Layer 3 -cont

- Coccygeus
- Piriformis
- Obturator Internus
Muscles - Summary
Pelvic Clock

External perineal palpation

12  Pubic symphysis
1 & 11  Ischiocavernosus
2 & 10  Bulbospongiosus
3 & 9  Transverse perineal/OI
4 & 8  Pubococcygeus
5 & 7  Pubococcygeus
6 -  Coccyx
Structure and form in the pelvic floor arise from the interaction of muscles, nerves and ligaments acting on the pelvic organs. The vagina and ligaments must be stretched to their limit of extension to attain the strength required to carry loads. Unequal balance of the forces may stretch the system one way or the other, thereby affecting opening or closure.
Structure & Function

**Anterior zone**
1. External urethral ligament (EUL)
2. Suburethral vagina (hammock)
3. Pubourethral ligament (PUL)

**Middle zone**
4. Arcus tendineus fascia pelvis (ATFP)
5. Pubocervical fascial defect (PCF) (cystocoele)
6. ‘Zone of critical elasticity’ (ZCE) – restoration of elasticity if ‘tethered’ by scarring

**Posterior zone**
7. Uterosacral ligaments (USL) defect
8. Rectovaginal fascial defect (RVF)

http://www.integraltheory.org/
Urethra

• Thin-walled muscular tube
• Conveys urine from bladder to outside
• Internal sphincter—involuntary
• External sphincter—voluntary
• Female urethra shorter than male
Neuroanatomy
Neuroanatomy of Voiding

- **Frontal lobe**
  - Micturition center
  - Sends **inhibitory** signals

- **Pons (Pontine Micturition Center)**
  - Major relay/excitatory center
  - Coordinates urinary sphincters and the bladder
  - Affected by emotions

- **Spinal cord**
  - Intermediary between upper and lower control
Neuroanatomy of Voiding

- **Somatic (S2-S4)**
  - Pudendal nerves
    - Excitatory to external sphincter

- **Parasympathetic (S2-S4)**
  - Pelvic nerves
    - Excitatory to bladder, relaxes sphincter

- **Sympathetic (T10-L2)**
  - Hypogastric nerves to pelvic ganglia
  - Inhibitory to bladder body, excitatory to bladder base/urethra

Parasympathetic – POURS  
Sympathetic - STORES
Closure of Urethra

During closure:

- Twin forward acting muscle forces (arrows), stretch the distal vagina to close the urethra.

- Backward/downward muscle forces stretch the proximal vagina (and bladder base) backwards, elongating and “kinking” the proximal urethra against the anterior ligaments.

http://www.integraltheory.org/
Micturition - Opening

During micturition the distal vagina is stretched forwards by pubococcygeal muscle (PCM). The upper vagina and bladder base are stretched down and back by levator plate (LP) and LMA.

PCM and LP contract against the pubourethral ligament (PUL). LMA contracts against the uterosacral ligaments (USL).

The broken lines represent the resting position of the bladder.
Continence

- Based on urethral resistance pressure that is greater than the intravesical bladder pressure
Physiology of Continence

- Voiding Cycle
  - Bladder stores 400-600ml & fills at a constant rate
  - 1st sensation to void at 150-200ml
  - Detrusor muscle is elastic and relaxed with filling
  - Postponement due to inhibition at sacral center
Physiology of Continence

• Emptying
  – at 400-600ml stretch receptors send strong sensation to brain
  – signal returns via somatic track and you walk to the restroom
  – pelvic floor relaxes
  – postvoid residual of 5 to 50ml
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Introduction to Pelvic Floor Dysfunctions

October 2019
Pelvic Floor Dysfunctions

- Supportive
- Hypertonus
- Incoordination
- Visceral
Supportive Dysfunction

- Loss of strength and integrity of the connective tissue and fibers of the pelvic floor
Supportive Dysfunctions

- Diagnoses:
  - Incontinence
  - Prolapse
  - Neurological dysfunctions
Pelvic Organ Prolapse

- Occurs when weakness is present in the supporting structures
- Pelvic viscera descend and ultimately fall through the anatomical defect
- Lifetime risk of having surgery for prolapse is 11% (Olsen et al 1997)

- Incidence of prolapse increases with age
- More common following childbirth
Pelvic Organ Prolapse

- **Urethrocele**
  - Prolapse of the lower anterior vaginal wall involving the urethra only
- **Cystocele**
  - Prolapse of the upper anterior vaginal wall involving the bladder
- **Uterovaginal prolapse**
  - Prolapse of the uterus, cervix, and upper vagina
- **Enterocele**
  - Prolapse of the upper posterior wall of the vagina usually containing loops of small bowel
- **Rectocele**
  - Prolapse of the lower posterior wall of the vagina involving the anterior wall of the rectum
Uterine Prolapse
Urethrocele

Normal female pelvic anatomy

Uterus  Rectum
Bladder  Urethra
Vagina

Urethrocele with moderate cystocele

Urethral prolapse
Bladder prolapse

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Symptoms of POP

- Falling out sensation
- Urinary and/or fecal incontinence
- Inability to control flatulence
- Obstructed voiding
- Painful sexual intercourse
- Inability to keep tampon in place
- Constipation
Effects of Prolapse on Bladder and Bowel Function

- Constipation
- Feeling of discomfort or falling out
- Urgency and/or frequency
- Incomplete bladder emptying
- Tenesmus and manual evacuation for defecation
- Fecal incontinence
- Urinary incontinence and/or voiding difficulty
- Sexual dysfunction
Causes of supportive dysfunction

- childbirth
- stretch weakness
- episiotomy & tears
- estrogen & relaxin
- obesity
- chronic coughing, asthma, smoking
- improper body mechanics

- chronic constipation
- pelvic fractures, malalignments
- surgery
  - i.e. hysterectomy, appendectomy, laparoscopic surgery
Hypertonus Dysfunctions

• Pain and/or spasm in the pelvic region due to trauma
• Symptoms: back, perivaginal, perirectal, lower abdominal, coccyx, posterior thigh pain, vulvar burning, itching, constipation
• Pelvic floor does not relax appropriately
Hypertonic Diagnoses

- Levator ani syndrome
- Tension myalgia
- Proctalgia fugax
- Coccygodynia
- Dyspareunia
- Vaginismus
- Anismus
- Interstitial cystitis
- Chronic pelvic pain
Causes of Hypertonus Dysfunction

- joint malalignment
- habitual postural dysfunction
- childbirth trauma/tears
- surgical trauma
- sexual abuse

- pelvic inflammation or infection
- hemorrhoids
- bowel and bladder disorders
Incoordination Dysfunctions

• Loss of neuromuscular control with an absent or inappropriate pattern of recruitment and timing

• Symptoms: incontinence, organ prolapse, poor knowledge of proper pelvic floor contraction, obstructed defecation, neurological disease, urinary urgency and frequency

• Incoordination of the pelvic floor, abdominals, and/or detrusor (i.e. paradoxical pelvic floor)
Incoordination Effects

• May lead to stress, urge, or overflow incontinence

• Voiding dysfunction due to straining and poor toilet positioning
Overactive Bladder

• Also known as detrusor instability
• Present when increased bladder activity without a neurological disorder
Bladder/Detrusor Sphincter Dyssynergia

• Description of the bladder outlet obstruction from detrusor muscle contraction with concomitant involuntary urethral sphincter activation
• Associated with neurological conditions such as SCI, MS, spina bifida
• At risk for autonomic dysreflexia, recurrent UTIs, or upper urinary tract compromise if the condition is not followed closely
• Diagnosed during the voiding phase of the urodynamic studies
Bladder hyperreflexia

- Frequency, urgency and urge incontinence
- Involuntary, uninhibited detrusor contractions
- Disruption of the balance between the cerebral stimulation and the supraspinal inhibition to urinate
- Seen in CVA, MS, SCI, but may also be seen in patients with benign prostatic hyperplasia or prolapse
Reflex Incontinence

- Occurs when there is detrusor hyperreflexia with involuntary sphincter relaxation without an urge
- Occurs in a neurological condition such as SCI, Parkinson’s Disease, MS
Neurogenic Bladder

• Described as a “baby’s bladder”
• Empties automatically
• Reflex incontinence is present
• Neurological disorder is present
• Urinary urgency and frequency
• Urinary or fecal incontinence (i.e. stress, urge, or overflow)
• Constipation
Causes of Incoordination Dysfunction

• val salva or chronic straining
• muscle strength imbalances
• poor toilet position

• myofascial scar formation
• radical pelvic surgery
• spinal cord damage
Voiding Dysfunctions in Neurological Disorders

- Depends on the location, type, and extent of the lesion as well as prior bladder function
- Detrusor hyperreflexia
  - May be lesion above S1, increased bladder activity
- Reflex incontinence
  - Urinary leakage due to detrusor hyperreflexia meanwhile the urinary sphincter relaxes without an urge present
- Neurogenic bladder
  - Bladder empties automatically- without warning
- Detrusor sphincter dyssynergia
  - Detrusor hyperreflexia is present with urinary sphincter contraction at the same time
Considerations for Voiding Dysfunctions in Neurological Disorders

• Look for this in Multiple sclerosis, Spina Bifida, Spinal Cord Injury, Parkinson’s Disease, Diabetes Mellitus

• Caution around recent development of symptoms (i.e. spinal cord tumor, HNP, spinal stenosis)

• Would likely have high post-void residual volume
Signs of Obstructed Micturition

- Urinary tract infection or recurrent
- Weak stream
- Incomplete bladder emptying
- Straining to void
- Frequency and urgency
- Overflow incontinence
Visceral Dysfunction

• Disease conditions and abnormal mobility of the pelvic organs leading to pain and dysfunction
• Symptoms: pain in the abdomen, back, thigh, perineum, bowel/bladder dysfunctions, muscle imbalances, weakness, deconditioning
Visceral Dysfunction Diagnoses

- Detrusor Instability
- Interstitial Cystitis
- Dysmenorrhea
- Endometriosis
- Irritable Bowel Syndrome
- Pelvic Inflammatory Disease
Interstitial Cystitis

• An unpleasant sensation (pain, pressure, discomfort) perceived to be related to the urinary bladder, associated with lower urinary tract symptoms of more than six weeks duration, in the absence of infection or other identifiable causes

• Also known as “Painful Bladder Syndrome”
Types of IC

- Hunner’s lesions- wounds on the bladder wall; identify severe inflammation
- Bladder wall injury- symptoms begin after a UTI, chemotherapy, poor diet, chemical exposure
- Pelvic floor injury- trauma or injury to PFM as with childbirth, repetitive trauma (i.e. bicycling), car accident, or fall
- Pudendal Neuralgia- nerve injury or entrapment causing PFM to be so tight they restrict around nerves
- Multiple Pain disorder- may have multitude of diagnoses such as fibromyalgia, prostatodynia, etc.
all - glomerularization of bladder consistent with IC
Prevalence

- Estimated to affect 3.2 to 7.9 million women and 1 to 4 million men
- Average onset is 40 years, 25% of patients under the age of 30
- Up to 50% of patients report spontaneous remission of symptoms for a duration of 1-80 months
- Patients with IC are 10 to 12 times more likely to have reported childhood bladder problems
Causes of IC

- Considered a complex neuromuscular disorder involving the bladder, pelvic floor, and nerves
- May or may not be due to chronic inflammation or psychosocial disorder
Other Considerations

- **Bladder wall trauma or injury**
  - I.e. bladder infection, chemical exposure, chemotherapy, excessive consumption of sodas, coffees, or alcohol

- **Pelvic floor injury/dysfunction**
  - i.e. childbirth, athletic injury, riding a bicycle or motorcycle causing tight PFM

- **Genetics**
  - Small percentage of patients have a first degree relative

- **Neurosensitivity disorder**
  - Likely IC is a hypersensitivity disorder affecting the bladder
  - IC patients often have a plethora of other diagnoses: IBS, vulvodynia, chronic fatigue syndrome, anxiety disorder, chronic prostatitis
  - Organs may “cross-talk”

- **Viral infection**
  - Polyoma BK virus has been found in the urine of patient’s with Hunner’s lesions
  - Rarely respond to oral and bladder instillation therapies
Treatment to Begin With

- Fluid modification
- Heat/cold modalities
- Self-help
- Stress management and meditation
- Relaxation
- Bladder retraining
- Avoiding known triggers
- Physical therapy
Other Treatment Options

- **Bladder instillations**
  - Bladder filled with a medication to coat and protect the bladder

- **Oral medications**
  - Tricyclic antidepressants, antihistamine, Elmiron

- **Pain management**
  - May consist of urinary analgesics, NSAIDS, narcotics

- **Hydrodistention**
  - Try to stretch the bladder by filling your bladder with a large volume of fluid

- **Neuromodulation**
  - Mild electrical impulse on various nerves
  - Interstim (Sacral or pudendal nerve stimulation) vs. PTNS (Posterior Tibial Nerve Stimulation)

- **Surgery**
  - Does not usually resolve pain
  - Cystoplasty - section of the bladder removed and replaced with bowel tissue
  - Cystectomy - removing the bladder
Dysmenorrhea

• Pain associated with menstruation
• Extremely common as more than half of women who menstruate have some pain for 1-2 days each month
• Primary vs. secondary
Primary Dysmenorrhea

• Pain that comes from having menstrual cramps
• Caused by an increase in the level of prostaglandins made by the uterus just prior to menstruation
• May start as soon as girl starts having menstrual periods
Secondary Dysmenorrhea

• Caused by a disorder in the reproductive system
  – i.e. endometriosis, adenomyosis, fibroids
• Pain gets worse over time
• Pain lasts longer than in primary
Treatment Options for Dysmenorrhea

• Pain relievers/medications
• Birth control pills
• Lifestyle changes
  – Exercise
  – Sleep
  – Relaxation techniques, meditation
• Physical therapy
  – To address PFM, adhesions
Endometriosis

• The endometrium tissue grows outside your uterus and has no way to escape
• Involves your ovaries, fallopian tubes, pelvic tissue
• May lead to fertility issues as it may block the fallopian tubes
• Increased risk of preterm labor, placenta previa, c-section (Lin H, Leng JH, et al)
Treatment Options for Endometriosis

- Pain medications
- Hormone therapy
  - Birth control pills
  - Progesterone
- Surgery
  - To remove or destroy lesions
  - Hysterectomy
  - Presacral neurectomy
- Physical therapy
Bowel Disorders

- **Irritable Bowel Syndrome**
  - Constipation or diarrhea or both
  - Higher risk for fecal incontinence

- **Crohn’s Disease**
  - Chronic inflammatory bowel disease that affects the GI tract
  - Inflammation can develop from the mouth to the anus
  - Overactive immune response
  - Frequent, recurring diarrhea, rectal bleeding, unexplained weight loss, fever, abdominal pain and cramping, fatigue, reduced appetite

- **Ulcerative Colitis**
  - Chronic inflammatory bowel disease affecting the large intestine
  - Abdominal pain/discomfort, blood in stool, fever, weight loss, frequent, recurring diarrhea, tenesmus
Pelvic Inflammatory Disease

• Infection of the reproductive organs
• May be caused by STDs
• Symptoms include fever, pain in lower abs, unusual vaginal discharge and odor, pain and/or bleeding with sex, burning sensation with urination
• Complications if untreated include ovarian abscesses, infertility, ectopic pregnancy, chronic pelvic pain
Causes of Visceral Dysfunction

- adhesions
- myofascial dysfunction due to surgery, trauma, childbirth, disease
- poor body mechanics and posture
- poor diet and fluid intake
- lack of exercise
References

• www.ic-network.com


• Dorsher PT, McIntosh PM. Neurogenic Bladder. Adv Urol. 2012 Feb 8; doi: 10.1155/2012/816274
Urologic Tests

Julie Peterson, PT, DPT, WCS, BCB-PMD

October 4-5, 2019
Objectives

- Review common urology tests
- Understand findings from urology tests and how it may affect physical therapy treatment
Urinanlysis

• Steps:
  – Assessment of color, cloudiness, and concentration
  – Examine the chemical composition
  – Look for bacteria, cells, and parts of cells

• Monitor UTI, bleeding in the urinary system, kidney/liver disease, diabetes, blood diseases, stones
Urodynameics

• Assess the function of the LUTS-including the bladder & urethra-using physical measurements such as urine pressure and flow rate as well as clinical assessment

• Types include:
  – Uroflowmetry
  – Cystometry
  – Videocystometry
  – Urethral pressure profilometry
Aims of Urodynamics

- To reproduce the patient’s symptomatic complaints
- To provide a pathophysiological explanation for the patient’s problems
Indications

- Recurrent incontinence in whom surgery is planned
- Mixed urge and stress symptoms
- Associated voiding problems
- Patient with neurologic disorder
- Patient with mismatch between signs and symptoms
Indications Continued

- Outflow obstruction
- Neurogenic bladder
- Children with voiding dysfunction
Normal filling & voiding

Slight change in pressure with increases in volume
Uroflowmetry

- Measures max flow rate, avg flow rate, flow time, time to max flow
- Simplest assessment of voiding dysfunction
- Used to identify women with poor peak flow
- Cannot distinguish between outflow obstruction vs. detrusor hypotonia
- Used to identify women at potential risk of voiding difficulty
- Often coupled with post-void bladder scan
Uroflowmetry

Unobstructed

Obstructed
Cystometry

- Measures intravesical pressure during filling and emptying
- Performed in upright position
- Bladder filled with water/saline
  - Slow fill (10ml/min)
  - Medium fill (10-100ml/min)
  - Fast fill (>100ml/min)
- Fast fill = detrusor overactivity
- Then ask patient to empty and measure max voiding pressure and flow rate
- Detrusor hypotonia (low pressure and low flow)
- Obstructed flow (high pressure and low flow)
Detrusor pressure

- Cannot be measured

- It is estimated/calculated by the automatic subtraction of rectal pressure (an index of IAP) from the total bladder pressure, *thus removing the influence of artefacts produced by abdominal straining*

\[ P_{\text{det}} = P_{\text{ves}} - P_{\text{abd}} \]
4 simple questions

1. Is the bladder relaxed during filling?
2. Is the urethra contracted during filling?
3. Does the bladder contract adequately during voiding?
4. Does the urethra open properly during voiding?
Technique – filling cystometry

• 4 essential measurements:
  1. Intravesical pressure ($P_{ves}$) – pressure exerted on the contents of the bladder
  2. Rectal pressure [≡abdominal] ($P_{abd}$)
  3. Detrusor pressure ($P_{det} = P_{ves} - P_{abd}$)
  4. Urine flow rate to detect leaks

• Other optional measurements include:
  1. Bladder volume
  2. Electromyography
  3. Urethral pressure
Bladder sensation

• Assessed during filling
  – First DV normally about 50% bladder capacity
  – Normal DV The feeling that leads patient to void at next convenient moment; about 75% bladder capacity
  – Strong DV Persistent desire to void without fear of leakage; about 90% bladder capacity
  – Urgency persistent desire to void with fear of leakage
  – Pain Pain during filling or voiding is abnormal
Detrusor activity

- During filling this can be either normal or increased (overactivity)

- Detrusor overactivity exists, when, during the filling phase, there are involuntary detrusor contractions
Normal / stable bladder

- Slight rise in detrusor pressure
- Good cancellation
- "Normal" or stable bladder
Unstable bladder

Rectal

Intravesical

Detrusor

Volume instilled

Phasic contractions of the detrusor
Detrusor-sphincter-dyssynergia

- Seen only in patients with neurological disease
- Characterised by phasic contractions of the intrinsic urethral striated muscle during detrusor contraction
- This produces a very high voiding pressure and an interrupted flow
Videocystometry

• Considered the gold standard for LUT testing
• Visualization of LUT while recording bladder function
• Intrinsic sphincter deficiency occurs when the bladder neck and proximal urethra open with urine leakage with a rise in abdominal pressure without detrusor pressure rise
Videocystometry

- Uses contrast medium instead of saline
- Assesses position and mobility of bladder neck
- Expensive
- Involves radiation
- Useful in complex cases where equivocal results from other tests; apparent failure of a previous surgical procedure
Patient:  
Date:  1/10/2001  
Time:  13:47:37

UDS-120 Image/Curve Printing [P4115714]

Image 4 of 19

Flow  
ml/s

Volume  
ml

Pves  
cm H2O

Pabd  
cm H2O

Pdet  
cm H2O

EMG  
none

Event Type: Valsalva
Urethral Pressure Profilometry

- Measures simultaneous pressure in bladder and urethra
- Looks at urethral function at rest and during stress conditions
- Used in patients with voiding difficulties and who have failed surgery with a low urethral closure pressure
Pad Test

- Can be divided into <1 hour, 1 hour, 24 hrs, 48 hrs
- Amount of urine lost is determined by change of weight of pad
- Cannot distinguish between type of incontinence
- Better sensitivity and reproducibility in the 24 and 48hrs test
Radiology of the LUT

- X-ray
- Ultrasound
- MRI
- EMG
X-ray

• Used to screen for urinary calculi, vertebral defects
• May be able to visualize diverticula, fistula, stones, tumors, and reflux
Ultrasound

- Visualize kidney, urethra, urethral sphincter, bladder wall
- Routinely used to measure residual bladder volumes
- Can be used to image the pelvic floor
MRI

- Static, dynamic, and 3-D imaging enhance understanding of the pelvic floor anatomy
- Expensive and often limited to research
EMG and Nerve Conduction

• Assess the neuromuscular integrity of the pelvic floor and anal sphincter
• Denervation with intrinsic sphincter deficiency compared to stress incontinence
References

Let's talk sex

PHYSICAL THERAPY FOR SEXUAL DYSFUNCTIONS
Sexuality defined-

- A person’s sexual orientation or preference
- The quality or state of being sexual
- Sexual character
- Just one of those things you are born with, you do not choose it, it's just part of who you are
What is sexuality?

- More than sex and body parts.
- We are sexual beings.
- Sexuality is linked to biological, psychological, familial, cultural, religious, and social factors.
- Sexuality includes our gender identity and sexual orientation.
- Sexuality includes how we feel about our bodies.
- Sexuality includes how we experience intimacy, touch, love, compassion, joy, and sorrow.
- Sexuality should be addressed in an interprofessional manner.
Statistics

• A survey of 391 women conducted by The Women’s Sexual Health Foundation found that 72 percent of respondents would be comfortable talking to their clinician about sexual problems, but 73 percent preferred that the health care provider bring up the topic.

• An online survey of 3,807 healthy volunteers reported that 40 percent of women who participated did not talk to a clinician about a sexual problem, but over half of them wanted to.

• A consumer poll of 1,209 US women found that 70 percent of respondents had experienced a sexual health issue (e.g., lack of desire or arousal, inability to orgasm, pain during intercourse, vaginal dryness, or excessive desire for sexual activity) and 22 percent were very or extremely concerned about it—yet only 18 percent had consulted a health care provider about their problem.

• The National Health and Social Life Survey of 1,749 women ages 18-59 found that 43% of respondents had a sexual issue; only 10%-20% had seen a clinician about it.
Statistics

- In addition, a poll of 304 US health care providers commissioned in 2009 by the Association of Reproductive Health Professionals (ARHP) and Healthy Women found that:
  - Sexuality is the least commonly discussed health topic with female patients for half of providers.
  - Providers discuss sexual health issues with less than half (39%) of their female patients.
  - Female providers are somewhat more likely than male providers to discuss sexuality with their patients (45% versus 34%, respectively).
  - Most providers (74%) rely on their patients to initiate a discussion about sexual health.
What is your role as a physical therapist?

- Start the conversation
- Put biases aside
- Look at it from as functional limitations and impairments
- Don’t assume one’s age either predicts or eliminates participation in sexual activity
- Never make assumptions about the patient’s sexual orientation
Starting the Conversation

• I am going to ask you a few questions about your sexual health and sexual practices. I understand that these questions are very personal, but they are important for your overall health.

• Just so you know, I ask these questions to all of my adult patients, regardless of age, gender, or marital status. These questions are as important as the questions about other areas of your physical and mental health. Like the rest of our visits, this information is kept in strict confidence. Do you have any questions before we get started?
Questions to Ask Your Patients

• Are you sexually active?
• Are you having any pain with sexual activity?
• Do you have any problems or questions regarding your sexual activity?
• Has anyone talked to you about how your illness/injury can affect your ability to have sex or a sexual relationship?
• Has there been a change in your physical relationship since your injury/illness?
• Have you ever been sexually abused? If yes...was there vaginal penetration? Anal penetration?
Female Sexual Dysfunctions

• Hypoactive sexual desire disorder: (HSDD)
  – Persistent or recurrent absence of sexual fantasies/thoughts and/or desire for sexual
• Female Sexual Arousal Disorders (FASD)
  – Recurrent inability to attain, or maintain until completion, sexual activity
• Sexual Pain Disorders
  – Dyspareunia: the recurrent or persistent genital pain associated with sexual intercourse
  – Vaginismus: the recurrent or persistent involuntary spasm of the musculature of the outer third of the vagina that interferes with vaginal penetration
  – Noncoital sexual pain disorder: recurrent or persistent genital pain induced by noncoital sexual stimulation
Causes of Female Sexual Dysfunctions

Hormonal

Physical

Emotional
Hormonal changes

• Decreased estrogen leads to decreased blood flow
  – Results in less genital sensation
  – More time needed to build up arousal and to reach orgasm

• Vulvovaginal Changes: Vaginal lining thins and is less elastic

• Sexual desire reduced when hormonal levels decrease

• Hormone levels shift after giving birth or with breast feeding
  – Leads to vaginal dryness
  – Can affect your desire for intercourse
Emotional Causes

- Untreated Anxiety
- Depression
- History of Sexual Abuse
- Cultural or religious issues
- Problems with body image
- Long term stress
  - Worries of pregnancy
  - Demands of a new mother
  - Long standing conflicts with a partner/spouse about sex or their relationship
Physical causes

• Medications
• Neurological conditions
  – MS, SCI
• Cancer – radiation or chemotherapy treatment
• Gynecological conditions
  – Infections (Candida)
  – Lichen Sclerosis or Lichen Planus
  – BV – Bacterial Vaginosis
• Surgical – Scar tissue or muscle guarding due to pain after surgery
  – hysterectomy, POP repair, C-section
Dyspaurenia

Vulvar Vestibulitis (leading cause for dyspareunia for women under age 50)

Hormonal changes - Vulvovaginal atrophy (leading cause of dyspareunia for women over age 50)
How can a Women's Health Physical Therapist Help?

Evaluate  Educate  Treat
Evaluate

• Subjective complaints
• Past History
• Observe the perineum, vulva and vestibule for tissue changes
• Palpate the perineum, Introitus, vaginal canal and innermost layer of the PFM
  – Watch for patient response vs what you are feeling through palpation
  – PFM function
    • Strength
    • Endurance
    • Relaxation
Education

- PFM function and pelvic anatomy
- Vulvar care
- PFM awareness / self checks
- Downtraining strategies for the PFM at home
  - Meditation
  - Diaphragmatic breathing
  - Visualization
- Preparation for Intercourse
- Appropriate referral to mental health therapist
Therapist treatment

- Dilator therapy - progressive sizes XS to large
- Pelvic wand
- Self or partner assisted stretching
- Soft tissue mobilization of the abdominal wall
  - Scars
  - Visceral mobilizations
- Vaginal manual Soft tissue mobilization
  - Posterior introitus stretching
  - Deep PFM lengthening, trigger point treatment
Outcome Measures

- Female Sexual Functional Index (FSFI)
- Pelvic Organ Prolapse-Urinary Incontinence Sexual Function Questionnaire (PISQ)
- Short Scale to Assess Female Sexual Function (SPEQ)
- Pelvic Floor Distress Inventory (PFDI)
- Pelvic Floor Impact Questionnaire (PFIQ)
- Chronic Prostatitis Symptoms Index (CPSI)
- Oswestry Disability Index - section 8
References

Case Study Mixed Urinary Incontinence

- Healthy 39 y/o female presents to PT with stress and urge urinary incontinence
- Urogynecologist performed UDS which identified incomplete bladder emptying
- She has to wear a pantiliner everyday, which is generally wet by the end of the day
- She leaks with sneezing, coughing, laughing, running (4-6 miles most days of the week), chasing her kids
- She gets a very strong urge to go to the bathroom; in sitting she can suppress the urge, otherwise she leaks urine
- Decreased her water intake to 2-3 glasses per day
- PMHx: 2 vaginal deliveries, and a recent endometrial ablation
- Also she suffers from frequent bouts of constipation
Anatomy Review

Bladder and the PF Muscles

- PF Muscles have 3 functions
  - Support
  - Sphincteric
  - Sexual

- During bladder filling, the PF remains contracted, preventing leakage

- At a certain bladder capacity, stretch receptors indicate the need to use the restroom and the PF relaxes, while the bladder contracts to empty urine
Continence

- Based on urethral resistance pressure that is greater than the intravesical (bladder) pressure
- Urethra is viscous/mucous lining assisting with continence
Physiology of Continence

- **Storage Cycle**
  - Bladder stores 400-600ml & fills at a constant rate
  - 1st sensation to void at 150-200ml
  - Detrusor muscle is elastic and relaxed with filling
  - Postponement due to inhibition at sacral center
  - Pelvic floor muscles contract to suppress urges and inhibit bladder contractions
Physiology of Continence

• Emptying
  – at 400-600ml stretch receptors send strong sensation to brain
  – signal returns via somatic track and you walk to the restroom
  – pelvic floor relaxes
  – Post-void residual of 5 to 50ml
When the system fails....

- Inability to control urine with an increase in intraabdominal pressure
- Leakage with sneezing, coughing, and laughing; sudden unexpected increase in abdominal pressure
- STRESS INCONTINENCE!!

- When we feel an “urge” our bladder is contracting
- Uninhibited bladder contractions
- So if the PF is weak, we have limited ability to suppress the “urge” to urinate
- URGE INCONTINENCE!!
Complications with Constipation

• Increased pressure in rectum puts additional strain on the pelvic floor
• When the bowels are full and not properly emptied, the bladder capacity is limited
• Constipation typically leads to val salva or straining during defecation
• Often the pelvic floor does not relax when you val salva and therefore this ultimately strains/weakens the pelvic floor
Bristol Stool Chart

This is our goal!
Fluid Intake

Appropriate fluids
• Should drink 6-8 eight ounce glasses of water or take your body weight in lbs. divide by 2= total ounces you should drink each day
• Water is the best thing for the bladder
• Do not restrict fluids because of urgency and frequency

What to avoid
• Caffeine in coffee, tea, and soda
• Smoking
• Alcohol
• Chocolate
• Some people may find spicy foods, dairy products, and tomato based products to be an irritant
Urodynamic Testing

• Urodynamic testing is any procedure that looks at how well the bladder, sphincters, and urethra are storing and releasing urine
• Most urodynamic tests focus on the bladder’s ability to hold urine and empty steadily and completely
• Urodynamic tests can also show whether the bladder is having involuntary contractions that cause urine leakage
• Performed by the urologist, urogynecologist, or gynecologist
Subjective History

- What is your primary complaint?
- Do you leak when you sneeze, cough, or laugh?
- Do you have a strong urge to urinate and if you don’t get to the restroom quickly, will you leak?
- How often do you use the restroom?
- How many restroom trips do you make each day? Night?
- Have you wet the bed in the last year?
- Do you experience leakage when you are under stress, anxiety, or in a hurry?
- Does running water or cold temperatures cause you to leak?
- Do you use any protective undergarments?
More Questions

• How often do you leak urine? Feces?
• Do you have any pain with urination or defecation?
• Do you strain to urinate or defecate?
• Have you had any blood in your urine?
• Do you find it difficult to start your urine stream?
• Do you feel like you empty your bladder all the way?
• Do you have any dribbling after urination?
Tests and Measures

- Screen lumbar and sacral spine
- Pain
  - Look for palpable tenderness at introitus, posterior pelvic floor, or sphincter or compressor urethrae
- Posture
  - Slumped sitting or standing
  - Increased lumbar lordosis or thoracic kyphosis
  - Pelvic alignment
- Sensory Integrity
  - Able to identify pressure and light touch
Muscle Performance for the Pelvic Floor Muscles

• Manual Muscle Testing (Pauline Chirarelli, PT)
  - 0- no contraction
  - 1- flicker, only with muscles stretched
  - 2- a weak squeeze, two second hold
  - 3- a fair squeeze, definite “lift”
  - 4- a good squeeze, good hold w/ lift and repeatable
  - 5- a strong squeeze, good lift, repeatable

• Performed transvaginally or rectally

• Quick vs. Endurance kegels
What were the findings?

- Manual muscle testing of the pelvic floor = 1/5
- Poor ability to identify a pelvic floor contraction
- She is able to illicit a 1-2 second kegel contraction
- Normal sensation to light touch and deep pressure in the pelvic floor
- Denies any palpable pain at the introitus or pelvic floor
- Slight increase in lumbar lordosis and thoracic kyphosis
- Level pelvis
- Elevated resting level on EMG recording
  - 8.3uV (normal is 2-3uV)
Assessment

- Significant pelvic floor weakness with poor identification of “kegel” exercises
- She has limited ability to suppress the urge and cannot stop the incontinence with stressful activities
- Now affecting her quality of life
  - Limiting her running and avoiding playing with her kids
- Elevated resting level likely contributes to incomplete bladder emptying
- Is she prone to urinary tract infections if she does not empty appropriately??????
How about a bladder repair...

According to an article in Rev Urol 2003, states that the mainstay for SUI is behavioral and surgical therapies...
So why NOT surgery?

- We know that if there is incomplete bladder emptying prior to surgery, then a bladder repair may worsen symptoms
  - According to Kristensen, Eldoma et al found that following a TVT procedure, 34.3% had to self-catheterize and 8% had an indwelling catheter upon discharge from the hospital. Voiding dysfunction pre-operatively had a 1.8 fold odds of difficulty with voiding post-op (Int Urogynecol J Pelvic Floor Dysfunct 2010 Nov; 21 (11))

- A bladder repair is not appropriate for urge incontinence
  - Urge incontinence is treated by OAB meds and behavioral techniques (Indian J Urol 2010 Apr; 26(2): 270-8)

- She is still of child bearing years
Is she a good candidate for PT?

• Motivated to keep up with exercise program
• Very active with kids, regular aerobic program
• Trying to avoid surgery and OAB medications
• Still childbearing age
What can Physical Therapists do to treat the bladder?
Case Study Interstitial Cystitis

- 54y/o female with extensive past medical history for interstitial cystitis
- Has seen many urologists, gynecologists, and urogyn’s in Omaha, San Diego, Rochester, Michigan, NYC, DC, etc
- Diagnosed with IC in 2001, but PMHx includes: IBS, chronic constipation, rectal fissures, fibromyalgia, TMJ, depression, latex allergy
- She is menopausal since 2004
- Medical treatment has included distillations, instillations with DMSO, anti-depressants, nerve and pain meds, pudendal nerve blocks, trigger point injections to the pelvic floor, trial of Interstim, and most recently botox injections and valium suppositories
Case Study- IC

- Pain is located in the vagina and labia; dyspareunia, dysuria and urinary frequency hourly
- Symptoms aggravated with any type of clothing that touches the perineum, as well as sitting, bending, lifting, pushing, pulling, and intercourse
- She must alter the way she dresses and can no longer work full-time despite being a business owner
- She has been seen by several physical therapists prior to her referral to Peterson Physical Therapy
Case Study- IC

• Objective Findings:
  – Trigger points throughout bilateral iliococcygeus, ischiococcygeus, elevated resting level
  – Pelvic malalignment, lumbar flexion 80%, lumbar extension 50%
  – Decreased flexibility in piriformis, hamstrings, hip flexors
  – PFM MMT= 1/5
Research

• Bassaly et al correlated myofascial pain with IC patients and pelvic floor dysfunction (Int Urogynecol J Pelvic Floor Dysfunct. 2010 Oct 26)

• Weiss evaluated the effectiveness of manual physical therapy in patients with IC and found that 70% had moderate to marked improvement (J Urol. 2001 Dec; 166(6): 2226-31)

• Oyama, Rejba, et al looked at transvaginal manual therapy in pelvic pain patients. Treatment was provided 2x/wk for 5 weeks and used Q of L questionnaires to evaluate improvement. Manual therapy appears to be helpful in improving irritative bladder symptoms and decreasing pelvic floor tone (Urology. 2004 Nov; 64 (5): 862-5)
Additional Research

• At the 2004 International Consultation on IC in Rome, Dr. Kristine Whitmore presented that 30-70% of patients with IC have high tone pelvic floor dysfunction, IBS, female sexual dysfunction, or endometriosis. She underscored the importance of a multi-disciplinary therapeutic approach for IC patients. (Int Urogynecol J (2005) 16: S2-34)

• Lukban and Whitmore, as well as Thiele and Lilius, eluded to an association of poor posture and poor, prolonged sitting with high tone pelvic floor dysfunction (Clin Ob & Gyn (2002) 45 (1): 271-85)