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Bowel Dysfunction and Why It Matters to General Orthopedic Patients and Athletes

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Disclosure

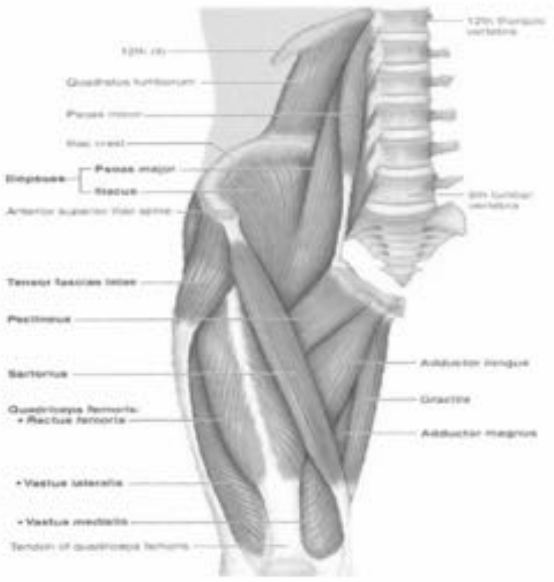
I provide continuing educational courses in this subject matter and receives honorariums for these presentations.

I sit on the Board of Directors for the Association of Pelvic Organ Proloapse Support (APOPS) and the Gobal Women's Health Initiative (GWHI). I am on the advisory board for Pelvic Guru.

Course Objectives

- Explain bowel dysfunction as it applies to the general orthopedic lumbar/pelvic/hip dysfunction population.
- Describe the history end examination process for multisystem dysfunctions with spine and the enteric nervous system
- Apply the algorithm for intervention and referral of patients with multisystem dysfunction
- Explain the implications of bowel dysfunction for the athletic population

Anatomy and Physiology



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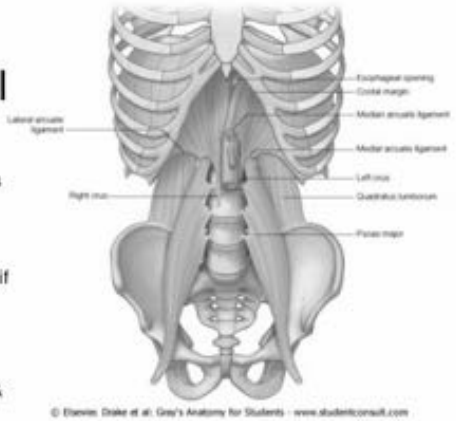
Posterior abdominal wall

- Diaphragm
  - Retroperitoneum
  - Inf. Fascia = transversalis fascia
  - Inf. Phrenic aa.
- Right crus: LV1-3 origin
  - Spincteric to esophagus, if enlarged→ stomach can herniate
- Left crus: LV1-2 origin
- Central GSA pain (C3,4,5 dermatomes) refers to neck & shoulder
- lateral arcuate lig. (quadratus)
- medial arcuate lig. (over psoas & sympathetic trunk)



•Quadratus lumborum m.

•Psoas m. (Psoas Sign – flex thigh and psoas m. should irritate inflamed appendix)

•Iliacus m.

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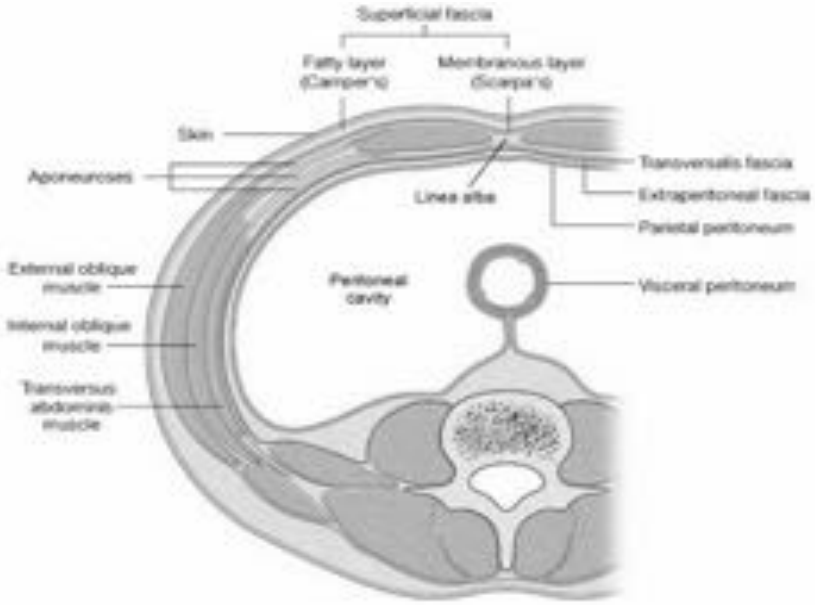

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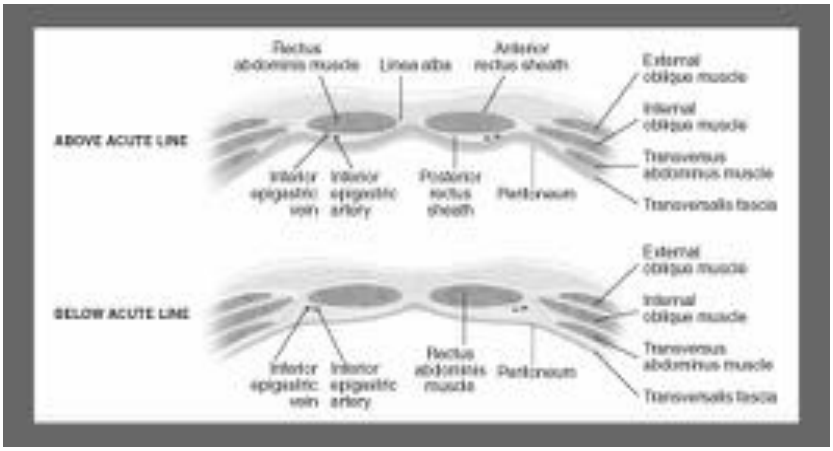

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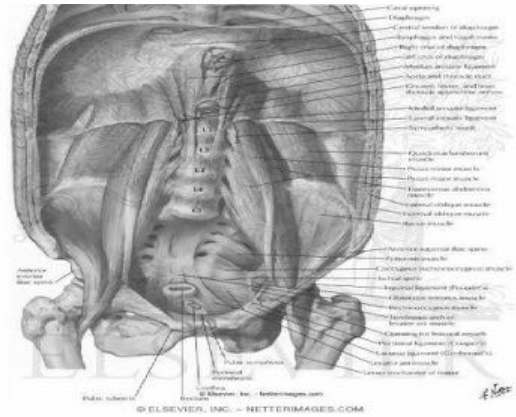

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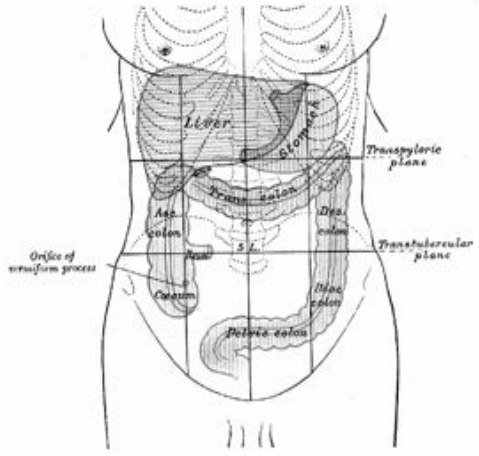
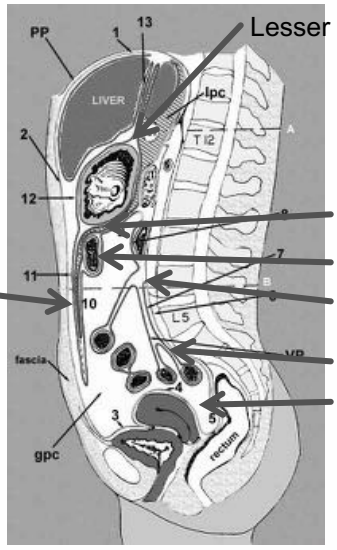


http://www.google.com/imgres?imgurl=http://www.bmb.leeds.ac.uk/teaching/icu3/practic/anat/Image38.jpg&imgrefurl=

10th costal cartilage

Iliac crest
tubercles L4-5



Lesser Omentum

Transverse Mesocolon

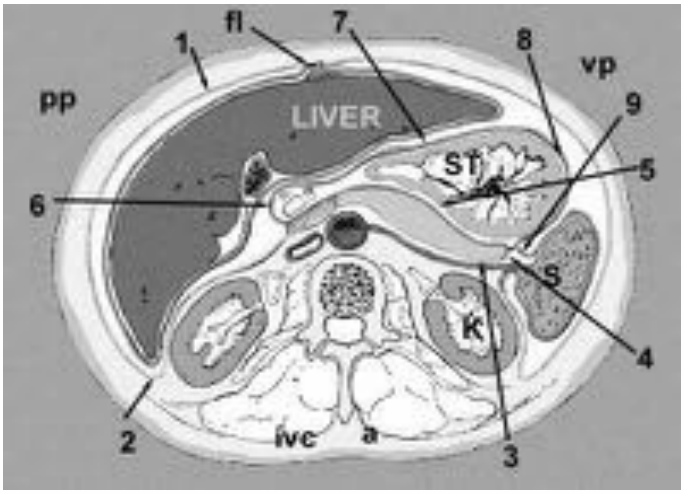
Transverse Colon

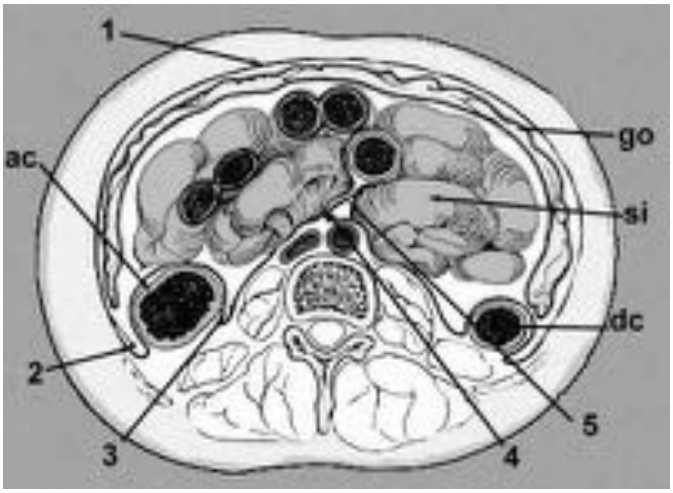
Mesenteric Root

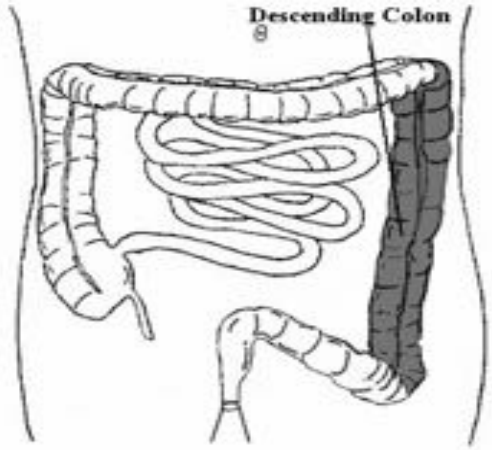
Sigmoid Mesocolon

Pouch of Douglas

Greater Omentum: sometimes travels down to pelvis



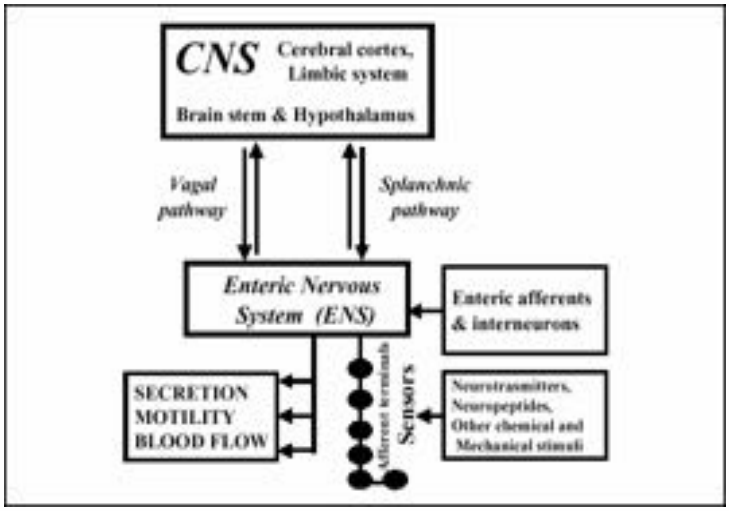


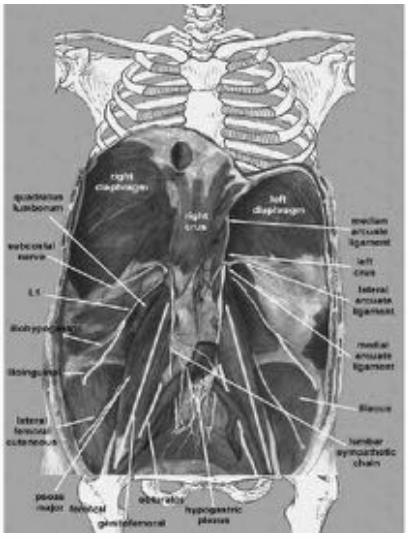


http://www.knowyourbody.net/descending-colon.html

https://en.wikipedia.org/wiki/Ovarian_fossa

https://en.wikipedia.org/wiki/Ovarian_fossa





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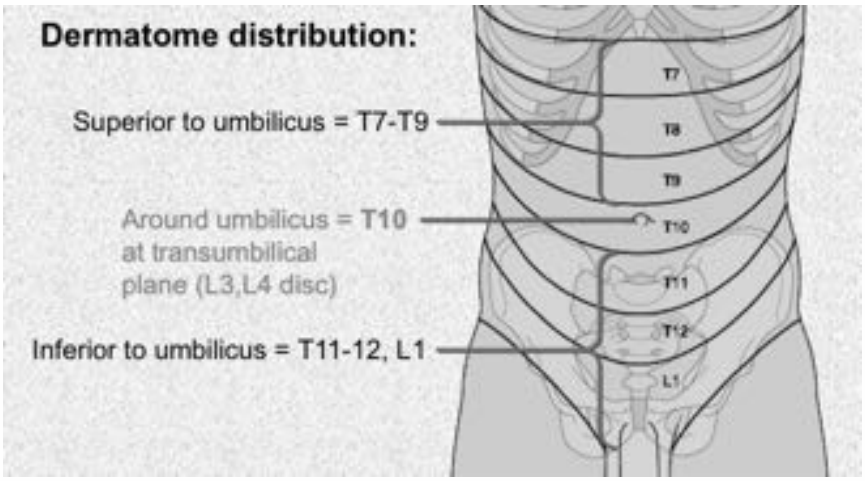

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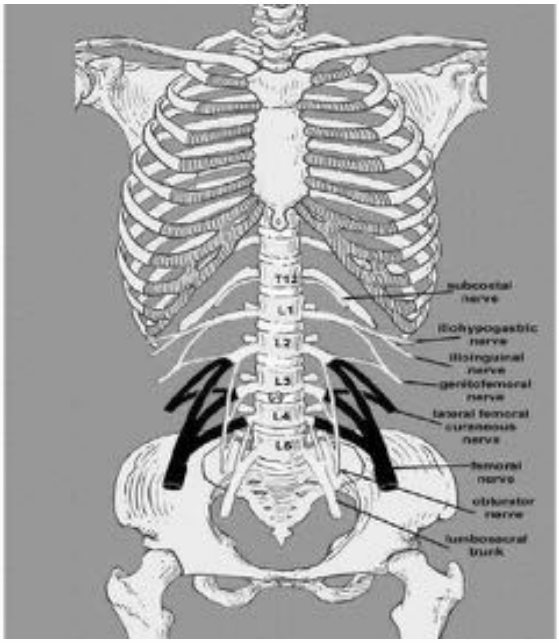

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Lumbar plexus
(somatic, ventral primary rami)

Branch	Spinal segments	Function: motor	Function: sensory
Iliohypogastric	**L1**	Internal oblique and transversus abdominis	Posterolateral gluteal skin and skin in **pubic** region
Ilio-inguinal	**L1**	Internal oblique and transversus abdominis	Skin in the **upper medial thigh**, and either the skin over the root of the penis and **anterior scrotum** or the mons pubis and labium majus
Genitofemoral	**L1,L2**	Genital branch-male **cremasteric muscle**	Genital branch-skin of anterior scrotum or skin of mons pubis and labium majus; femoral branch-skin of **upper anterior thigh**
Lateral cutaneous nerve of thigh	**L2,L3**		Skin on anterior and lateral thigh to the knee
Obturator	**L2 to L4**	Obturator externus, pectineus, and muscles in medial compartment of thigh	Skin on medial aspect of the thigh
Femoral	**L2 to L4**	Iliacus, pectineus, and muscles in anterior compartment of thigh	Skin on anterior thigh and medial surface of leg

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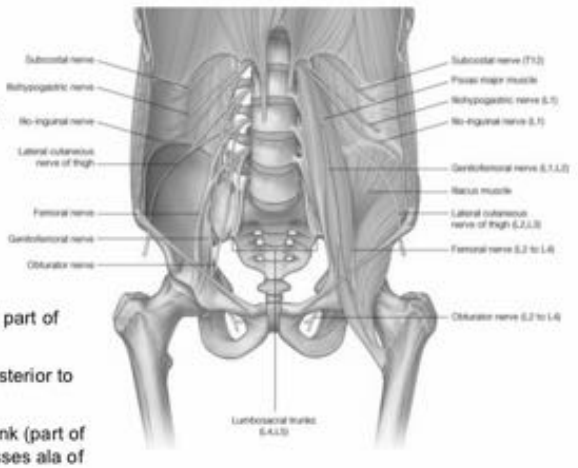
Lumbar plexus cont.



- Subcostal n. not part of plexus (T12)
- Plexus forms posterior to psoas
- Lumbosacral trunk (part of L4, all of L5) crosses ala of sacrum
- Cremasteric Reflex (genitofemoral n.)

-Know how nerves are in relation to psoas for lab IDing

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Referred pain overview

Organ	Afferent pathway	Spinal cord level	Referral area
Heart	Thoracic splanchnic nerves	T1 to T4	Upper thorax and medial arm
Foregut (organs supplied by celiac trunk)	Greater splanchnic nerve	T5 to T9 (or T10)	Lower thorax and epigastric region
Midgut (organs supplied by superior mesenteric artery)	Lesser splanchnic nerve	T9,T10 (or T10,T11)	Umbilical region
Kidneys and upper ureter	Least splanchnic nerve	T12	Flanks (lateral regions) and pubic region
Hindgut (organs supplied by inferior mesenteric artery)	Lumbar splanchnic nerves	L1,L2	Left and right flanks and groins, lateral and anterior thighs

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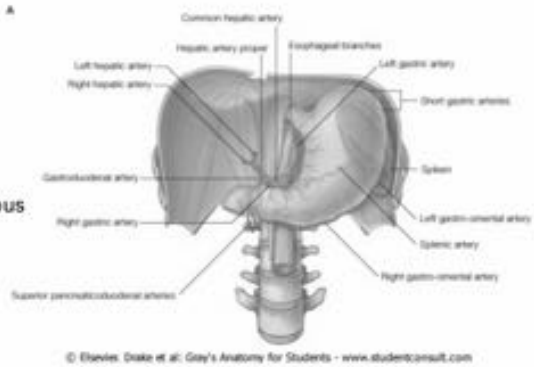
Foregut

- Blood supply : **CELIAC TRUNK**
  - Upper LV1
2. Splenic A.-largest, tortuous
   - On Sup. Border of pancreas
3. Common hepatic A.
4. Left gastric A.-smallest



- **VAGUS N.** provides preganglionic parasympathetic (posterior vagal trunk passes thru **celiac ganglion** but does not synapse, the anterior vagal trunk courses on the stomach's surface)
- **Greater Thoracic Splanchnic Ns.** (T5-T9) provides preganglionic sympathetic, which synapse in **celiac ganglion**
  - Autonomics travel with vasculature from celiac trunk to organs
- **Celiac ganglion** found on the crura of diaphragm in the vicinity of celiac trunk, (bulbous and has nerves!)

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Medical Management – Red Flags

- Weight loss (> 7 lbs)
- Difficulty swallowing
- Repeated vomiting
- Fatty stool
- Recent change in bowel habits
- Significant abdominal pain
- Anorectal pain
- Anorectal bleeding
- Nausea/Vomiting/Cramping
- Fever
- Onset in older age
- Wakes up one up in the night
- Family history of cancer

IBS (Associated Problems)
Heartburn(Non ulcer dyspepsia)
Fibromyalgia
Chronic Fatigue Syndrome

No weight loss
Unremarkable physical Examination but abdominal tenderness may be present.

Tensing the abdominal wall increases local tenderness associated with abdominal wall pain, whereas it lessens visceral tenderness by protecting the abdominal organs (Carnett test).

http://www.slideshare.net/zaryabghauri/funtional-bowel-disease?qid=4273ed11-f6b4-4dc5-8a27-115c42180909&v=&b=&from_search=32

Functional Constipation(Diagnostic Criteria)

1. Must include *2 or more of the following:*
   a. Straining during defecations
   b. Lumpy or hard stools
   c. Sensation of incomplete evacuation
   d. Sensation of anorectal obstruction/blockage
   e. Manual maneuvers to facilitate defecations (e.g., support of the pelvic floor)
   f. Fewer than 3 defecations per week
2. Loose stools are rarely present without the use of laxatives
3. There are insufficient criteria for IBS

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Functional Constipation(Clinical Evaluation)

Patient's gut symptoms
General health
Psychological status
Use of constipating medications
Dietary fiber intake
Signs of medical illnesses (e.g., hypothyroidism) should guide investigation.

Perianal and anal examination to detect fecal impaction, anal stricture, rectal prolapse, mass, or abnormal perineal descent with straining.

Laboratory tests are rarely helpful. Endoscopic evaluation of the colon may be justified for patients 50 with new symptoms or patients with alarm features or a family history of colon cancer.

- Blood cell count and thyroid-stimulating hormone
- Calcium—if ↑ can contribute to constipation
- Glucose—DM associated with constipation
- Potassium– if ↓ can cause constipation
- Creatinine—if ↑ can contribute to constipation

http://www.slideshare.net/zaryabghauri/funtional-bowel-disease?qid=4273ed11-f6b4-4dc5-8a27-115c42180909&v=&b=&from_search=32

Functional Diarrhea(Clinical Evaluation)

Dietary history can disclose poorly absorbed carbohydrate intake, such as lactose or "sugar-free" products containing fructose, sorbitol, or mannitol.
Alcohol can cause diarrhea by impairing sodium and water absorption from the small bowel.

http://www.slideshare.net/zaryabghauri/funtional-bowel-disease?qid=4273ed11-f6b4-4dc5-8a27-115c42180909&v=&b=&from_search=32

Subjective History - Bowels

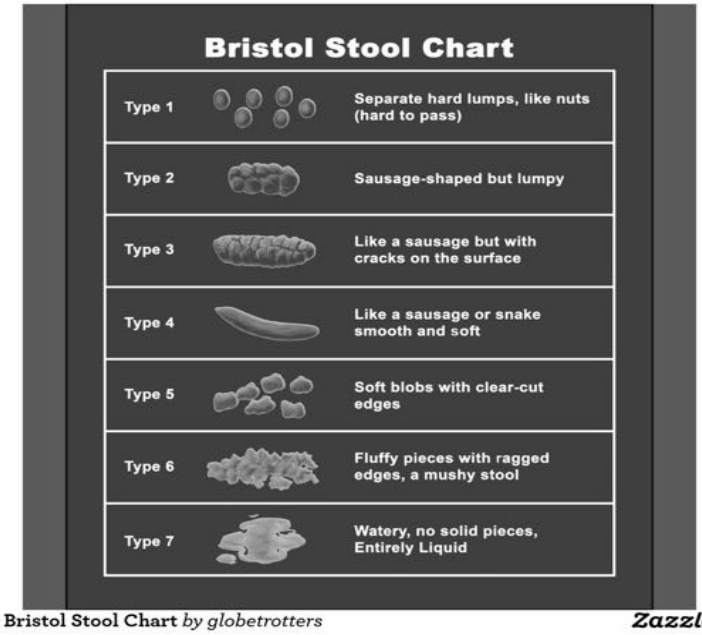
- **Bowel Symptoms:**
- Number of bowel movements per day
- Pain with bowel movement
- Constipation
- Abdominal cramping-with every bowel movement
- Leakage or staining of stool – how often
- Diarrhea

Subjective History - Bowels

- How often do you successfully produce a bowel movement?
- How often do you unsuccessfully attempt to produce a bowel movement?
- How long do you sit on the toilet with each attempt?

Subjective History - Bowels

- What helps you produce a bowel movement?
- Do You Use:
  - Laxatives How often?
  - Enemas How Often?
- Size and consistency of each bowel movement: (use Bristol Stool Chart)
  - Loose, Long And Narrow, Soft, Firm, Hard, Pellets



Subjective History - Diet

Dietary

- Please describe your typical diet – (number of meals/day, types of protein, carbs, grain and fat)
- What do you typically drink during the day (water, caffeine, carbonated drinks, juices)
- Include fiber in your diet – dietary, supplemental – how much?

Consequences of straining

- Increased risk of developing a pudendal nerve dysfunction. (Engel & Kamm, 1994)
  - Decreased anal electrosensitivity and pudendal nerve terminal motor latency found with straining regardless of perineal descent.
  - Compression, ischemia, fibrosis and stretch injury between the sacrotuberous and sacrospinous ligaments – demyelination distal
- Change in the normal sequence of pelvic floor muscle activity.

Consequences of straining

- Abnormal perineal descent, telescoping rectum.
  - This can be from 1 cm to below the ischial tuberosities.
  - Rectocele (anterior prolapse of the rectum) and/or intussusception (apical prolapse of the lining of the rectum)
- Hemorrhoids (internal and external)

Consequences of straining

- Failure of the pelvic floor connective tissue and fascia.
- Development of pain and pelvic floor muscle dysfunction.
- Increased blood pressure, intrathecal pressure and in some cases risk for annuerysm rupture. (Matsuda, et. al, 2007).

Toileting Position

- Proper Position
  - Anatomic position for defecation:
    - Knees higher than hip joints—feet on stool with heels elevated.
    - Knees abducted
    - Arms/Forearms on knees position—"thinker position". . .this position can effect the anal angle and shifts abdominal contents anteriorly.
    - Neutral spine

- Polden, Mantle. Physiotherapy in Obstetrics and Gynecology. Stoneham, MA: Butterworth-Heinemann Publishers; 1990.

www.marketlaunchers.com

Subjective History - Pain

- **Pain**

- **Lumbar pain**
- **Pelvic pain or "tailbone" pain**
- **Pain in the legs**
- **Upper back/shoulder pain**
- **Cervical pain**

Pain

- Strong association between back pain and GI symptoms in women.

- The higher perception of GI symptoms showed increase in back pain symptoms.

  - 38,050 women of three age groups in Australia (Smith, Russell, Hodges, 2008)

Pain

- Referred pain through viscerosomatic convergence
- Altered pain perception
- Increased spinal loading when straining during defecation
- Reduced support of abdominal contents and spine
  - Changes in function of the abdominal muscles

Pain

- Visceral Pathology and Disease mimicking pain in the lumbosacral region
  - The large intestine – T11 – L1
  - The sigmoid colon – T11 – L1
  - The diaphragm – T6 – T12
  - The epigastric region – T10-T12

  Note: urinary bladder - T11-L1 and S2-S4

  Uterus and ovaries add T10

  (Boissonnault, 2001)

Pain

- Myofascial pain syndromes can occur as a result of visceral disorders, but can also mimic visceral disease. Visceral disease must be considered in the differential diagnosis of a regional MPS
- Visceral referral share same central mechanism as somatic and hyperalgesia can occur specific to viscera.

(Gerwin, 2002)

Pain

- Central sensitization occurs at the level of the dorsal horn cell in the posterior horns of the SC.
  - Receive input from viscera as well as receptors in the skin and/or deep tissues
  - Majority of dorsal horn cell driven by visceral input have additional somatic input and travel the spinal thalamic tract
  - (Foreman, 1977, 1984)) (Tattersall et. al, 1986)

Pain

- Autonomic system excitation occurs at the ventrolateral medulla. Ability to affect the trigeminal system and the vagal system
  - Autonomic reflex activity – sympathetic reactions such as change in heart rate, cold hands etc.
    - Impact of autonomic quieting on this system

    (Ness, 2000)

Pain

- Non-damaging mechanisms of visceral pain can include excessive distention or contraction of a hollow visceral organ and the subsequent traction on the ligamentous structure.

(Giamberardino, 2000)

Pain

- MPS and chronic visceral pain syndromes are much higher in women than men
  - Abdominal pain, migraine, TMJ, and fibromyalgia, IBS and IC
  - Associated low back and pelvic floor MPS

  (LeResche, 2000)

Differential Diagnosis

- Assess for Red Flags: Systemic or visceral "Red Flags"
  - The heart – common and non common presentation of cardiac symptoms
    - Indigestion, bloating and gas
    - Discomfort and burning in epigastric region
    - Interscapular pain
    - Symptoms present with increased HR, SOB, and profuse sweating, cold clammy skin
    - Diabetics may not have sensory innervations to the coronary arteries (1st neuropathy to take place)

Differential Diagnosis

- Gallbladder:
  - First presents right-sided lower chest pain – patient tends to be seated with full thoracic slump
  - Reference spreads to the right upper trap as the irritation of the diaphragm occurs

Differential Diagnosis

- Stomach:
  - Pain referred locally and anterior
  - Can lead to interscapular and lower thoracic pain
    - Differentiate from heart – not elevated with exertion and present with eating
  - Reflux irritates the esophagus – upper anterior chest pain and even jaw pain

Differential Diagnosis

- Spleen
  - Blunt trauma to chest is most common injury
  - Left lateral and sometimes posterior part of the chest

Differential Diagnosis

- Lungs
  - Reference tends to be localized
  - Chronic can refer to the interscapular region

Differential Diagnosis

- Apparent Red Flags – pain that has visceral reference from spondylogenic origin
  - Mid thoracic region
    - Region with most non-traumatic dysfunctions
    - Refers pain to the chest and abdomen
      - Can result in unnecessary surgery
  - Lower thoracic region
    - Refers pain into the groin, labia, testicles

Differential Diagnosis

- Musculoskeletal Red Flags
  - Space Occupying Lesions
    - T3-T9 – narrowest part of the canal
    - Tumors, osteophytes, disc protrusions, meningeal bleeds
    - Increased pressure to the spinal cord
      - Onset of cord signs – bilateral pain and/or parasthesia, spastic gain, hyper-reflexia, clonus, babinski, urinary retention, constipation
    - **Combination of UMN signs and positive thoracic slump test is an ABSOLUTE CONTRAINDICATION to any further treatment**

Post Surgical Issues

- Abdominal surgeries:
  - C section
  - Hysterectomy
- Gallbladder
  - GI hormones

- Colorectal surgeries:
  - Colon resection
  - Temporary iliostomy
  - Rectocele repair
  - Hemerrhoidectomy
  - EAS repair
  - Fissure management
- Urogynecolgic surgeries:
  - Hysterectomies
  - Suspensions
- Vaginal delivery
  - Laceration/episiotomy

Consequences to Surgery

- Gastric paresis with any form of anethesia in early post-op
- Small bowel obstruction
- Incontinence
- Diarrhea

Consequences of Surgery

- Myofascial/visceral restrictions from surgical incisions.
  - decreased mobility of the entire abdominal and/or pelvic cavity
  - decreased organ mobility/motility

Consequences of Surgery

- Change in normal abdominal, pelvic and thoracic cavity pressures
- Breathing Dysfunctions
- Pressure changes also affect pelvic cavity
  - sigmoid has to do to overcome the differences for evacuation into the rectum as sigmoid passes from abdominal cavity into the pelvic cavity

Consequences of Surgery

- Change in lumbar/thoracic/cervical ROM and postural adaptations
- Change in core muscle activation/coordination due to surgical trauma
- Change in lumbar trunk stability due to effects of abdominal tone on the thoracolumbar fascia.
- Loss of normal biomechanics for walking and other functional movement patterns – decreased transverse motion and limitations of sagittal motions.

Making the Clinical Connection

- The Psoas pyramid – Pettman
  - making the functional connections –
    - neurological innervations (T12/L1) – iliolumbar ligament /psoas innervation/(illioinguinal, hypogastric and genitofemoral nn) and femoral nn superior cluneal nn– doral nerve
    - Control of movement:
      - Lumbar Side bending - epsilateral
      - T/L rotation – contralateral
      - Hip flexion
      - Pelvic posterior rotation

Actions of the Psoas

- Trunk mm
  - Side bending of the trunk and contralateral rotation of the T/L region
- Hip mm
  - Flexion/ER – concentric
  - Extension/IR - eccentric

Gait

- Gait dysfunction – decreased hip extension associated with trunk rotation: decreased L hip extension associated decreased TL rotation – eccentric lengthening at the end of range corresponding with mechanical energy explosion into hip flexion, SB and contralateral rotation on the opposite side.
- Stored mechanical energy constitutes the "spinal engine" described by Gracovetsky. Gray also described – load to explode – eccentric loading of the psoas is required for efficient psoas concentric movement to re-rotate the spine.

Gait

- Hip internal rotation is also necessary at the end of stance phase – to completely lengthen the psoas as well as provide for closed packed position of the hip (nutrition). Requires eccentric work of hip ER (gluts and OI)
  - SI joint and lumbar spine dysfunction can be result from break down of this system.
  - Conversely – if psoas is too long – then cannot generate the mechanical stored energy required for efficient gait – ligament leaning, shutting off of gluts – over use of quads and TFL – over rotation of the spine and arm swing to compensate. Over use of the quadratus (early and over active firing of the mm) and abdominal spring will not be efficient

Faulty Breathing Patterns

Changes in respiratory chemistry and ph

Triggers smooth muscle constriction

electrolyte imbalance

decreased tissue oxygenation

increased excitability of the NS and muscles

(Levitsky-2007)

Sleep

- A reduction in the GI processes
  - slowing of the GI and digestive cycle resulting in problems of food absorption and constipation.
- The production of HGH and serotonin
  - activation of peristaltic waves and the ability of the body to process digestion and elimination naturally.

Subjective History - Stress

- Prolonged stress
  - Increased cortisol levels in the body
    - High blood pressure
    - Breakdown of muscle
    - Suppressed immune system
    - Changes in GI activity
      - Ulcers
      - constipation

Fluid Intake Guidelines

- Insufficient fluid intake may result in reduced gastric distension and peristaltic action (Annells 2003)
- 1.5-2L/day – no scientific guidelines for this
- So. .. How much should we drink
- Careful with patients who have CHF and fluid restriction (Wanitschke 2003)
- New evidence supports liquid from food and other beverages add to the mix
- Requirements differ with heavy exercise, work, or heat index

Valtin, H. "Drink 8 glasses of water a day." Really? Is there scientific evidence for "8 X 8"? *Am J Physiol Regul Integr Comp Physiol* 283: R993–R1004, 2002

Fiber Education

- Fiber defined: Ingested plant material resistant to digestive tract break-down.
- Fiber's Job: Combine with water in the colon to prevent water from becoming reabsorbed into the walls of the intestine.
  - Bulky stool stretches the walls of the colon, and facilitates movement of stool through the colon.
  - Americans consume 10% of the fiber that they did 100 years ago.
  - A good diet for healthy adults should contain approximately 25-35 grams of fiber a day. The average American eats less than half of that amount.
    - Only add 3 g of fiber/day each week to work your way up to the goal
  - Dietary fiber helps with constipation (and some report with diarrhea) to normalize stool bulk.

Athlete Considerations

- Most studies suggest (GI) problems are common among athletes
  - incidence ranging from 20 to 96 percent
  - The majority of endurance athletes experience GI symptoms during training or races;
    - running appears to be more problematic than cycling.
    - mixed endurance events (such as triathlons), most symptoms occur during the running portion.

Athlete Considerations

- Complex pathophysiological mechanisms
- three main factors
  - Ischemic – most serious – favorable if treated immediately
  - motor mechanics
    - Digestive motility, mucosal injury
  - personal and / or environmental parameters.

Athlete Considerations

- Women more susceptible than men – regardless of effort
- Age increases susceptibility
- Training level – protective in lower levels of work and changes with intensity
- Use of aspirin or nsaids, birth control or HRT
- High altitude
- hypoglycemia, hyperthermia (by increase of sympathetic tone and blood viscosity) or by dehydration
- Stress: usually occurring immediately before the competition
  - vago-sympathetic dysregulation

Athlete Considerations

- Esophogeal
  - Heart burn and reflux greater in men
  - Intensity related:
    - Sustained intensity at 90% VO2
    - Greater than 70% max HR
    - Eating before exercise
    - Worse with dehydration
  - Change diet and time of nutrition – Stay hydrated and avoid hypertonic drinks

Athlete Considerations

- Abdominal Pain, GI urgency and Diarrhea (and bleeding)
  - Alteration in ischemia rate
  - Alteration in colonic motility – Ascending is slowed (where absorption and mixing occur) and Descending is accelerated (where water absorption occurs)
  - Intestinal trauma from abs and posterior abdominal wall

Athlete Considerations

- Increased intestinal permeability: Local and systemic inflammatory responses – production of Ig antibodies and becomes a relative autoimmune response
- Higher and sustained training levels
- Use of NSAIDS or aspirin
- Infection – especially low hygiene countries
- Treat with Vitamin C and probiotics (caution with Vitamin C) – psychological prep to reduce stress and train in similar environments

Athlete Considerations

- Ischemia
  - Medical Emergency
  - Rapid heart rate, pallor, illness, decreased cognition, acute pain, rectal bleeding, cold/clammy, nausea/vomiting
  - Lesser trained athletes are at greater risk – tends to occur closer to the end of any race (5K, half and full marathons). Or, running portion of triathalons.

Athlete Considerations

Need for Medical Evaluation – including hemoglobin and antibodies in athletes with difficulty recovering – but not displaying acute ischemic symptoms.

Questions

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