



Medical Screening and Care Management

Introduction

Course Objectives

1. Apply appropriate medical screening by systematically collecting and analyzing data from subjective and objective findings related to body systems that may effect the musculoskeletal presentation. **(Applying)**
2. Apply critical thinking skills to identify and evaluate potential contributors (local, regional, global) from the cardiovascular, pulmonary, endocrine, neurologic, hepatic, biliary, and urinary systems that may contribute to patient symptoms based on available evidence and patient information. **(Applying)**
3. Utilize a procedural flow checklist as a systematic tool to stimulate hypothesis generation and guide the clinical reasoning process specifically for the evaluation and treatment of patients with associated medical conditions and impairments. **(Applying)**
4. Skillfully execute joint and soft tissue mobilization interventions with attention to key elements including the direction and amount of force, therapist body mechanics, and patient positioning, while implementing appropriate modifications for medically complex patients. **(Applying)**
5. Proficiently prescribe specific exercise interventions for the medically complex patient based on the available evidence, utilizing the impairment model, considering the functional needs of the patient, and to complement the specific manual therapy techniques. **(Applying)**

Course Objectives Continued

6. Demonstrate a working knowledge of medical screening/visceral referral/flags. **(Understanding)**
7. Integrate a biopsychosocial approach in the clinical examination and treatment of medically complex patients, considering biological, psychological, and social factors in the patient's presentation and management. **(Applying)**
8. Demonstrate an understanding of specific anatomical and biomechanical implications relevant to cardiovascular, pulmonary, endocrine, neurologic, hepatic, biliary, and urinary systems and their implications for orthopedic clinical case management. **(Understanding)**



Course Overview

- Online Modules
 - What do we need to screen and why?
 - Is it musculoskeletal?
 - Cancer
 - Infections
 - Metabolic/Endocrine/Immune Systems
 - Lymphatic/Integumentary Systems
 - Cardiovascular System
 - Respiratory System
 - Vitals and Exercise Prescription
 - Brain/Nervous System
 - Gastrointestinal System
 - Hepatic/Pancreatic/Biliary Systems
 - Urinary System
 - Conclusion/Live Course Preparation
- Live Course – Clinical Integration and Application



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Why is Appropriate Medical Screening Important?

2002 APTA Interactive Guide to PT Practice

“...for acute musculoskeletal and neuromuscular conditions, triage and initial examination are appropriate PT responsibilities, and for certain chronic conditions PTs should be recognized as principle providers of care within a collaborative Primary Care Team”



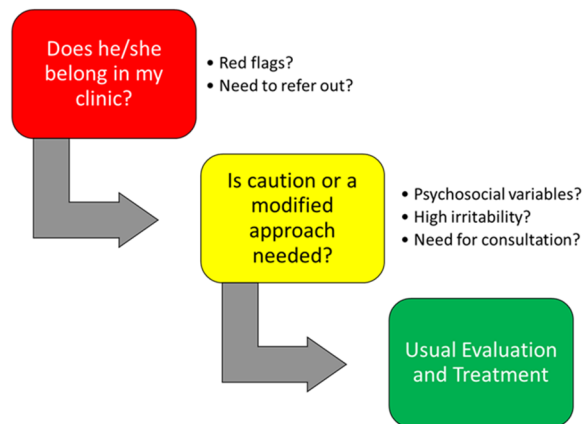
Why is Appropriate Medical Screening Important?

2020 AOPT Position Paper

The American Occupational Therapy Association (AOTA) affirms that occupational therapy practitioners¹ are well prepared to contribute to interprofessional collaborative care teams addressing the primary care needs of individuals across the life course. Because of an increased focus on preventive population health and social determinants of health by health care organizations, synergy between primary care and occupational therapy is growing, with support for client-centered,² comprehensive whole-person care, health promotion and prevention, disease self-management, and quality of life ([Halle et al., 2018](#))

Medical Screening and Triage

(Blanpied et al., 2017)



Medical Screening: Flag System

(Nicholas et al., 2011)

- Red – serious pathology
- Orange – psychiatric symptoms
- Yellow – beliefs, appraisals, judgements, emotional responses, pain behaviors and coping strategies
- Blue – perceptions about the relationship between work and health
- Black – system or contextual obstacles



Enjoy the course!





Medical Screening and Care Management

Screening and Decision Making

Patient Case

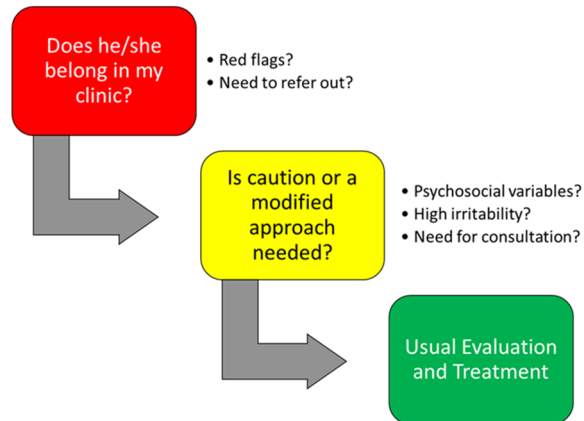
- A 48 y.o. male presents to PT with left shoulder pain. Pain began about 3 weeks. Pt. is left handed and believes that “time has finally caught up with him” as he played baseball through college. Pt. is overweight and has a positive medical history of hypertension and high cholesterol. Pt. is relatively sedentary. He does not exercise outside of playing catch with his sons and he works in IT. Pt. drinks an average of 10-12 beers per week and smokes 1-2 cigarettes per day.

What’s on your hypothesis list?

What additional questions could you ask?

Medical Screening and Triage

(Blanpied et al., 2017)



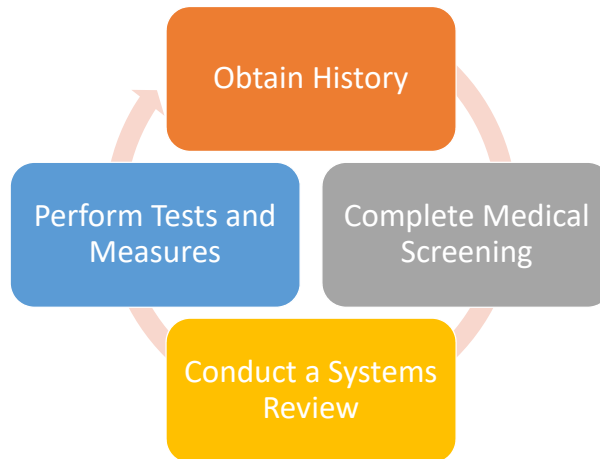
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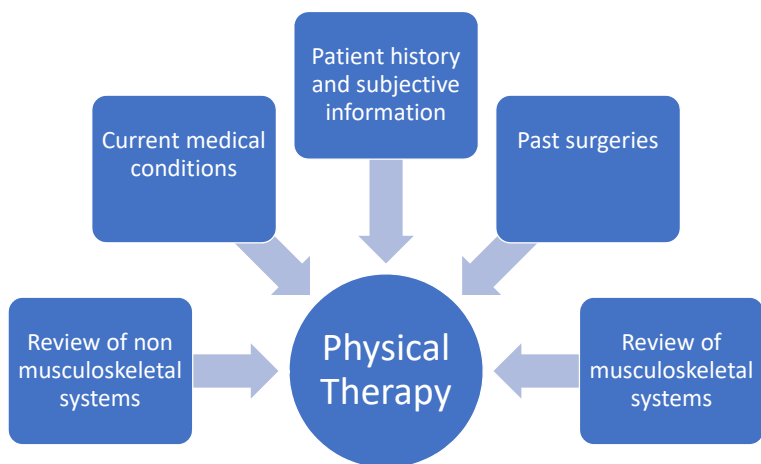
Examination Process



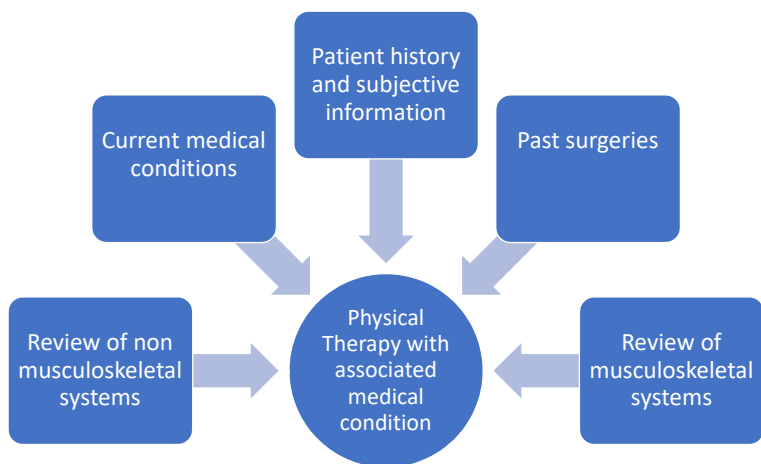
Algorithms

- There are 4 outcomes that exist when seeing a patients:
 - **I: Physical therapy performed with no associated medical conditions**
 - **II: Physical therapy performed with associated medical conditions**
 - **III: Physical therapy performed with associated medical condition/contact M.D.**
 - **IV: No physical therapy performed and call M.D./send to Emergency Room**

Algorithm I



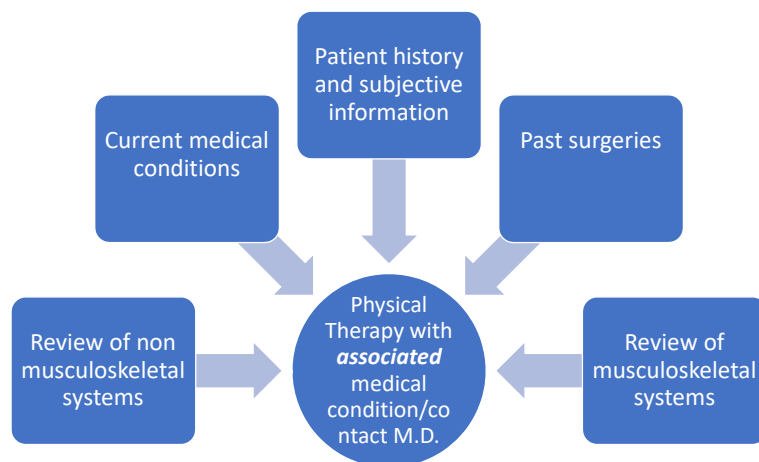
Algorithm II



Algorithm II Considerations

- **Patient history** - Controlled HBP or DM, CVA, cancer
- **Current medical conditions** - HBP, COPD, CVD, DM, arthritis, Parkinson's
- **Psychosocial Factors** - Depression, poor sleep quality, nutrition, smoking and alcohol use, stress, social support, level of activity, past experience and pain/health beliefs
- **Past surgeries** - Heart/lung/abdominal, unassociated orthopedic
- **Review of non-musculoskeletal systems** - Skin, vision, hearing, lymph, pulse/bp, respiration, CNS, GI
- **Review of musculoskeletal systems** - Previous/concurrent secondary diagnoses

Algorithm III

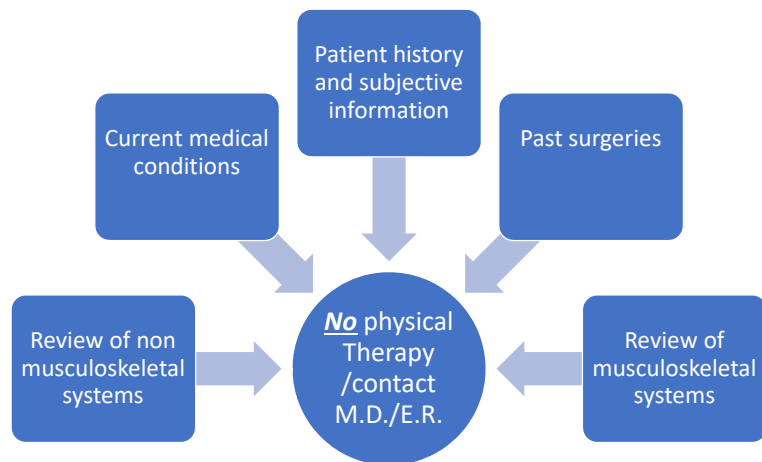


Algorithm III Considerations

Why might you need to contact the referral source/MD?

- **Patient history**
 - Not taking meds for HBP, DM, pain, inflammation
 - Concerning symptoms or findings that have not been discussed with MD
- **Current medical conditions**
 - Contraindicated for current treatment? HBP, COPD, arthritis, DM
- **Past surgeries**
 - Is surgical M.D. aware of referral?
 - Lack of clarity about surgical procedure or precautions

Algorithm IV



Algorithm IV Considerations

- **Patient history**

- Severe dizziness, severe nausea, bowel/bladder, seizures, psychiatric, pain at night

- **Current medical conditions**

- Fever, signs of infection: systemic/local, allergic reaction, multiple non-MSK factors present, progressing neurological symptoms

Algorithm IV

- **Review of non-musculoskeletal conditions**

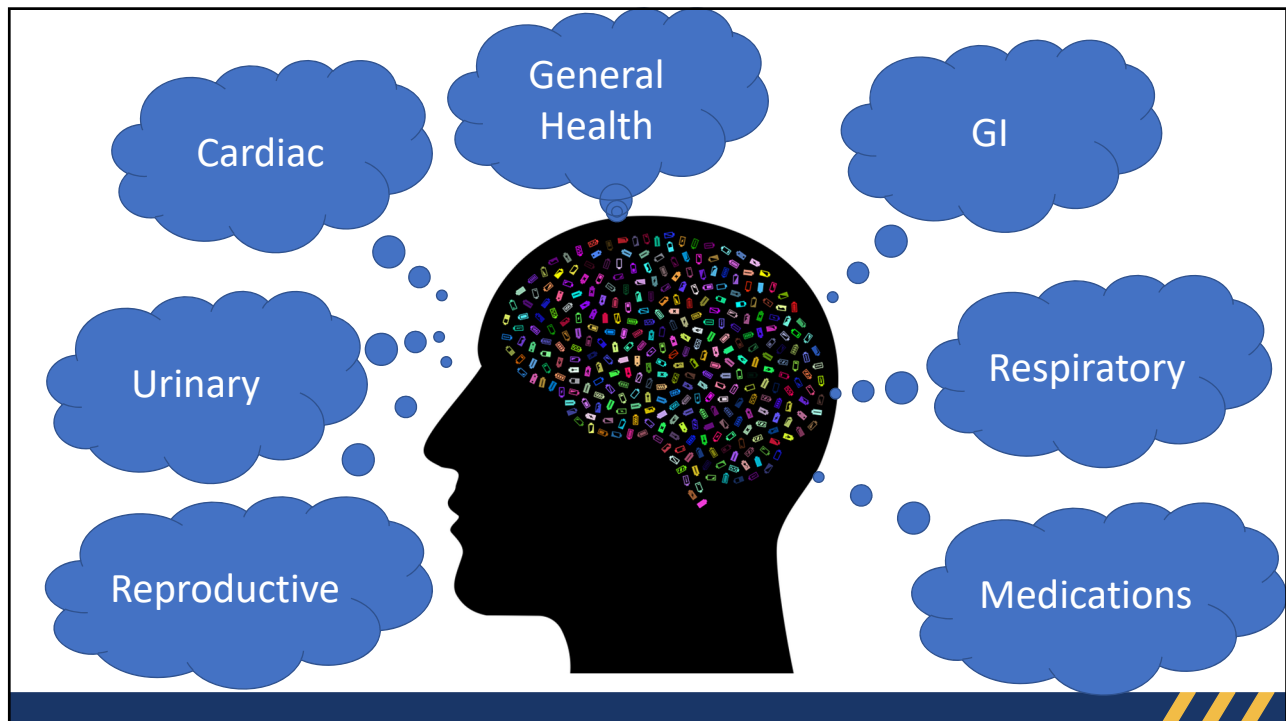
- Angina pain not relieved in 20 minutes
- Angina with nausea, vomiting, sweating
- Diabetic with confusion, lethargy, changes in alertness and function
- Bowel/bladder incontinence and/or saddle anesthesia
- Anaphylactic shock

- **Review of musculoskeletal conditions**

- Gross joint instability, unstable fracture, nerve root compression, abnormal edema

Imaging for LBP

- Routine imaging should be discouraged
 - Early imaging (MRI) increases disability from 1-2 months to 4-7 months
- Should be used if severe, progressive neuro disorder suspected OR when Red Flags are suspected
 - Drop foot
 - Loss of bowel/bladder control





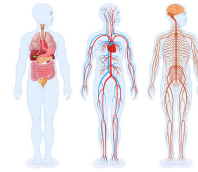
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Medical Screening and Care Management

Is it Musculoskeletal?

Referrals by Body Region

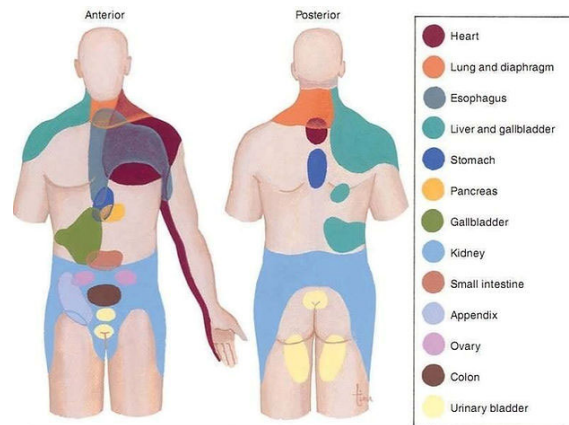


Cervicothoracic	Upper Quarter	Lumbopelvic	Lower Quarter
<ul style="list-style-type: none"> • Upper Cervical Instability • Fracture • Vascular • Neurologic • Cancer • Pulmonary • Cardiac • GI 	<ul style="list-style-type: none"> • Vascular • Cardiac • Pulmonary • Liver • Gallbladder • Cancer • Neurologic 	<ul style="list-style-type: none"> • Urogenital • Fracture • AAA • Cancer • Spinal Infection • Cauda Equina • GI • Appendix 	<ul style="list-style-type: none"> • Vascular • Fracture • Cancer • Infection • Urogenital • Neurologic

Quality of Symptoms: MSK vs Non-MSK

Bone/Joint	Muscle	Nerve	Visceral	Emotional
<ul style="list-style-type: none"> • Can be local or referred • Descriptors may: sharp or deep ache • Pain with weight bearing (compression) • Reduced symptoms with distraction • Symptoms may improve with activity (i.e. OA-morning stiffness) • AROM/PROM • Joint Mobility 	<ul style="list-style-type: none"> • Can be local or referred • Descriptors may include: achy, throbbing, tight • Pain with contraction or resistance as well as pain on stretch • Symptoms may increase with activity • AROM/PROM • Resisted Tests • Palpation 	<ul style="list-style-type: none"> • Symptoms are usually more widespread and diffuse • Descriptors may include: sharp, burning, deep ache, numbness, tingling, pins and needles • Neuro screen • neurodynamic tests 	<ul style="list-style-type: none"> • Diffuse/Vague • Symptoms may be referred • Descriptors may include: deep ache, nagging, gnawing, throbbing, pulsating, burning • Vitals • Palpation • Screening tests 	<ul style="list-style-type: none"> • Widespread • Descriptors may include: agonizing, punishing, exhausting, constant, annoying, miserable, relentless, killing, unbearable • Hyperalgesia • 2 point discrimination

Visceral Referral Patterns



Referred pain. The sites for referred pain from various organs are shown.

Visceral Referral Patterns

Viscera	Location
Diaphragm	C4- Left shoulder
Heart	T3-4- Left chest, shoulder/arm, jaw
Esophagus	T4-5 Sternum
Liver	T8-11 Right flank
Gall bladder	T5- Posterior thoracic; right scapula
Small intestine	T10- central umbilicus
Large Intestine	T11- Central below umbilicus

Visceral Referral Patterns

Viscera	Location
Bladder	T11-L1- Central pubic symphysis
Kidney	T10-L1, iliac crest, groin
Ovary/Testes	L1- Groin

Systems Screen: OSPRO

• OSPRO-10

Have you recently experienced:

1. abnormal sensations (eg, numbness, pins and needles)?
2. recently experienced headaches?
3. recently experienced night pain?
4. recently experienced sustained morning stiffness?
5. light-headedness?
6. trauma (eg, a motor vehicle accident, a fall)?
7. night sweats?
8. constipation?
9. easy bruising?
10. changes in vision?



Systems Screen: OSPRO

- **OSPRO-23**

OSPRO-10+ these additional 13 questions:

11. (FEMALE ONLY) changes in menstruation patterns?
12. gait or balance disturbances?
13. chest pain with rest?
14. shortness of breath?
15. muscle weakness?
16. a failure of conservative intervention (failure to improve within 30 days)?
17. excessive sweating?
18. excessive swelling or weight gain?
19. a heartbeat in your abdomen when you lie down?
20. cramps in your legs when you walk for several blocks?
21. abdominal pain?
22. changes in the integrity of your nails?
23. prolonged use of corticosteroids?



“Red” Flags

- **Nausea/Vomiting**

- GI system, pregnancy, **cancer**, medication side effects

- **Fever/chills/sweats**

- Flu, infection, **cancer**

- **Unexplained weight change**

- 5% over 4 week period
- GI disorders, diabetes, hyperthyroidism, adrenal insufficiency, **common infections, malignancy**, depression

- **Night Pain**

- Wakes up from deep sleep, can not reposition to fall back asleep
- Pain at night is most severe and progressing

“Red” Flags

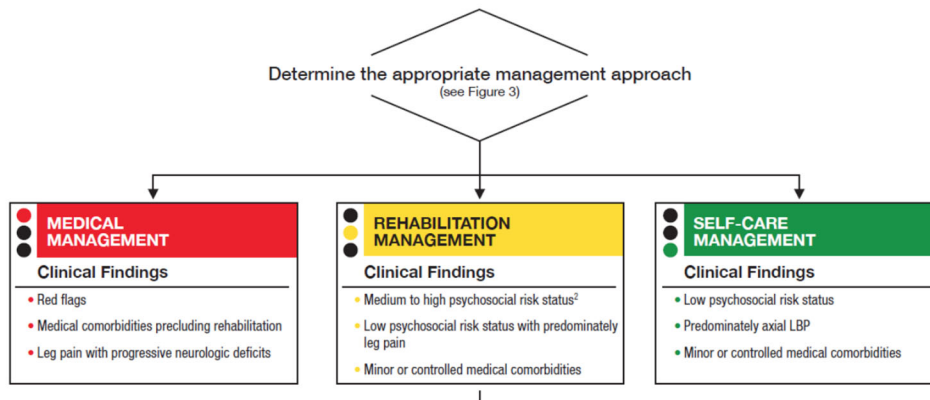
- **Numbness/tingling**
 - Nerve irritation or compression, neurologic condition, renal disease, adverse drug reaction, **malignancy**
 - Concern when stocking glove distribution is present, bilateral symptoms, both sensory and motor involvement, saddle parasthesia
- **Syncope**
 - Sudden but temporary loss of consciousness
 - **Cardiac, cerebrovascular**, vasovagal, orthostatic
- **Dizziness/lightheadedness**
 - Medication side effect, hypoglycemia, **cardiovascular dysfunction**, BPPV
- **Dyspnea/SOB**
 - URI, **cardiovascular** or pulmonary disorder
- **Difficulty swallowing**
 - Neurologic disorder, **tumor**, fracture, pericarditis

“Red” Flags

- **Changes in bowel/bladder function**
 - Urinary retention or inability to retain=**cauda equina**
 - Increased frequency/dysuria=urogenital dysfunction
 - Blood in urine = infection, urogenital dysfunction
 - Dark blood in stool = **GI bleed**
 - Red blood in stool = hemorrhoid
- **Weakness**
 - Musculoskeletal injury, neuromuscular pathology, **tumor**
 - Extreme (foot or wrist drop)
 - Onset with sensory changes, changes in gait or balance, visual changes, changes in smell/taste/hearing

Alrwaily 2015: Lumbar TBC

TRIAGE BY THE FIRST CONTACT HEALTHCARE PROVIDER



Ask More Questions

- **Location of Symptoms**
 - Consistent or Variable; Superficial or Deep
- **Quality of Symptoms**
 - Burning, Stabbing, Nagging, Vague, Tingling
- **Behavior of Symptoms**
 - Constant or Intermittent, Night Pain, Pain Related to Activity
- **Medical History and Medications**
- **Social Habits**
 - Smoking, Alcohol Intake, Exercise

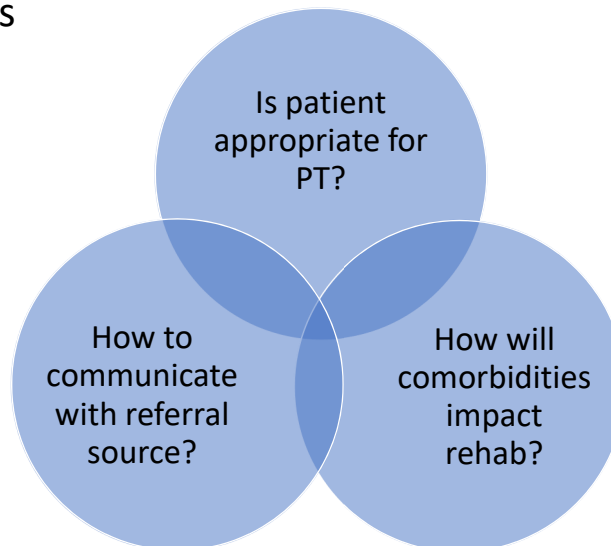
Patient Case

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What's on your hypothesis list?

What additional questions could you ask?

Considerations



Screening Process for Patterns in Musculoskeletal Diagnosis

- Patterns of Processes
 - Degenerative, trauma/inflammatory, ischemic, strain
- Patterns of Symptoms and Physical Impairments Common to Different Diagnostic and Clinical Syndromes
 - Spinal stenosis, postural patterns, instability patterns, impingement patterns



Screening Process for Patterns in Musculoskeletal Diagnosis

- Patterns of Tissue Pathology
 - Muscle/tendon, bursa, disc, ligament, nerve, etc
 - Symptoms should be reproducible
- Patterns of Predisposing Risk Factors to Patients Health Conditions, Physical Impairments, Activity and Participation Restrictions
 - For CVD: diet, weight, BP, stress, smoking, etc
 - For chronic disability: socioeconomic status, inactivity, failure to return to work, beliefs about pain

Screening Process for Patterns in Musculoskeletal Diagnosis

- Patterns that Signal Precaution in Exam and Treatment
 - Red flags, further investigation
- Patterns of Management Strategies
 - Treatment approaches
- Patterns Reflecting Prognosis
 - Degrees of pathology(trauma)/illness/impairment, environmental factors, personal factors

Screening Process for Patterns in Musculoskeletal Diagnosis

- Each step in our evaluative procedure should **identify or eliminate** one or more of those patterns/tissue types as pathology
- The following is an example of a procedural flow and the information each step could provide

Clinical Examination Guide

- Observation, Gait, Posture
- History
- Inspection
- Functional Provocation
- Active Motion (Repeated)
- Passive Motion (O/P)
- Resisted Motion (3P)
- Palpation
- Neurology
- Special Tests
- Segmental Mobility Test



Internal Influences on the Musculoskeletal System: Review of Systems

- Musculoskeletal Disease
- Lymphatic System
- Integumentary System
- Cardiac System
- Respiratory System
- Brain Disorders
- Endocrine System
- Gastrointestinal System
- Hepatic/Biliary/Pancreatic
- Urinary Tract/Pelvic Systems





Thank you!



Medical Screening and Care
Management

Musculoskeletal Disease - Cancer

Cancer – Primary Tumors

- **Clinical manifestations:**
 - Swelling, fever and a mass may be present
 - Unexplained weight loss
 - Failure of rest to provide relief
 - Constant pain is often present without regard to position or activity
 - Night pain, which wakes a person from sleep, is a common finding
 - Pain pattern is atypical and varied
- **Risk Factors:**
 - Age <17y.o. or >50y.o.
 - History of cancer
 - Family history of cancer

Cancers

- **Diagnosis**
 - Often cannot be palpated directly but through muscle
 - X ray needed for detection but often too late
 - Bone scan better for early detection
 - Biopsy is definitive
- **Treatment**
 - Ranges from observation to radical resection
 - Radiation
 - Chemotherapy
- **Prognosis**
 - Varies according to type and stage

Cancer

- Primary malignant bone and soft tissue tumors are **rare** but metastatic disease is **common from breast, lung, prostate**
 - Metastasis to axial skeleton due to the high vascularity and valve-less venous system leading to sluggish blood flow
- **Metastatic Tumors**
 - Secondary or metastatic tumors refer to lesions that originate in other organs
 - **Skeletal metastasis are often seen in cancers of the lung, prostate, breast, kidney, and thyroid**

Cancers

Metastatic Tumors

- **Clinical signs**
 - Pain is the most common complaint, however, 50% of breast or prostate metastasis has no bone pain
 - Swelling, tenderness, or masses are less likely
 - Pathologic fractures may result from tumor itself, from biopsy, or immobilization

Table 2. An Example of Traditionally Described Red Flags That May Raise the Suspicion of a Serious Undetected Condition Presenting as Low Back Pain

Red flags that may increase the likelihood of metastatic cancer^{72,75-78}

- History of cancer
- Night pain or pain at rest
- Unexplained weight loss
- Age > 50 years or < 17 years old
- Failure to improve over the predicted time interval following treatment

Red flags that may suggest the presence of an infection within the disk (diskitis) or vertebrae (osteomyelitis)⁷⁵

- The patient is immunosuppressed
- A prolonged fever with a temperature over 100.4° F
- History of intravenous drug abuse
- History of a recent urinary tract infection, cellulitis, or pneumonia

Red flags suggesting an undiagnosed vertebral fracture^{76,83}

- Prolonged use of corticosteroids
- Mild trauma > age 50 years
- Age > 70 years
- A known history of osteoporosis
- Recent major trauma at any age (motor vehicle accident or a fall from greater than 5 ft)
- Bruising over the spine following trauma

Red flags that may indicate a dangerous abdominal aortic aneurysm^{72,75}

- A pulsating mass in the abdomen
- A history of atherosclerotic vascular disease
- A throbbing, pulsing back pain at rest or with recumbency
- Age > 60 years



Spinal Cancer

History	Sensitivity	Specificity
Age >50	0.77	0.71
Previous history	0.31	0.98
Failure to improve in one month of therapy	0.31	0.90
No relief: bed rest	>0.90	0.46
Duration > one month	0.50	0.81
Age <50 or no cancer history or unexplained weight loss or failure of conservative treatment	1.00	0.60

- Insidious onset
- Constitutional symptoms

Deyo RA, Jarvik JG. Diagnostic evaluation of low back pain with emphasis on imaging. *Ann Intern Med.* 2002;137:586-97

CAUTION: Cancer Screen

- **C**hanges in bowel/bladder
- **A** sore that does not heal in 6 weeks
- **U**nusual bleeding or discharge
- **T**ender lump in breast or elsewhere
- **I**ndigestion or difficulty swallowing
- **O**bvious change in wart or mole
- **N**agging cough or hoarseness



Side Effects of Cancer Treatments

- Fatigue
- Pain
- Lymphedema
- GI problems
- Joint Stiffness
- Loss of bone density
- Hair Loss
- Neuropathy
 - May cause impaired balance
- Cognitive changes (brain fog)

Cancer

Implications for the Therapist

- Early detection is essential
- Family/patient history of cancer should be discussed
- Treatment aimed at restoring or improving function within the parameters of the pathology
- Consider tumor in your differential diagnosis when patients have continued pain despite appropriate rest and treatment
- Be aware of effects of chemo and radiation on other organ systems
- Monitor for effects of primary lesion on other organ systems
- Monitor weight bearing status
- Monitor psychosocial aspects of care



Thank you!



Medical Screening and Care Management

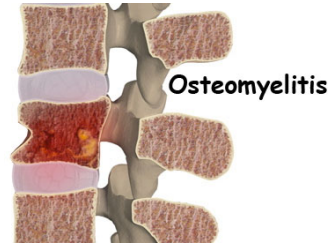
Musculoskeletal Disease - Infection

Infections

- As with cancer, infection can originate in the msk system or spread to the msk system
- The most common cause is bacteria from **wounds, fractures, surgery**
 - Staphylococci and streptococci are most common
- The most common route is via the **blood**
- The original infection is often from the **urinary tract, skin, or teeth**
- The most common site in adults is the **vertebral body** (osteomyelitis)
- The most common site in children is region around the **growth plates** where blood flow is sluggish
- **Back or extremity pain and fever** are the most common symptoms

Infections

- Spinal infection usually blood-borne from elsewhere
- Signs/Symptoms
 - Fever
 - Hyperhidrosis
 - Night Sweats
 - Loss of Appetite
 - Chills
 - Local Infection: Redness, Warmth, Swelling, Persistent Symptoms
- History
 - Recent skin rash; Recent Hx of infection (UTI, mono, etc...); Recent cut (locally or anywhere); Intravenous drug use
 - Lack of clear precipitating factors



Fever

- Normal temperature range: 97-99.3 deg F
- Fever: 99.5 deg F
 - Clinical relevant if low grade fever is present for >2 weeks
 - Fever is >102.5 deg F



Meningitis

<ul style="list-style-type: none">• Inflammation of the meninges that line the CNS• May be viral, bacterial, fungal or parasitic• Risk Factors:<ul style="list-style-type: none">-Hx of recent infection-Hx of skull fracture	<ul style="list-style-type: none">• Signs/Symptoms<ul style="list-style-type: none">• Fever• Pain on slump testing (L'hermitte's sign)• Headache• GI Symptoms (Nausea/Vomiting)• Confusion• Seizures• Sleepiness• Photophobia or Phonophobia
--	---

All negative?

- Fever
- Neck Stiffness
- Altered Mental Status



- Effectively r/o meningitis
- Sn = 99-100
- (Attia et al 1999)

Infections

- Symptoms
 - Acute onset of local pain,
 - Swelling,
 - Tenderness,
 - Decreased joint motion.
 - Reduced weight bearing.
 - Systemic fever, chills...**medical emergency**

Infections

- Diagnosis-

- Joint fluid analysis

- Implication:

- Severity often the only difference from tendinitis
- Occur in prosthetic joints
- Associated joint pathologies often delay diagnosis

Infections

Implications for the Therapist:

- Prognosis is related to the time between onset of symptoms and definitive treatment
- Treatment of hip infection must be within 4 days to prevent joint destruction
- Age, DJD, RA, DM may also reduce prognosis



Thank you!



Medical Screening and Care
Management

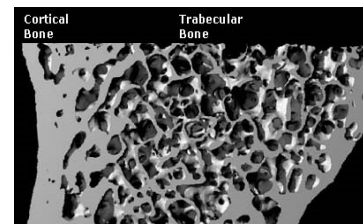
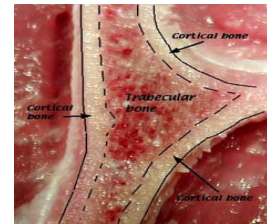
Metabolic/Endocrine/Immune Systems

Metabolic System

- Parathyroid
 - Produces PTH: only purpose is to control Ca^{++} and phosphorus in blood, and consequently in nerve, bone, muscle, brain
- Thyroid
 - Produces hormones upon stimulation by TSH to regulate metabolism
 - Produces calcitonin to reduce blood calcium
- Pituitary
 - Produces TSH, GH which stimulates bone
- Gonads
 - Produces estrogen, progesterone, testosterone to stimulate bone growth
- Vitamin D
 - Calcitriol: has a hormone like effect on Ca regulation, it stimulates resorption and allows formation

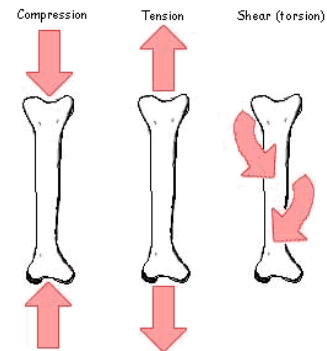
Metabolic Disorders

- Function of bone
 - Primary storage of calcium, phosphate, sodium, magnesium
 - Marrow has hemopoetic (growth and development of blood cells) function
 - Protects viscera and nervous system
 - Provides rigid support for trunk and extremities
 - Provides attachment sites for soft tissue



Metabolic Disorders

- Constant remodeling by:
 - Mechanical stress
 - Calcium and phosphate levels in the extracellular fluid
 - Levels of parathyroid (PTH)/thyroid (TSH)/growth hormone (GH from pituitary)/sex hormones
 - Levels of calcitonin, Vitamin D, cortisol (decreases osteoblastic activity)



Metabolic Disorders

- Manifestations of metabolic bone disease
 - Loss of bone density and decreased strength
 - Increased bone density and decreased strength
 - Bone pain
 - Postural deformity
 - Fractures

Metabolic Disorders

- Osteoporosis

- Definition: Disorder involving loss of bone mass

- Primary osteoporosis:

- Idiopathic in children and young adults with normal gonadal function

- Postmenopausal osteoporosis

- Senile or involutional (backward change) osteoporosis



Metabolic Disorders

- Secondary Osteoporosis due to endocrine disorders
 - Hyperthyroidism
 - Hyperparathyroidism
 - Hypogonadism
 - Cushing's disease (Hypersecretion of glucocorticoids from the adrenal cortex)
 - Diabetes Mellitus
 - Osteomalacia (loss of Ca^{++} in bones due to lack of vit D)

Metabolic Disorders

- Other conditions that may cause osteoporosis
 - Chronic renal failure
 - RA
 - Malabsorption syndrome
 - Chronic respiratory disease
 - Malignancy
 - Alcoholism

Metabolic Disorders

- Risk Factors

- Caucasian female 50 years and older
- Post menopausal Northern European ancestry
- Decreased estrogen production causes increased bone reabsorption to compensate for decreased intestinal calcium absorption
- Family history
- Long period of inactivity or immobilization

Metabolic System

- Fluid Imbalances
 - Dehydration
- Metabolic disorders
 - Metabolic syndrome, alkalosis, acidosis
- Gout
- Hemochromatosis
- Metabolic Bone Disease
 - Osteomalacia, Paget's Disease, Osteoporosis

Metabolic Syndrome

- Characterized by insulin resistance
 - Increased risk for developing diabetes
- Signs and Symptoms
 - Abdominal obesity
 - Waist measurement ≥ 40 inches (males) or ≥ 35 inches (females)
 - Increased triglycerides and LDL cholesterol; decreased HDL cholesterol
 - Elevated BP (130/85mm/Hg or more)
 - Insulin resistance

Metabolic Disorders

Risk Factors

Long term intake of

- Alcohol
- Tobacco
- Caffeine
- Corticosteroids

- Impairs osteoblastic activity
 - Decreases bone mass
- Impairs calcium absorption

Metabolic Disorders

- Clinical Manifestations
 - Back Pain
 - Long bone and compression fractures
 - Postural changes

History	Sensitivity	Specificity	+LR
Age >50	0.84	0.61	N/A
Age >70	0.22	0.96 ★	11.19
Trauma	0.30	0.85	10.03
Corticosteroid use	0.06	0.995 ★	+48.5

In elderly, trauma can be minor

Deyo RA, Jarvik JG. Diagnostic evaluation of low back pain with emphasis on imaging. Ann Intern Med. 2002;137:586-97

	1 positive Feature	>=2 Positive Features	>=3 positive Features
+LR (95% CI)	1.8	15.5	218
Post-Test Prob Fracture (Pre-test Prob=3%)	5%	32%	87%

Spinal Compression Fracture

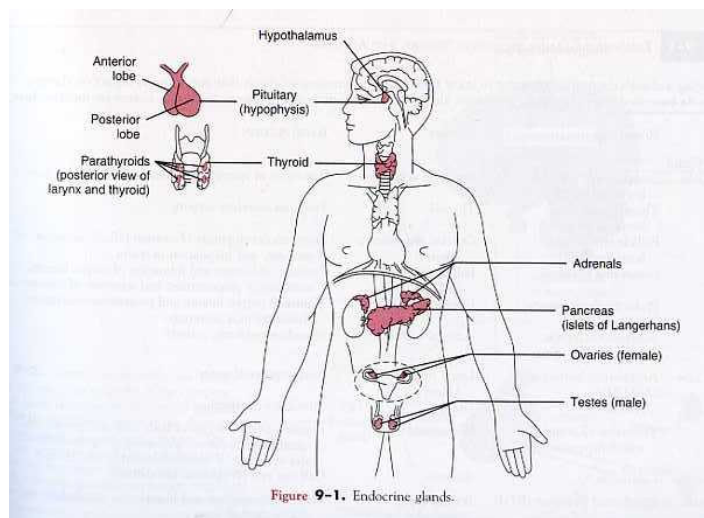
Metabolic Disorders

- Medical Management: Diagnosis
 - X-ray
 - Thinning cortical bone
 - At least 30% reduction of bone loss needed before showing on xray
 - CT's obtain baseline bone density levels

Most Common Fracture Sites:

- Vertebra
- Ribs
- Radius
- Femur

Endocrine Glands



Endocrine System

Glands capable of synthesizing and releasing hormones into the bloodstream to regulate and integrate body function

- Pituitary
 - Diabetes Insipidus, Acromegaly
- Thyroid
 - Goiter, hypo/hyper-thyroidism, neoplasms
- Adrenals
 - Addison's or Cushing's disease
- Pancreas
 - Diabetes Mellitus
 - Hyper/hypoglycemia
- Ovaries/Testes

Endocrine

- Five general functions:
 - Differentiation of reproductive and CNS development of the fetus
 - Stimulation of growth
 - Coordination of male and female reproductive systems
 - ***Homeostasis of internal environment***
 - Correction/adaptation to emergencies

Endocrine System

- Signs and Symptoms of Endocrine Disease
 - Pathology occurs as a result of excess (hyperfunction) or insufficiency (hypofunction)
 - The most common are observed in the musculoskeletal system
 - **Connective tissue structures** are influenced and sometimes controlled by hormones and metabolic processes
 - Structural and functional changes can occur

Signs/Symptoms of Endocrine Dysfunction

Neuromusculoskeletal	Systemic
RA symptoms	Excessive or delayed growth
Muscle weakness	Polyuria
Muscle atrophy	Polydipsia
Myalgia	Mental changes
Fatigue	Changes in hair
CTS	Changes in skin pigmentation
Synovial fluid changes	Changes in distribution of fat
Periarthritis	Changes in vital signs (increased BP, PR)
Chondrocalcinosis	Heart palpitations
Osteoarthritis	Increased perspiration
Hand stiffness	Kussmaul's breathing (deep/rapid)
Arthralgia	Dehydration or retention of body water

Endocrine System

Implications for the therapist:

- Monitor heart rate and BP
- Avoid heating with exercise
- Avoid manipulation over soft tissue surrounding thyroid
- Monitor easy fatigability

Endocrine Disorders

Implications for the therapist:

- Treat the pseudogout with aspiration, injection or medication and preserve joint function
- Hypothyroid and FM: depressed metabolism may explain fatigue/lethargy, noticeable in mornings, worse with weather changes of cold and rain
- Build exercise routine but watch for intolerance to activity, rhabdomyolysis
- *Musculoskeletal success will be poor without treatment of endocrine conditions.*

Endocrine Gland

- Pancreas: Acts as an endocrine gland secreting insulin and glucagon and as an exocrine gland producing digestive enzymes.
- Diabetes Mellitus: insufficient (type 1) or ineffective (type 2) insulin resulting in high blood glucose and an disruption in the metabolism of carbs/fats/proteins
 - Affects up to 20 million, 3x more likely in Blacks, Native American, Hispanics, 1/3 older than 60, male and female equally affected
 - Genetic, obesity, age and environmental factors

Diabetes

- Diabetes can cause changes in:
 - Cardiac function
 - Kidney Function
 - Vision
 - Nervous System
 - Vascular system

Endocrine Disorders

- Clinical signs include:
 - Increased atherosclerosis causing skin/nail changes, diminished pulse, and impaired wound healing
 - Infection higher because *hyperglycemia impairs resistance* and glucose content encourages bacterial growth

Endocrine Disorders

- **Clinical signs include:**
 - Neuromusculoskeletal complications include:
 - Sensory, motor, autonomic neuropathy predisposing to trauma and joint destruction
 - Other conditions include:
 - Flexion contractures
 - Flexor tenosynovitis
 - Adhesive capsulitis
 - RSD
 - DISH
 - Osteoporosis
 - Ulcerations

Endocrine Disorders

- Treatment includes control of food, insulin and activity
 - Overwhelming evidence shows exercise improves muscle glucose transport and whole body glucose homeostasis
 - Exercise increases carbohydrate metabolism (lowers blood glucose), maintains optimal body weight, increase HDL, decreases triglycerides, BP, stress

Endocrine System

Monitor complications which include:

- Autonomic neuropathy involving decreased max heart rate and increased resting heart rate
- Hypotensive episodes, *muscle damage from exercise*, heat intolerance, cold intolerance, foot ulcers

Endocrine System

- Hyperglycemia: If left uncontrolled or untreated, DM can progress to a state of severe hyperglycemia and a condition called DKA (Diabetic Ketoacidosis)
 - Lack of insulin to use the carbohydrates forces the body to use fats and proteins
 - Catabolizing fat for fuel gives rise to incomplete lipid metabolism
- Symptoms include:
 - Mild nausea to coma
 - Thirst
 - Polyuria
 - Progressive weakness
 - Dry mouth
 - Hot, dry skin
 - Fruity breath
 - Confusion
 - Rapid respiration

Endocrine Disorders

Hyperglcemia	Hypoglycemia
Diabetic KetoAcidois	Insulin Shock
Gradual onset	Sudden onset
H/A	Pallor
Thirst	Perspiration
Hyperventilation	Piloerection
Fruity breath	Inc . heart rate/palpitations
Lethargy/confusion/coma	Irritability
Abdominal pain	Weakness/Hunger
Dehydration/polyuria	Shakiness/H/A, Blurred vision
Flushed face, fever	Double vision/fatigue
Blood glucose > 300 mg/dl	Blood glucose <70 mg/dl

Endocrine System

Implications for the therapist:

- Recognize the symptoms of hypo/hyperglycemia
 - Patient may need to eat/drink something
 - May schedule therapy following meal times
- Understand role diabetes may play in prognosis
 - Delayed healing
 - Increased likelihood for ulcers/wounds
 - Peripheral neuropathy
 - Decreased balance/proprioception/fine motor coordination

Autoimmune Disorders

- Fibromyalgia
- Rheumatoid Arthritis
- Polymyalgia Rheumatica
- Systemic Lupus Erythematosus (SLE)
- Lyme Disease
- Multiple Sclerosis
- Ankylosis Spondylitis
- Guillain-Barre Syndrome
- Myasthenia Gravis



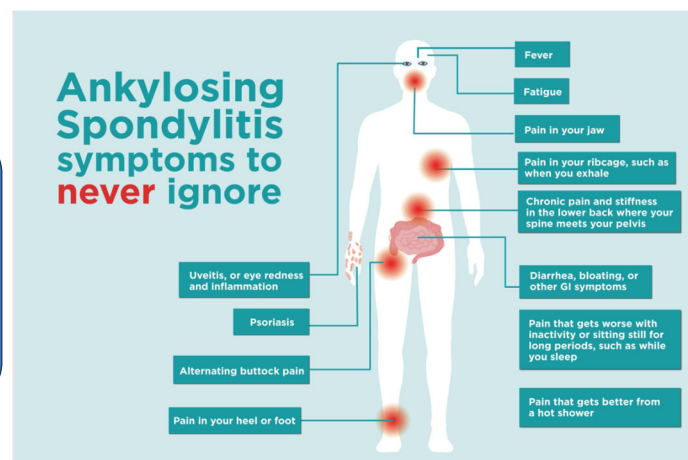
Global Clinical Presentation

- Rheumatic Disorders
 - Symmetric soft tissue joint/pain
 - Stiffness
 - Swelling
 - Weakness
 - Constitutional symptoms
 - Raynaud's phenomena
 - Sleep Disturbance

Ankylosing Spondylitis

- Inflammatory arthritis of spine/SI region

- Males 2:1
- Age < 40 y.o.
- Duration of symptoms > 3 months
 - Morning stiffness > 30 mins
- Pain increased with rest; decreased with exercise



Ankylosing Spondylitis

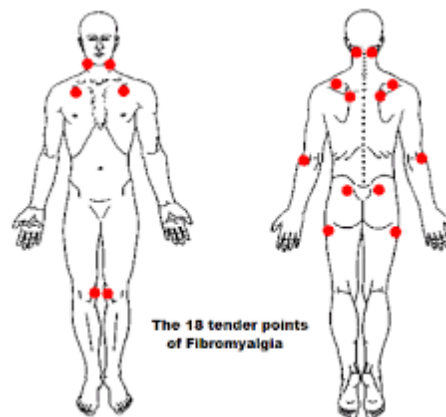
History	Sensitivity	Specificity
Age at onset <40	1.00	0.07
Pain not relieved by supine	0.80	0.49
Morning back stiffness	0.64	0.59
Pain duration >3 months	0.71	0.54
4 of 5 questions above positive	0.23	0.82

Remember: improved by exercise

Deyo RA, Jarvik JG. Diagnostic evaluation of low back pain with emphasis on imaging. *Ann Intern Med.* 2002;137:586-97.

Fibromyalgia

- Non-inflammatory condition
 - Generalized MSK pain with TTP globally
 - Females 2-5x more likely than males
- 18 “tender” points
 - Must report pain in 11/18 sites
 - Bilateral
 - Axial and appendicular



Autoimmune Disorders

Implications for the Therapist:

- Autoimmune disorders can cause MSK pain
- May need to be mindful of other factors that influence presentation
 - Activity level
 - Nutrition
 - Symptom Flares
- Education for management is critical
- Physical therapy is indicated for patients with auto-immune disease, but may need to refer and treat or consult with additional health care providers



Thank you!

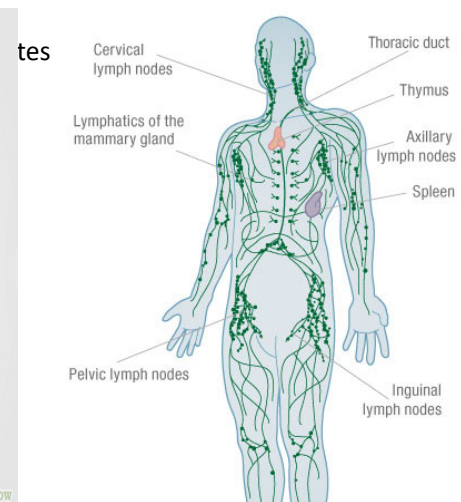
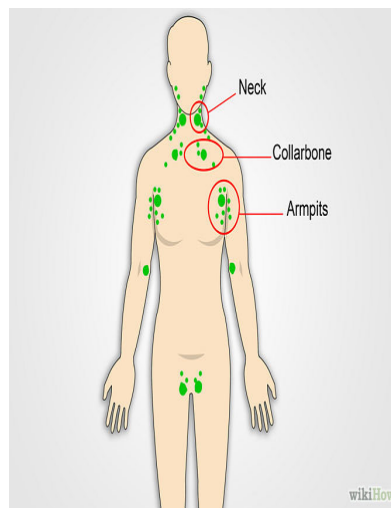


Medical Screening and Care Management

Lymphatic and Integument Systems

Lymphatic System

- Epitrochlear
- Supraclavicular
- Axillary
- Cervical
- Inguinal



Lymphatic System

- The immune and lymphatic systems are two closely related organ systems that share several organs and physiological functions.
- The immune system is our body's defense system against infectious pathogenic viruses, bacteria, and fungi as well as parasitic animals and protists (pathogens).
- The immune system works to keep these harmful agents out of the body and attacks those that manage to enter.

Lymphedema

- Implications for Treating Clinician
 - Active lymphedema may be a contraindication or precaution for manual therapy interventions
 - Exercise can be beneficial for lymphedema
 - Lymphedema may require specialized treatment including lymphatic massage, wrapping and fitting for garments

Integumentary System

- The following are some common skin disorders that should be recognized in therapy and considered as possible reasons for referral and further medical evaluation
 - Infectious skin disorders
 - Skin disorders associated with immune dysfunction

Skin

• **Infectious:**

- These include
 - *Bacterial* infections like impetigo and cellulitis,
 - *Viral* infections like herpes zoster and warts,
 - *Fungal* infections like ringworm and athlete's foot,
 - *Parasitic* infections like scabies and pediculosis (Lice)

Cellulitis



Skin - Shingles



Skin

Herpes Zoster: Shingles

- A local reactivation of the systemic disease called varicella (chicken pox).
- Often activated by an immunocompromised state.
- Pathogenesis:
 - Dormant in the cerebral ganglia of the cranial nerves III, V or the posterior nerve roots of other spinal nerves.
 - The virus multiplies, destroys the host neuron and spreads down the sensory nerve to the skin.
 - Reactivation cause is unknown.

Skin

- Herpes Zoster - Clinical manifestations:
 - Prodromal symptoms of pain and tingling along the dermatome.
 - Accompanied by fever, chills, malaise, GI disturbances.
 - Red papules form unilaterally around the thorax or vertically over the arm or legs

Skin

- Clinical manifestations:
 - Cr III involves eye pain, loss of vision.
 - C V involves facial palsy, loss of taste.
 - Other symptoms include constant or intermittent pain lasting days, weeks, years
- Diagnosis is based on clinical examination and recognition of lesions.
- Treatment: No cure. Symptomatic treatment for pain and itching.
- Prognosis is good unless infection spreads to the brain.

Skin - Lupus



Skin

- Lupus Erythematosus:
 - Chronic inflammatory disorder of the connective tissues.
 - It appears as discoid lupus, DLE, which affects only the skin or
 - SLE, which affects multiple organ systems including the skin.
 - Diagnosis is by history and rash.
- Etiology:
 - Unknown
 - Possible autoimmune defect with
 - Environmental
 - Hormonal
 - Genetic factors involved

Skin – Systemic Lupus Erythematosus (SLE)

- Pathogenesis:
 - Worsened by sunlight, direct or reflected, and
 - Florescent light
- Clinical manifestations:
 - Raised, red scaling, plaques, with coin like appearance. Appear on any exposed skin.
- Treatments are topical or systemic medications

Skin - SLE

- Clinical manifestations:
 - Malaise
 - Overwhelming fatigue
 - Fever
 - Arthritis
 - Facial butterfly rash
 - Photosensitivity

Skin - Psoriasis

- Etiology: Unknown, possibly hereditary. May be an immune system disorder.
- Precipitating factors include:
 - Trauma
 - Infection
 - Pregnancy
 - Aggravating factors include cold weather, anxiety

Skin - Scleroderma



Skin - Scleroderma

Clinical Manifestations:

- Raynaud's: blanching, cyanosis
- Skin: taut, shiny, thickened
- Joints and tendons: involvement of fingers, toes, may include larger joints. Tenosynovial involvement like carpal tunnel
- Skeletal muscle: diffuse atrophy due to limited motion.

Treatment:

- Symptomatic
- Medications: immunosuppressants, NSAID's
- Joint protection
- Exercise
- Stress management

Skin

Implications for the therapist:

- Infectious to those who have not had chicken pox but universal precautions should be used
- Heat and ultrasound should **not** be used. This may magnify severity of symptoms
- May need to modify hand placement for manual therapy interventions or exercise to avoid areas of skin irritation
- May need to consider PPE (especially gloves)

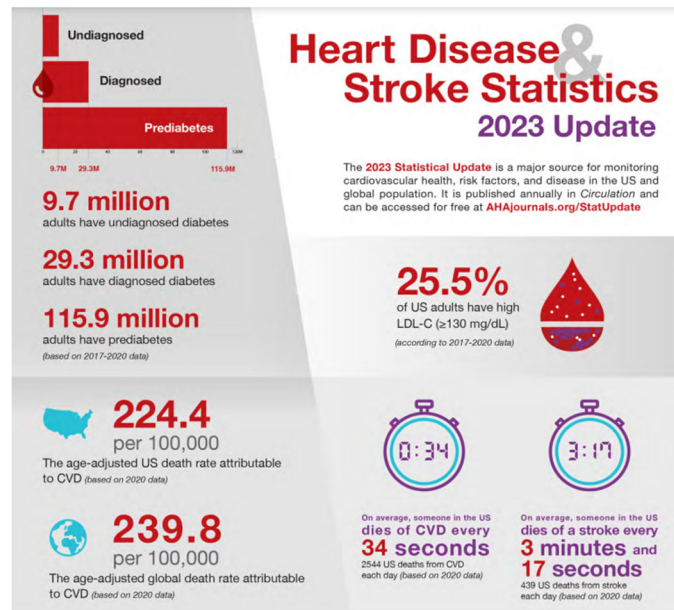


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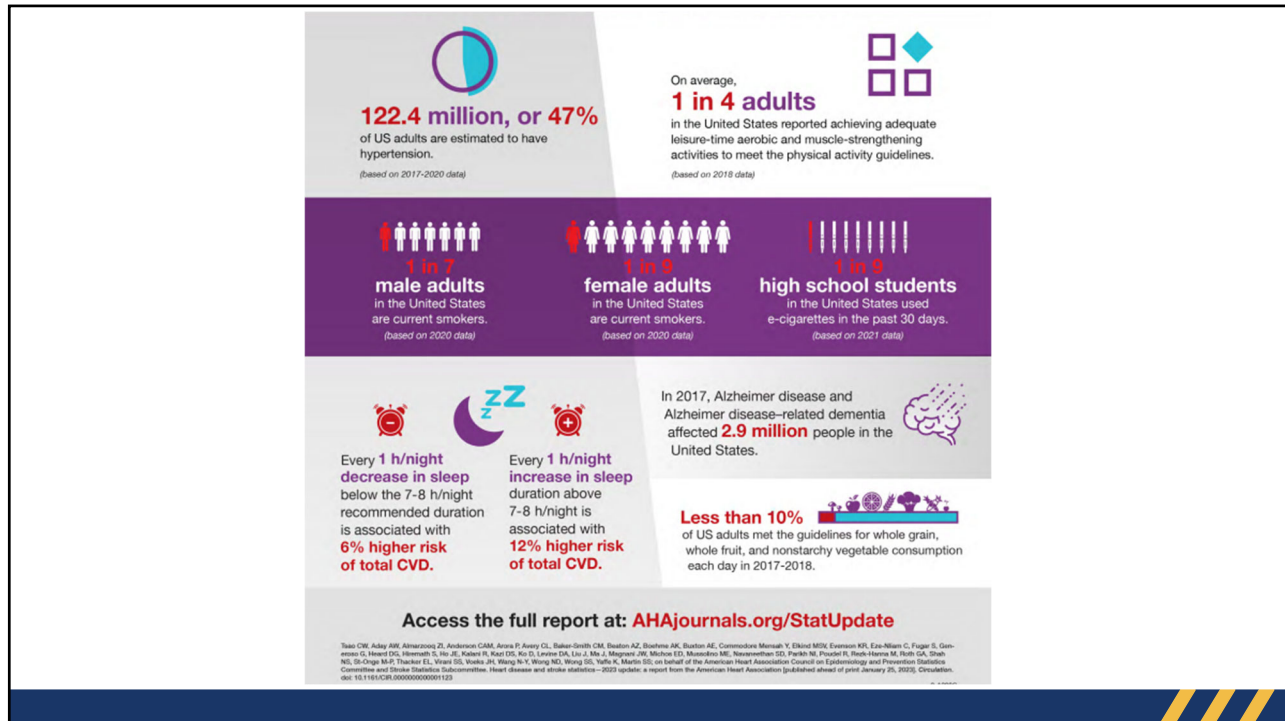


Medical Screening and Care Management

Cardiovascular System



Team CDE, Aday LA, Alramadan JI, Anderson CAM, Arora P, Avery CL, Baker-Smith CM, Beaton AZ, Bhatnagar SK, Bhatnagar AE, Commodore-Mensah Y, Elkind MSJ, Emerson KN, Ezzamel C, Flegal DM, Gosselin G, Head OD, Hreniath S, Ho JE, Kalkreuth R, Kazi DS, Ko D, Lavee DA, Liu J, Ma J, Maganti JM, Michos ED, Mussolino ME, Neenanathan SD, Parkh N, Poudyal R, Reddy-Hanna M, Roth GA, Shah NK, Shoghi B-F, Thacker EL, Vliet SJ, Wada JK, Wang B, Wang ND, Wang SJ, Yaffe K, Martin SS, on behalf of the American Heart Association Council on Epidemiology and Prevention, Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2023 update: a report from the American Heart Association [published ahead of print January 25, 2023]. *Circulation*. doi:10.1161/CIR.0000000000001123



Cervicoarterial : Vertebral Artery

- Non-Ischaemic Sy/Sx
 - Neck pain / occipital headache
 - C5 or C6 nerve root impairment (rare)
- Ischemic Sy/Sx (to name some of the most common)
 - **5 D's**: Dizziness, Diplopia, Dysarthria, Dysphagia, Drop attacks
 - **3 N's**: Nausea, Numbness (facial), Nystagmus
 - Ataxia
 - Hoarseness
 - Short-term memory loss
 - Hearing disturbance
 - Photophobia



Cervicoarterial: Internal Carotid Artery

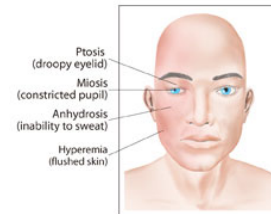
• Non-Ischemic Sy/Sx

- Head/Neck pain
- Horner's syndrome
- Pulsatile Tinnitus
- CN Palsies (most commonly 9-12):
 - Uvular displacement to strong side
 - Weak shoulder shrug
 - Tongue deviation to weak side when stuck out



• Ischemic Sy/Sx

- Hemiparesis: contralateral face, contralateral UE/LE
- Sensory loss: contralateral face, contralateral UE/LE
- Speech Impairments
- Visual loss/disturbance



Signs and Symptoms of Cardiac Disease

- Cardinal symptoms with implications to therapy:
 - Chest pain
 - Palpitations
 - Dyspnea
 - Fatigue
 - Syncope
 - Cough

**5Ds: Dizziness, Diplopia, Dysphagia, Drop Attacks,
Dysarthria**

3Ns: Nystagmus, Nausea, Numbness

Vascular Pathologies - Rushton 2020

Table 1: Range of vascular pathologies of the neck

Structure/site	Pathology	Symptoms/Presentation
Carotid artery	Atherosclerosis Stenotic Thrombotic Aneurysmal	Carotidynia ³ , neck pain, facial pain, headache, cranial nerve dysfunction, Horner's Syndrome, transient ischaemic attack (TIA), stroke
Carotid artery	Hypoplasia	Commonly silent, rare cerebral ischaemia
Carotid artery	Dissection	Neck pain, facial pain, headache, TIA, cranial nerve palsies, Horner's syndrome
Vertebral artery	Atherosclerosis	Neck pain, occipital headache, possible transient ischaemic attack (TIA), stroke
Vertebral artery	Hypoplasia	Commonly silent, rare cerebral ischaemia
Vertebral artery	Dissection	Neck pain, occipital headache, TIA, cranial nerve palsy
Temporal/ Vertebral/ Occipital/Carotid arteries	Giant cell arteritis	Temporal pain (headache), scalp tenderness, jaw and tongue claudication, visual symptoms (diplopia or vision loss – may be permanent)
Cerebral vessels	Reversible cerebral vasoconstriction syndrome (RCVS)	Severe 'thunderclap' headaches
Subarachnoid	Haemorrhage	Sudden severe headache, stiff neck, visual disturbance, photophobia, slurred speech, sickness, unilateral weakness,
Jugular vein	Thrombosis	Neck pain, headaches, fever, swelling around neck/angle of jaw
Any other cervico-cranial vessel	Vascular anomaly or malformation	Possible headache/neck pain i.e. un-ruptured carotid aneurysm

Risk Factors and Reported Symptoms - Rushton 2020

Table 2: Risk factors for dissection vascular events

Risk Factor - in order of most-to-least common	Dissection event (%)
Recent trauma	40 - 64
Vascular anomaly	39
Current or past smoker	30
Migraine	23
High total cholesterol	23
Recent infection	22
Hypertension	19
Oral contraception	11
Family history of stroke	9

Table 4: Reported symptoms for dissection events

Symptoms - in order of most-to-least common	Dissection vascular event %
Headache	81
Neck pain	57 - 80
Visual disturbance	34
Paraesthesia (Upper Limb)	34
Dizziness	32
Paraesthesia (face)	30
Paraesthesia (Lower Limb)	19

Table 3: Risk factors for non-dissection vascular events

Risk factor - in order of most-to-least common	Non-dissection event (%)
Current or past smoker	65 - 74
Hypertension	53 - 74
High total cholesterol	53
Migraine	19
Vascular anomaly	16
Family history of stroke	14
Oral contraception	9
Recent infection	9
Recent trauma (mild-moderate, which may include recent OMT)	7

Table 5: Reported symptoms for non-dissection events

Symptoms - in order of most-to-least common	Non-dissection vascular event %
Headache	51
Paraesthesia (Upper Limb)	47
Paraesthesia (Lower Limb)	33
Visual disturbance	28
Paraesthesia (face)	19
Neck pain	14
Dizziness	7

Table 6. Signs of Vertebrobasilar Artery (VBA) Dissection*

Signs, listed by frequency of occurrence	Percentage of presentation in VBA dissection
Unsteadiness, ataxia	67
Dysphagia, dysarthria, aphasia	44
Lower limb weakness	41
Upper limb weakness	33
Nausea, vomiting	26
Facial palsy	22
Dizziness, loss of equilibrium	20
Loss of consciousness	15

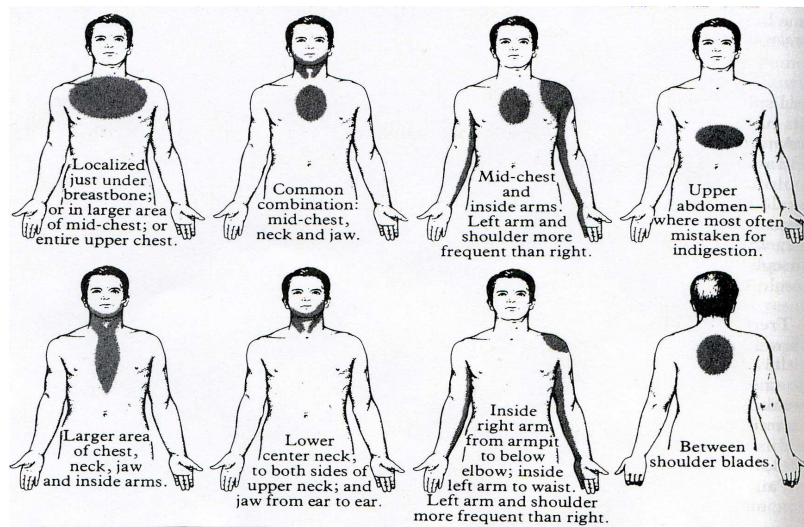
*Adapted from The International Framework for Examination of the Cervical Region for potential of vascular pathologies of the neck prior to orthopaedic manual therapy intervention (International Federation of Orthopaedic Manual Physical Therapists [IFOMPT] Framework, 2020).¹⁹

Table 7. Signs of Internal Carotid Artery (ICA) Dissection*

Signs, listed by frequency of occurrence	Percentage of presentation in ICA dissection
Ptosis	60-80
Upper limb weakness	65
Facial palsy	60
Lower limb weakness	50
Dysphagia, dysarthria, aphasia	45
Unsteadiness, ataxia	40
Nausea, vomiting	30
Loss of consciousness	20

*Adapted from The International Framework for Examination of the Cervical Region for potential of vascular pathologies of the neck prior to orthopaedic manual therapy intervention (International Federation of Orthopaedic Manual Physical Therapists [IFOMPT] Framework, 2020).¹⁹

Signs and Symptoms of Cardiac Disease



Most Common Symptoms of MI Men Vs Women

Men	Women
<ul style="list-style-type: none"> • Squeezing Chest pressure or pain • Jaw, neck or back pain • Nausea or vomiting • Shortness of breath 	<ul style="list-style-type: none"> • Chest pain, but not always • Pain or pressure in lower chest or upper abdomen • Nausea or vomiting • Shortness or breath • Fainting • Indigestion • Extreme fatigue

Signs and Symptoms of Cardiac Disease

Precautions in P.T.

- New onset of chest pain
- Discomfort in the upper body..chest, arm, neck, jaw
- Fainting, lightheaded
- Dyspnea, severe
- Nausea/vomiting



Signs and Symptoms of Cardiac Disease

- **Precautions in Treatment** – **Screen and refer for consult**
 - Severe leg claudication
 - Ataxia
 - Confusion, blank stare in response to questions
- **BP abnormalities:** with exercise a fall of 10mm HG systolic or a rise in systolic above 250 mm, or diastolic above 120 mm HG

Signs and Symptoms of Cardiac Disease

Implications for the Therapist:

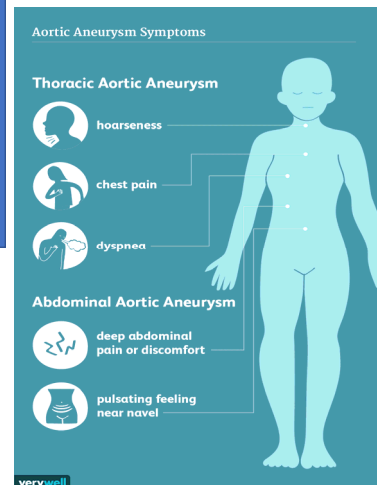
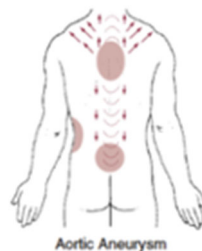
- Keep exercise intensity below symptoms
- Severely winded patient with 1 flight of stairs...notify M.D.
- Check vertebral artery for patients with syncope
- Check for fatigue beyond normal expectations
- Edema with >3 pounds/day weight gain over several days
- Monitor core temp, peripheral pulse, skin temp
- Monitor indigestion
- Heart rate > 130 BPM or <40 BPM

Abdominal Aortic Aneurysm (AAA)

- Palpable abnormal aortic pulse: -LR 0.22
 - Rules out of no palpable pulse
- Abdominal Aorta diameter
 - Normal 3.0cm or less
 - Small aneurysm <4.0 cm
 - Medium aneurysm 4.0-5.5cm
 - Large aneurysm >5.5 cm
- Larger aneurysm indicates greater risk for rupture
- **Suspicion of aneurysm warrants referral!**

Risk Factors:

- Male
- Age>65
- Tobacco Use
- Atherosclerosis
 - CAD/PAD
- Hypertension
- Family History
- Obesity



How Comfortable are Clinicians with Cardiovascular Screening?

- A study by Severin et al in 2019 surveyed 1812 outpatient physical therapists.
 - 51.38% reported that at least HALF of their current caseload included patients with diagnosed CVD or moderate risk for future occurrence
 - 14.8% of respondents report measuring BP and HR on initial exam for each new patient
 - Barriers reported for not taking vitals:
 - Lack of time (37.44%)
 - Lack of perceived importance (79.48%)

Peripheral Vascular Disease

Comparison of Arterial and Venous Insufficiency

Assessment	Arterial	Venous
Skin Color	Pale with limb elevated, rubor when limb dependent	Brawny; brownish-red pigmentation, cyanotic when dependent
Skin texture	Thin, shiny, dry; hair loss on leg, ankle foot Thickened, yellow, rigid toe nails	Stasis dermatitis, eczema, skin mottling, thickened skin
Skin temperature	Cool	Warm
Edema	Absent or mild, usually unilateral	Present, usually foot to calf. May be unilateral or bilateral
Pain	Pain in buttocks, hip, thigh or calf when walking which eases with rest. Worse while supine, decreases when limb is dependent	Ache, dull, vague, localized in lower leg and ankle. Relieved with walking, leg elevation and/or compression stockings
Pulses	Diminished or absent	Normal, although they may be difficult to feel through edema or thickened skin
Ulcers	Severely painful; involves toes or other bony prominences of foot Well-demarcated edges: eschar or necrotic tissue common	Mildly painful, develops at medial malleolus Irregular edges, base varies from granular to necrotic. May have excaudate.

Peripheral Vascular Disease

Arterial



Venous



Risk Factors for Peripheral Vascular Disease

- Diabetes
- High Cholesterol
- Hypertension
- Smoking
- Family history of PVD, stroke or CAD
- Obesity
- Sedentary Lifestyle
- Age > 65

Lower Quarter Peripheral Pulses

- **Femoral Artery**
 - fingertips of examining hand pressed firmly into femoral triangle
- **Popliteal Artery**
 - pt. supine, examiner's hands encircle and support knee , press deeply into popliteal space with fingertips
- **Dorsalis Pedis**
 - dorsum of the forefoot near the ankle
- **Posterior Tibial Artery**
 - just posterior to medial malleolus



Neurogenic vs Vascular Claudication

	Neurogenic	Vascular
Etiology	Men > age 50	Age > 50
Quality of Pain	Dull Ache, Cramping	Burning, Cramping
Low Back Pain	Present or history of LBP	Absent
Neuro signs	Frequently present	Absent
Arterial Pulses	Normal	Decreased or absent
Aggravating Factors	Standing, walking	Any exercise
Relieving Factors	Sitting, bending forward	Rest
Walking Uphill (TM test)	Symptom onset later	Symptom onset sooner
Bicycle Test	No symptoms	Provokes symptoms

Deep Vein Thrombosis (DVT)

- Commonly affects lower extremity, but can also be present in upper extremity
- Prevalence: 1.6 in 1000 per year
- Common sites:
 - Distal veins 40%
 - Femoral 20%
 - Popliteal 16%
 - Iliac 4%
 - Upper Extremity 10% of all DVTs

Risk Factors For DVT

- Surgery
- Hospitalization (>3 days bed rest)
- Caesarean Section
- Pregnancy or peri-partum
- Leg injury with reduced mobility x 3 days
- Active Cancer
- History of DVT
- Medical conditions including IBS and SLE

Probability of DVT

Box 2: Pre-test probability scores for DVT^{10,13}

Wells score (1997)

- Active cancer (treatment ongoing or within 6 months, or palliative) +1 point
- Paralysis, paresis, recent immobilisation of the lower limbs +1 point
- Recently bedridden for >3 days, or major surgery within 4 weeks +1 point
- Localised tenderness along distribution of deep venous system +1 point
- Entire leg swelling +1 point
- Calf swelling, >3 cm, compared with asymptomatic leg +1 point
- Pitting oedema (greater in symptomatic leg) +1 point
- Collateral superficial veins (non-varicose) +1 point
- Alternative diagnosis as likely, or more likely, than DVT -2 points

Modified Wells score (2003)

Scoring criteria as for Wells Score, with the addition of
Previous documented DVT +1 point

Interpretation

Wells score ≥ 3 high, 1-2 moderate, 0 low probability
Modified Wells score ≥ 2 likely DVT, < 2 DVT unlikely

Testing:DVT

- **Low Probability: D-Dimer lab**
 - Negative Predictive Value 99%
 - Positive test: Compression Ultrasound
- **Moderate/High Probability: Compression Ultrasound**
 - Sensitivity and Specificity: 95% for DVT detection

May need to refer back to MD prior to
treatment

DVT Clinical Decision Making

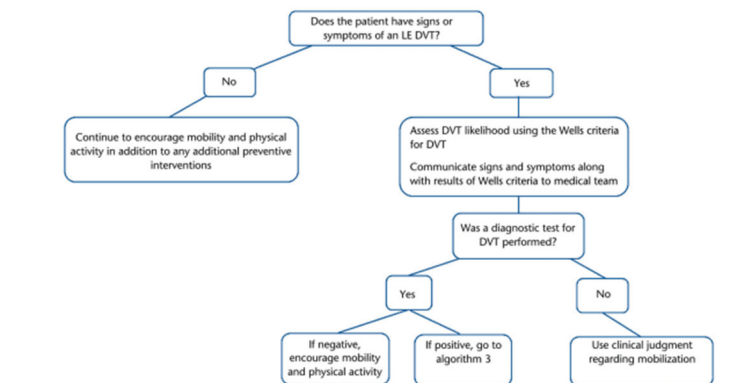


Figure 2.
Algorithm for determining likelihood of a lower extremity deep vein thrombosis (LE DVT). DVT=deep vein thrombosis.

Vascular

Implications to the Therapist:

- Recommendation for patients with claudication is a supervised exercise training program 3x week for 12 weeks including an aggressive walking program for 30 to 45 mins per day (Gardner et al 2010, Schmidt-Trucass 2011)
 - When claudication occurs patients should be instructed to walk a little further then stop, wait for symptoms to pass and then continue walking
- Hand placement for manual therapy may have to be adjusted in presence of ulcers or lower extremity pain due to PVD
- Proper footwear for patient is important
- Lower extremity including foot should be inspected by therapist in presence of PVD
- Recognize risk factors for DVT and communicate with medical team



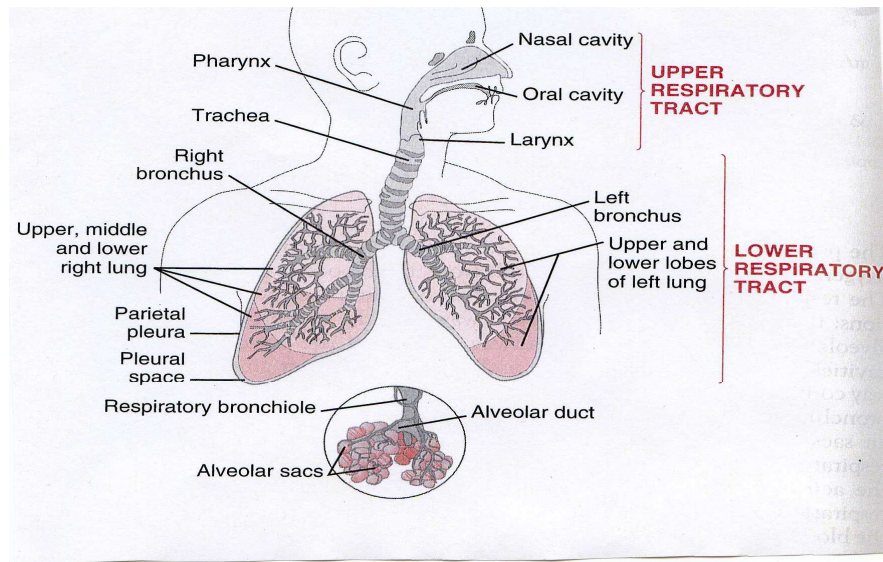
Thank you!



Medical Screening and Care Management

Respiratory System

Respiratory System



Respiratory System

- Pulmonary diseases provide many signs and symptoms that may be seen in any therapy setting
- The pulmonary diseases are classified as
 - acute or chronic
 - obstructive or restrictive
 - infectious or non infectious

Respiratory System

• Diseases include:

- Respiratory acidosis/alkalosis
- Acute/chronic bronchitis
- Emphysema
- Asthma
- Pneumonia
- TB
- Lung cancer
- Paraneoplastic syndrome
- Cystic fibrosis
- Pulmonary Embolism
- Pleurisy

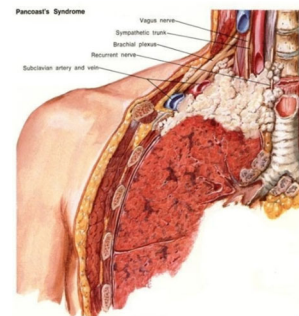
Pancoast Tumor

- Lung cancer that is limited to the apical segment of either lung
- Metastasis to adjacent structures such as subclavian vessels, brachial plexus, second and third rib
 - Often present with C8/T1 pain pattern

• Symptoms include:

- Severe shoulder pain radiating to axilla
- Pain/paresthesia radiating down to ulnar border of hand (55-60%) (C8-T1 dermatomes)
- Atrophy of hand and arm muscles (thenar/hypothenar mm)
- Horner's syndrome (30%)
 - Unilateral constricted pupil, ptosis, loss of facial sweating
- Edema or discoloration due to compression of blood vessels

History of smoking
Asbestos Exposure
Male>Female
Ages 40-60



Pulmonary Embolism (PE) Clinical Prediction Rule - Gibson 2008

Clinical Finding	Odds Ratio
Clinical signs and symptoms of DVT	5.8
Tachycardia (>100 bmp)	3.0
Immobilization or surgery in previous 4 weeks	2.5
Previous DVT/PE	2.4
Hemoptysis	2.4
Malignancy	2.3
An alternative diagnosis is less likely than PE	4.6

Revised Geneva PE Clinical Prediction Rule - Le Gal 2006

Clinical Finding	Score
Age >65	1
Previous DVT or PE	3
Surgery or fx (LE) within 1 month	2
Active or malignant condition (within last year)	2
Unilateral lower limb pain	3
Hemoptysis	2
Heart Rate	
75-94 bmp	3
>95 bmp;	5
Pain on LE deep vein palpation and unilateral edema	4

Probability of PE

- 0-3: Low 9%
- 4-10: Moderate 38%
- >=11: High 72%

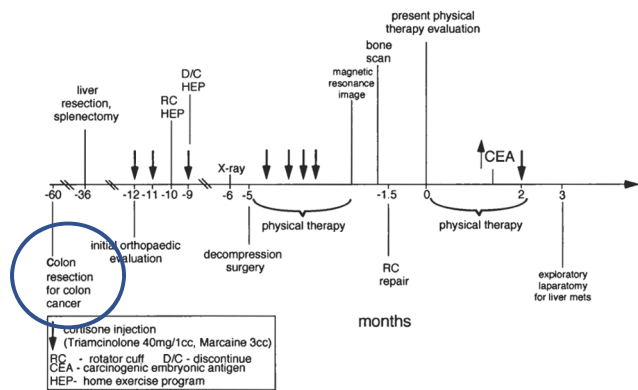
Diaphragm

- Referral Pattern C4-Left Shoulder
 - Innervated by Phrenic nerve (C3-5)
- May also cause chest pain
- Symptoms
 - Discomfort and SOB after eating
 - Difficulty taking deep breath
 - “Stich” in the side during exercise
 - Pain in chest or lower ribs
 - Pain with sneezing or coughing



Case Study

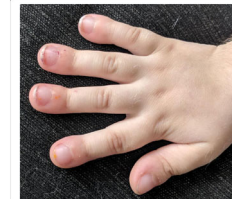
- JOSPT 2001
- 63 y.o. female referred for prolonged left shoulder pain
- RCR reduced symptoms from 9/10 to 7/10
- Abdominal exploratory surgery revealed infiltration of adenocarcinoma along the dome of the left hemi-diaphragm



Respiratory System

The most common symptoms include:

- Cough
- Dyspnea
- Chest pain
- Abnormal sputum
- Hemoptysis
- Cyanosis
- Clubbing
- Altered breathing patterns



Respiratory System

•Cough

- **Persistent dry cough**: caused by tumor, congestion, allergies
- **Productive cough**: with purulent sputum indicates infection, non purulent sputum indicates irritation
- **Hemoptysis**: indicates infection, inflammation, abscess, tumor, infarction

•Dyspnea:

- SOB from inadequate ventilation or insufficient amounts of oxygen in the blood
- Factors include increased work of breathing, respiratory muscle fatigue, decreased reserve, strong emotion
- **Orthopnea is dyspnea lying down**, caused by a redistribution of body water

Respiratory System

Chest pain:

- Sharp, stabbing chest pain increased with breathing
 - Pain can originate in the pleura, airways, chest wall
 - Caused by pleurisy, pneumonia, pulmonary infarct, tumor, spontaneous pneumothorax
 - Pain can be substernal, or over the lungs anterior, lateral, posterior. Also can radiate to the neck, upper traps, costal margins, scapula, shoulder with radiation down the medial arm
 - Pleural irritation can be sharp with any breathing and is alleviated with lying on it to diminish motion

Pneumothorax

- Can occur spontaneously or secondary to trauma
 - Primary
 - Secondary
- Symptoms
 - Shortness of breath
 - Acute Chest Pain
 - Decreased blood pressure
 - Decreased O2 saturation
 - Increased HR

Risk Factors:

- Males > Females
- Ages 20-40
- Tall/thin build
- Underlying lung disease
 - Smoking
- Previous pneumothorax

Respiratory System

- **Cyanosis:**

- Caused by decreased oxygenation from pulmonary or cardiac restriction, cold temperature, anxiety
- Central cyanosis – bluish discoloration of mucous membranes in the mouth and lips
- Peripheral cyanosis – in the nail beds

- **Clubbing:**

- Thickening/widening of the DIP's
- Change in the angle of the nail bed from <160 degrees to 180 degrees
- Caused by an interference in oxygenation from cystic fibrosis, lung cancer, bronchiectasis, pulmonary fibrosis, congenital heart disease, lung abscess, liver disorders, GI disorders



Respiratory System

- **Clinical signs and symptoms**

- First signs are paresthesias and feelings of numbness
- Rapidly progressive weakness for 3-7 days
- Symmetrical, involves LE first, then UE, then respiratory muscles
- Facial nerve may be involved
- Deep tendon reflexes are decreased or are lost early



Respiratory System

Implications for the therapist:

- Must assess the muscles of respiration including the abdominals, intercostals, diaphragm that are involved in normal respiration
- Assess rib and thoracic mobility as it relates to breathing
- Improve functional outcomes by improving pulmonary potential
- Teach diaphragmatic breathing
- Musculoskeletal causes of pain must be differentiated from cardiac, pulmonary, epigastric
- Precautions for chest therapy include: fragile ribs, burns/open wounds in the thoracic area, pulmonary edema, CHF, spinal laminectomies/fusions
- Contraindications for chest therapy include: untreated pneumothorax, hemoptysis, hypo/hypertension, arrhythmias, head/neck injury



Respiratory System

Implications for the therapist:

- Coughing can exacerbate MSK symptoms
- May need to monitor Oxygen
- Watch for Valsalva or holding breath
- Patient may require more rest breaks to catch their breath
- Patient may be unable to lie supine or prone; may prefer to be inclined





Thank you!



Medical Screening and Care Management

Vitals and Exercise Parameters



Heart Rate

Vital Sign	Normal Range	Implications
Heart Rate (bpm)	60-100 bpm	<p><60 bpm</p> <ul style="list-style-type: none">• No action if asymptomatic• Refer to physician if symptomatic• Symptoms may include: shortness of breath, chest pain, fatigue, confusion, dizziness, lightheadedness, syncope <p>120-150bpm</p> <ul style="list-style-type: none">• Precaution in initiating activity/exercise• Refer to physician <p>>150 bpm</p> <ul style="list-style-type: none">• Contraindication to initiating activity/exercise• Refer to physician immediately• Symptoms include: shortness of breath, chest pain, heart palpitations, dizziness, lightheadedness, syncope <p>With Exercise/Activity</p> <ul style="list-style-type: none">• Increases in proportion to workload• Significant drop is indication to stop exercise• Monitor HR recovery

HR Recovery (HRR)

- Following exercise, 1-minute HRR of at least 20 bpm is the goal

Heart Rate Recovery-Heart Beats lowered in 1st Minute Following Exercise

Great
30 or higher

Good
20-29

Fair
14-19

Needs
Improvement
12-13

Needs Significant
Improvement
Less than 12

Target HR During Exercise

Age	Target HR Zone 50-85%	Average Maximum Heart Rate, 100%
20 years	100-170 beats per minute (bpm)	200 bpm
30 years	95-162 bpm	190 bpm
35 years	93-157 bpm	185 bpm
40 years	90-153 bpm	180 bpm
45 years	88-149 bpm	175 bpm
50 years	85-145 bpm	170 bpm
55 years	83-140 bpm	165 bpm
60 years	80-136 bpm	160 bpm
65 years	78-132 bpm	155 bpm
70 years	75-128 bpm	150 bpm

Max HR=220-Age

Target HR for moderate intensity activities should be 50-70% max HR

Target HR during vigorous activity is 70-85% of max HR

Blood Pressure

Vital Sign	Normal Range	Implications
Blood Pressure (mmHg)	Normal <120/80 mmHg	<p><90/60 mmHg Hypotension</p> <ul style="list-style-type: none"> Monitor for symptoms including dizziness, lightheadedness, syncope, nausea, fatigue Drop in systolic BP >10mmHg may be indication to stop exercise <p>>140/90 mmHg Hypertension</p> <ul style="list-style-type: none"> Precaution for exercise Monitor for symptoms including chest pain, shortness of breath, nausea, dizziness Monitor for elevation of BP > 150/100 <p>>180/110 mmHg</p> <ul style="list-style-type: none"> Contraindication. Do not exercise Refer to physician
	Elevated 120-129/80 mmHg	
	Hypertension Stage 1 130-139/80-89	
	Hypertension Stage 2 >140/90	

02 Saturation

Vital Sign	Normal Range	Implications
SpO2	>90%	<p>86-89%</p> <ul style="list-style-type: none"> • Consider adding or increasing supplemental oxygen • Stop exercise if patient does not have supplemental oxygen and work on breathing • Refer to physician if previously undiagnosed <p><85%</p> <ul style="list-style-type: none"> • Add or increase supplemental oxygen • Contraindication to initiating activity/exercise • Refer to physician if SpO2 remains <90% <p>With Exercise/activity</p> <ul style="list-style-type: none"> • Should remain >90% • 86-89% relative indication to stop exercise • <85% absolute indication to stop exercise

Glucose

Vital Sign	Normal Range	Implications
Glucose	<p>Fasting:70-100 mg/dL</p> <p>2-3 hours post-meal:90-150 mg/dL</p>	<p>>200 mg/dL Hyperglycemia</p> <ul style="list-style-type: none"> • Decreased tolerance to exercise activity • Monitor symptoms throughout exercise <p>>270mg/dL</p> <ul style="list-style-type: none"> • Exercise is contraindicated <p><70 mg/dL Hypoglycemia</p> <ul style="list-style-type: none"> • May be a contraindication to exercise if symptoms are present including feeling shaky, weak, dizzy or confused • Patient may need to have fruit juice or a piece of candy to elevate blood sugar

Contraindications for Initiating Exercise

Absolute Exercise Contraindications

- Unstable angina
- Acute or suspected major cardiovascular event (MI, Pulmonary Embolism, Dissecting aneurysm, Myocarditis)
- Acute infection
- HR>150 bpm
- BP >180/110mmHg
- SpO₂<85%

Relative Exercise Contraindications

- Known cardiac disease
- BP>150/100
- HR>100 bpm
- SpO₂<90%
- Uncontrolled metabolic disease
- Mental or physical impairment leading to inability to exercise safely

Indications for Stopping Exercise

Absolute Indications for Stopping Exercise

- Drop in systolic BP of >10mmHG from baseline accompanied by symptoms
- Moderately severe angina (>2/4 on angina scale)
- Signs of poor perfusion
 - Numbness, and tingling
 - Coldness in limbs
 - Discoloration
 - Cramping

Relative Indications for Stopping Exercise

- Drop in systolic BP of >10 mmHg without symptoms
- Increasing chest pain
- Hypertensive response (systolic BP>200 mmHg, diastolic >100 mmHg)
- Fatigue, shortness of breath, leg cramps, claudication
- Dizziness, lightheadedness or disorientation

Symptom Scales

Angina Scale

- 1-Mild, barely noticeable
- 2-Moderate, bothersome
- 3-Moderately severe, very uncomfortable
- 4-Most severe or intense pain ever experienced

Dyspnea Scale

- 1-Mild, barely noticeable
- 2-Moderate, bothersome
- 3-Moderately severe, very uncomfortable
- 4-Most severe or intense dyspnea ever experienced

Claudication Scale

- 1-Definite discomfort or pain, but only at initial or modest levels (established, but minimal)
- 2-Moderate discomfort or pain from which the patient's attention can not be diverted (i.e. by conversation)
- 3-Intense pain (short of grade 4) from which the patient's attention can not be diverted
- 4-Excruciating and unbearable pain

Rating of Perceived Exertion (RPE)

- | | |
|------------------|--------------------|
| 0-Nothing at All | 6 |
| 1-Very Light | 7-Very Hard |
| 2-Fairly Light | 8 |
| 3-Moderate | 9 |
| 4-Somewhat hard | 10-Very, Very Hard |
| 5-Hard | |

Vitals and Exercise Parameters

Implications for the Therapist:

- Taking baseline vitals (HR, BP, O₂) is essential, especially for our patients with complex medical histories
- Monitor patient symptoms
 - Significant shortness of breath, chest pain, dizziness, lightheadedness could indicate a medical problem and are not a normal response to exercise
- Consider performing a sub-max test such as a 2-minute step test to determine patients aerobic capacity and HR recovery
- Can use Rate of Perceived Exertion to monitor patient and to guide exercise prescription
- May consider time of therapy appointment based on meal schedule or medication schedule



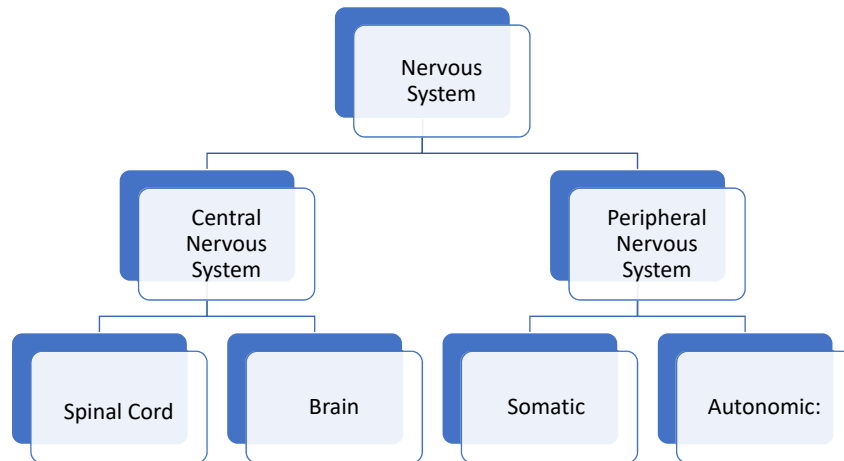
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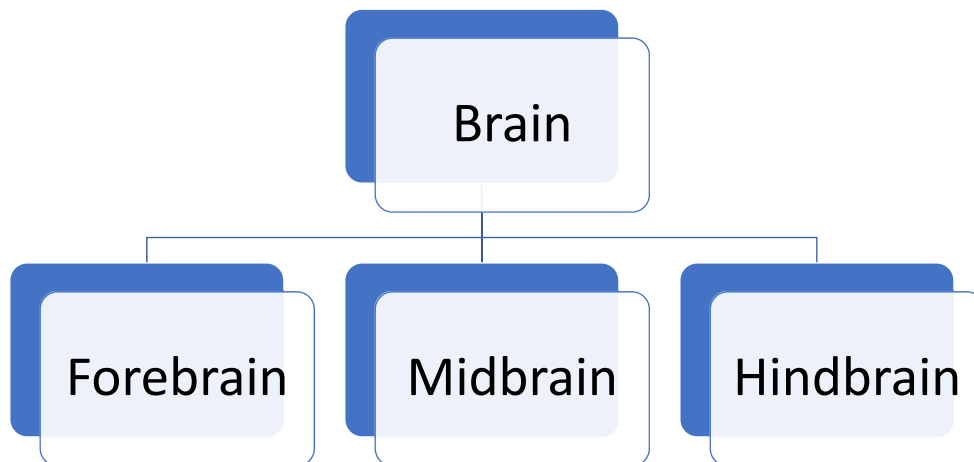
Medical Screening and Care
Management

Nervous System

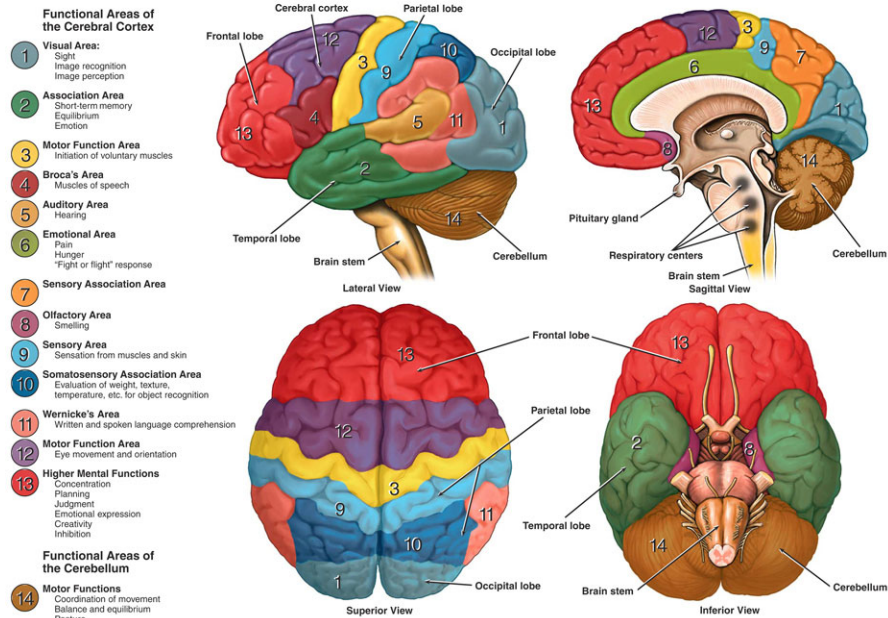
Brain Disorders



Brain Disorders

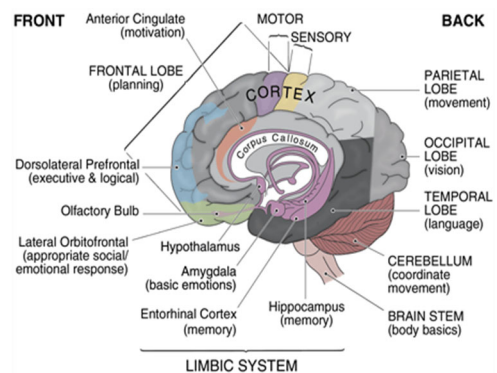


Anatomy and Functional Areas of the Brain



Brain Disorders

- Cerebrum includes
 - **Frontal-** supervises, plans, directs, reasoning, problem solving
 - **Temporal-** memory, understanding, recognition, temper control, hearing, language
 - **Occipital-** visual processing
 - **Parietal-** sensory processing of taste, touch, pain, temperature also language, memory



Brain Disorders

- Limbic System (Bonding and mood control) includes:
 - Cingulate gyrus-gear shifting
 - Hippocampus- emotional responses, spatial orientation, short term to long term memories
 - Amygdala- memory, emotion, fear
 - Basal ganglia-idling speed
 - Thalamus-sensory processing, motor function
 - Hypothalamus-emotion, thirst, hunger, body temperature, biorhythms, control of ANS

Cognition and Memory

- Aging as well as disease pathology can create cognitive or memory impairments
- Consider how interventions including education may be adapted to a patient with dementia
- A patient with cognitive impairments may:
 - Have difficulty following directions
 - Have difficulty with verbal instructions
 - Have difficulty counting reps or staying on task
 - Have difficulty providing meaningful information about their pain experience
- For patients post-stroke or post-concussion, we may provide interventions to train cognitive function
 - Dual-task challenges
 - Counting or naming tasks during an activity/exercise

Cognition and Memory



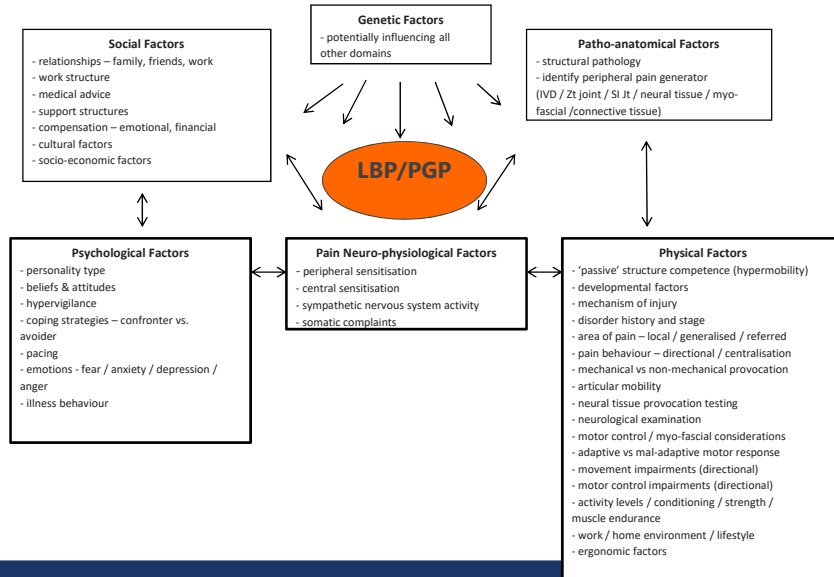
- Your patient is a 78 y.o. male who you are treating for spinal stenosis. He also has clear signs of early stages of dementia which is being monitored by a neurologist. The patient lives at home with his wife who assists him as needed.
- On the initial evaluation, the wife was present and did have to provide some subjective history information as the patient could not recall many details. You also had to repeat instructions several times during the objective exam do to patient not understanding initial instruction.
- Consider how you might plan for follow up treatment sessions to enhance the patient experience and meet goals for this patient

Pathways

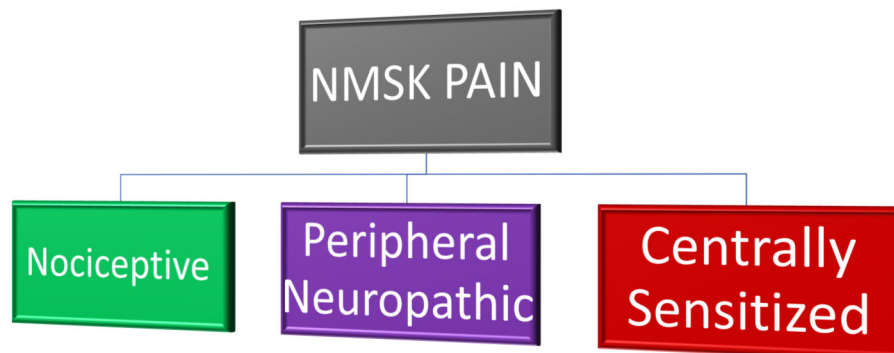
- Emotional and sensory components are completely blended
- Allodynia
 - Pain from non noxious stimulation
- Spontaneous pain
 - Pain with no stimulation at all
 - Arises after persistent tissue damage due to sensitization of the damaged area and spread to localized area
- Persistent pain
 - After tissue has healed:
 - Changes in the nerve endings of pain fibers
 - Changes at the dorsal horn

Considerations as drivers of the pain experience

O'Sullivan P. Diagnosis and classification of chronic low back pain disorders: Maladaptive movement and motor control impairments as underlying mechanisms. *Manual Therapy* 10 (2005) 242–255



Mechanism-Based Classification of Pain



Types of Pain

Central Sensitization	Peripheral Neuropathic Pain (Back Pain +Leg Pain)	Nociceptive Pain
1. Disproportionate, non-mechanical, unpredictable pain pattern 2. Pain disproportionate to the nature and extent of injury or pathology 3. Strong association with maladaptive psychosocial factors (negative emotions, poor self-efficacy, maladaptive beliefs)	1. Pain referred in a dermatomal or cutaneous distribution 2. History of nerve injury, pathology of mechanical compromise	1. Pain localized to the area of injury/dysfunction 2. Clear, proportionate mechanical/anatomical nature to pain presentation 3. Absence of burning, shooting, or electric shock pain
Diffuse/non-anatomic areas of pain and tenderness to palpation	Pain/symptom provocation with mechanical movement tests (A/PROM, neurodynamic) that load or compress neural tissue	Usually intermittent and sharp with movement/mechanical provocation. May be more dull/constant ache at rest

Nociceptive Cluster

- Present:
 - Intermittent
 - Dull or achy at rest, but often sharp with provocation
 - Localized to a specific area, but possibly with somatic referral
 - Clear, and proportionate agg/ease variables
- Absent:
 - Descriptions such as “burning”, “shooting”, or “shocking”
 - Other associated dysesthesias (crawling, electrical, heavy)
 - Night pain/disturbed sleep
 - Abnormal postures or movement patterns

Nociceptive Pain Cluster	
Sn	91%
Sp	91%
-LR	.10
+LR	10

Peripheral Sensitization

- Increased responsiveness and reduced threshold of nociceptive neurons in the periphery to the stimulation of their receptive fields.
- Reduction in threshold and an amplification in the responsiveness of nociceptors that occurs when the peripheral terminals of these high-threshold primary sensory neurons are exposed to inflammatory mediators and damaged tissue
- **Restricted to site of injury**

Latremoliere A, Woolf C. Central Sensitization: A Generator of Pain Hypersensitivity by Central Neural Plasticity. *J Pain*. 2009; 10(9): 895-926.

Peripheral Neuropathic Cluster

- History of nerve injury, pathology, or mechanical compromise
- Pain referred in a **dermatomal** or **peripheral nerve** distribution
 - i.e. cervical/lumbar radiculopathy
 - Pronator teres syndrome
 - Sciatica
- Symptom provocation with tests that move/load/compress neural tissue

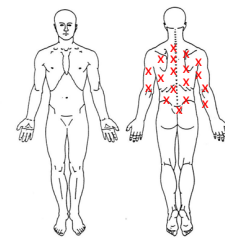
Peripheral Neuropathic Pain Cluster	
Sn	86%
Sp	96%
-LR	.14
+LR	22

Central Sensitization

- Pain disproportionate to nature or extent of injury
- Widespread and Diffuse/non-anatomic areas of pain/tenderness to palpation
- Maladaptive psychological factors
- Pain persisting beyond expected tissue healing/pathological recovery times
- History of failed interventions (medical/surgical/therapeutic)
- Pain in association with high levels of functional disability
- More constant/unremitting pain
- Night pain/disturbed sleep
- Unpredictable pattern of pain provocation in response to agg/ease factors

Centrally Sensitized Cluster

- Pain disproportionate to nature/extent of injury or pathology
- Non-mechanical, disproportional, or unpredictable patterns of pain provocation
- Presence of maladaptive psychosocial factors
- Diffuse and widespread tenderness to palpation



Centrally Sensitized Pain Cluster	
Sn	92%
Sp	98%
-LR	.08
+LR	41

Factors that influence pain and prognosis

- Pain beliefs
- Depression
- Anxiety
- Loneliness/Isolation
- Social Support
- Stress
- Sleep
- Diet and Exercise

Implications for Therapist

- Pain Neuroscience Education as an intervention may be a tool to **complement** a multi-modal treatment approach for patients with chronic, centrally mediated pain
 - Graded Motor Imagery
 - Laterality Training
 - Mirror Therapy
- Consider complexity of tasks and instructions for patients with cognitive deficits – **Meet the patient where they are**
 - Can train cognitive function



What and when to screen?

Cranial Nerves

	Cranial Nerve	Function
I	Olfactory	Sensory-smell
II	Optic	Sensory-vision
III	Oculomotor	Motor-eye movements and pupillary constriction
IV	Trochlear	Motor-eye movements (downward gaze)
V	Trigeminal	Sensory-sensation of face and mouth Motor-muscles of mastication
VI	Abducens	Motor-eye movements (abduction or lateral movements)

Cranial Nerves

	Cranial Nerve	Test
VII	Facial	Sensory-taste anterior tongue Motor-muscles of facial expression
VIII	Vestibulocochlear	Sensory-hearing and balance (equilibrium)
IX	Glossopharyngeal	Sensory-sensation of posterior tongue and pharynx Motor-carotid baroreceptors and salivary glands
X	Vagus	Sensory-sensation from larynx and pharynx Motor-muscles of vocal cords, swallowing
XI	Accessory	Motor-shoulder and neck muscles
XII	Hypoglossal	Motor-movements of tongue

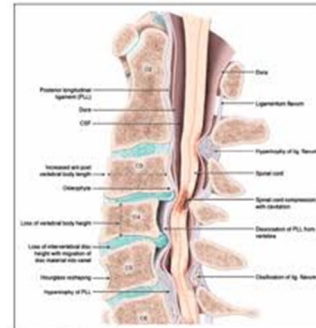
Cranial Nerves

• Indications for Cranial Nerve Screen:

- Changes in vision
- Smell
- Hearing
- Changes in balance
- Dizziness (PRN)
- Change in affect
- Difficulty swallowing
- Facial numbness or paralysis

Cervical Myelopathy

- Most common over the age of 60
- Compression of Spinal Cord
 - Cervical stenosis (most common)
 - Space occupying lesion
 - Disease
- **Common Symptoms:**
 - Distal weakness
 - Decreased ROM in the cervical spine, especially extension.
 - Clumsy or weak hands
 - Pain in shoulder or arms
 - Unsteady or clumsy gait
 - Increased reflexes in the lower extremities and in the upper extremities below the level of the lesion.
 - Numbness and paresthesia in one or both hands (bilateral symptoms)



Source: Kalia et al., 2016

- MRI is gold standard for diagnosis

Cervical Myelopathy

Cook 2010 TIC:

- $\leq 1/5$ positive:
 - Sn = 94%
 - -LR = 0.18
- $\geq 3/5$ positive:
 - Sp = 99%
 - +LR = 31

<u>Factors</u>
Age >45
(+) Hoffman's Sign
(+) Babinski Reflex
Gait Deviation
(+) Inverted Supinator Sign

Upper vs Lower Motor Neuro Signs

Feature	Upper Motor Neuron Lesion	Lower Motor Neuron Lesion
Site of Lesion	Cerebral hemispheres, cerebellum, brainstem, spinal cord	Anterior horn cell, nerve roots, peripheral nerves, neuromuscular junction
Muscle Weakness	Quadriplegia, hemiplegia, diplegia, paraplegia	Proximal (myopathy), Distal (neuropathy)
Muscle Tone	Spasticity, Rigidity, Minimal to no atrophy	Hypotonia, Flaccid, Atrophy/mm wasting present
Fasciculations	Absent	May be Present
Tendon Reflexes	Hyperreflexia	Hyporeflexia
Pathological Reflex	Babinski, Hoffman, Clonus	Absent

Nervous System

Implications for the Therapist:

- Perform neuro screening when appropriate
 - Dermatomes, Myotomes, Reflexes
 - Cranial Nerve Screen
 - Motor Neuron Screen
- Altered sensation, proprioception or cognition may require adaptation for treatment
- The nervous system often impacts the musculoskeletal system



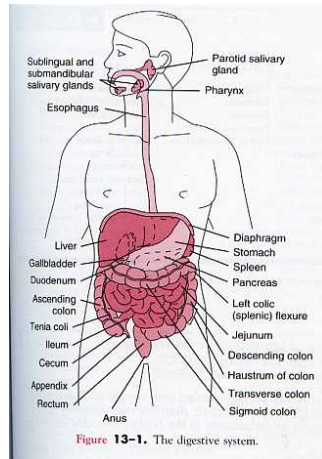
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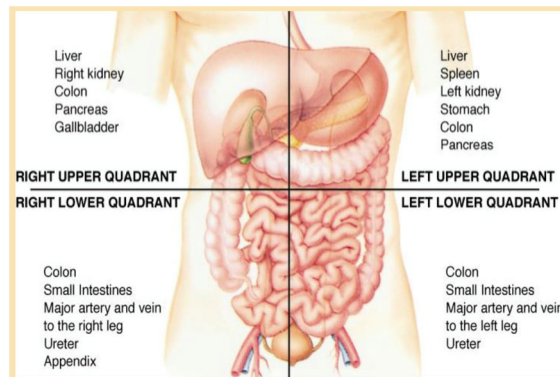
Medical Screening and Care
Management

Gastrointestinal System

Gastrointestinal System



Abdominal Cavity



GI System

- GI signs and symptoms
 - **Primary GI symptoms:** nausea and vomiting, diarrhea, anorexia, constipation, dysphagia, achalasia, heartburn, **abdominal pain, LBP, GI bleeding, incontinence**
 - **Secondary (constitutional) symptoms:** n/v, diarrhea, malaise, **fatigue**, night sweats, pallor, diaphoresis, **dizziness**
- Risk Factors: High fat diet, malnutrition, chronic NSAID use, trauma

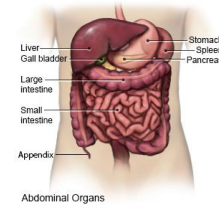
GI System

Implications for the therapist:

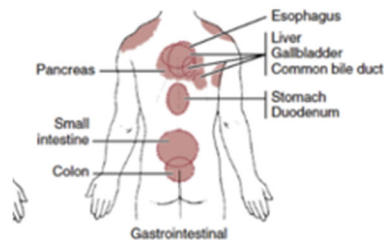
- Weight loss
- BP changes, hypotension
- *Muscle cramping*
- Difficulty swallowing
- *Back pain* from ulcer, GI bleed, constipation, bloating
- *Left shoulder pain* from blood in abdomen, laparoscopy, ruptured spleen

Gastrointestinal

Upper GI Symptoms	Lower GI Symptoms
<ul style="list-style-type: none"> • Difficulty Swallowing • Heartburn or Indigestion • Ask about using antacids • Specific Food intolerance • Rashes • Migraines • Change in appetite • Weight change • Nausea 	<p>Bowel dysfunction</p> <ul style="list-style-type: none"> • Color <ul style="list-style-type: none"> • Melena=black, tarry stool • Red=bleeding in colon or anorectal area • Light color=possible liver dysfunction • Constipation • Diarrhea • Frequency - Change from normal • Difficulty initiating - Constipation or opioid use • Incontinence



GI Referral Patterns



1. T3-5 sympathetic distribution
2. T10 sympathetic distribution
3. T10-L2 sympathetic distribution

- Bowel Dysfunction
- Difficulty Swallowing
- Heartburn/Indigestion
- Symptoms after eating
 - Nausea/Vomiting
 - Abdominal Pain
- Unexplained weight change

- Hx of GI disorder (GERD, peptic ulcer, IBS)
- HX of prolonged NSAID, corticosteroid, opioid use

Diagnosing Abdominal Pain of MSK Origin – Sparkes 2003

- Does coughing, sneezing or taking a deep breath aggravate your symptoms? (Y)
 - Does bending, sitting, lifting or twisting your back aggravate your symptoms? (Y)
 - Has there been any changes in your bowel habits since onset of your symptoms? (N)
 - Does eating certain food aggravate your symptoms? (N)
 - Has there been any weight change since onset of your symptoms? (N)
- Sp=.96 (+LR=16.8), Sn=.67 (-LR=.34)

Symptoms Associated with Malabsorption

Symptoms	Malabsorbed Nutrients
Muscle weakness, wasting, parasthesias	Generalized malnutrition: fat, carbs, proteins
Osteomalacia	Fat, protein, carbs, iron, water, Vitamins A,D,K
Tetany, parasthesias	Calcium, Vitamin D, magnesium, potassium
Numbness, neurologic damage	Vitamin B12,
Bone pain, fractures, skeletal deformities	Calcium, vitamin D, protein
Muscle spasm	Electrolyte imbalance, calcium
Easy bleeding/bruising	Vitamin K
Generalized swelling	Protein

Gastrointestinal

- Clinical signs include:

- Fatigue
- Bloating
- Diarrhea
- Cramps
- Muscle wasting
- Low BP
- Weight loss



Gastrointestinal

Implications for the Therapist:

- Peptic ulcers located on the back wall of the stomach can perforate and hemorrhage, causing *back pain as the only presenting symptom*.
- Pain may also refer to *right upper quadrant and include the shoulder*.
- National Institute on Aging states *moderate exercise, 3x/week, greatly reduces the risk of GI bleed*.
- Ileum involvement can refer to the *low back or right lower quadrant in the region of the psoas*
- Monitor *hydration* (brittle hair, dry/inelastic skin, h/a) and *nutrition*
- Be aware of *emotional stresses*

Gastrointestinal

Implications for the therapist:

- Malabsorption of Ca⁺⁺, Mg, K, vitamin D can cause:

- Parathesias
- Tetany
- Bone pain
- Osteomalacia
- Osteoporosis

Gastrointestinal

Implications for the therapist:

- Regular activity relieves stress and improves bowel function
- Be aware of breath holding patterns in response to stress
- Teach relaxation and breathing techniques
- Consider patient comfort with conditions such as IBS



Thank you!

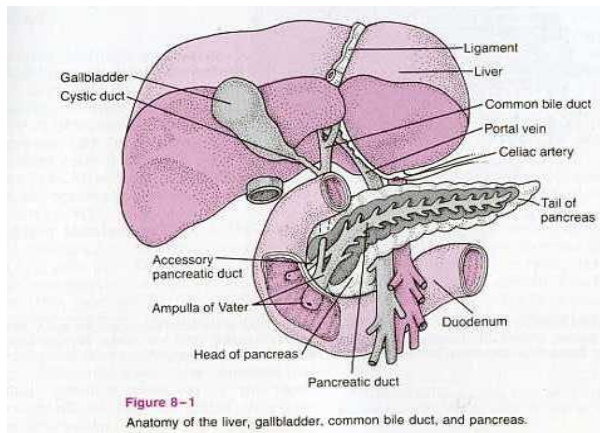


Medical Screening and Care
Management

Hepatic/Pancreatic/Biliary Systems

Hepatic, Pancreatic, Biliary Systems

- Liver
- Pancreas
- Gallbladder



HPB System

Signs and Symptoms of Liver Disease:

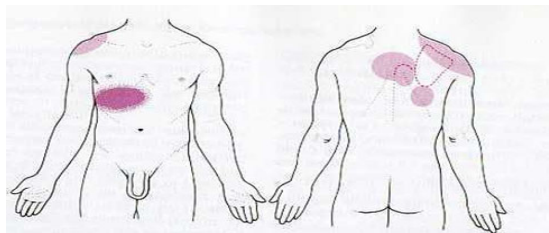
- GI symptoms
- Edema/ascites
- Dark urine
- Light colored feces
- Upper right quadrant pain
- Skin is jaundice, pallor, orange, or green
- Spider angioma: branched dilation of superficial capillaries
- Palmar erythema: warm redness of palms

HPB System

- Neurologic symptoms: Liver dysfunction increases serum ammonia and urea
 - Confusion
 - Sleep disturbances
 - Muscle tremors
 - Hyper-reactive reflexes
 - Asterixis: liver flap, a motor disturbance, an inability to maintain wrist extension with the arm flexed

HPB System

- Musculoskeletal symptoms:
 - Pain between the scapula, right shoulder, right upper trapezius, right subscapular areas
 - Symptoms may also refer to mid or lower thoracic region



HPB System

- Musculoskeletal symptoms:

- Hepatic *osteodystrophy*: abnormal development of bone due to the suppression of bile flow (cholestasis) which causes excessive bone resorption
- Hepatic *osteoporosis*: associated with biliary cirrhosis and osteoblastic dysfunction causing bone loss and vertebral wedging, crush fractures, severe kyphosis

HPB System

Implications for the therapist:

- *Avoid intensive exercise*. Liver must be rested to heal.
- Decreased clotting ability, easy bleeding under the skin and easy bruising. *Avoid aggressive manual therapy*.
- Other neurologic abnormalities include: rapid flexion/extension at MCP's, protruding tongue, tightly closed eyelids, *ataxic gait*

HPB System

- **Hepatitis: Acute or chronic inflammation of the liver from virus (A,B,C,D,E, Epstein Barr, herpes simplex, varicella-zoster, measles), chemicals, drugs, alcohol**

- Each year 500,000 are infected and 15,000 die
- HAV in those younger than 15
- 70% of HBV and 58% of HCV in 20-39 year olds

- **Clinical Manifestations:**

- Initial stage, preicteric stage
 - 1-3 weeks
 - Dark urine, stool lightens
- Icteric or jaundiced stage
 - Lasts 6-8 weeks
 - Jaundice appears
- Recovery period
 - Lasts 3-4 months
 - Easy fatigue

HPB System

Implications for the therapist:

- Avoid contact with blood and body fluids
- *Joint pain* occurs in 18% of children and 45% of adults
- Arthralgia will not respond to therapy and must be referred back to MD
- Conservation of energy is important in recovery
- Therapy or increased activity should be avoided after meals
- Watch for signs of weight gain, orthostasis, dehydration, pneumonia, vascular problems, pressure ulcers
- Intense training is not contraindicated in asymptomatic HBV infected person

HPB System

- **Pancreatitis: inflammation of pancreas that may result in autodigestion of pancreas by its own enzymes**

- Incidence increases in people over 55 years
- Pathogenesis of the 'escape' of enzymes into surrounding tissue is unknown

- **Clinical symptoms include:**

- Abdominal pain in mid epigastric area that radiates to the *upper thoracic region*
- Nausea/vomiting
- Fever
- Tachycardia
- Sweating
- Malaise
- Weakness

HPB System

Implications for the therapist:

- **Early presentation is back pain**
- Inflammation and scarring occur and may result in *decreased spinal extension at the thoracolumbar* junction
- Residual scarring is difficult to reach or affect with mobilization and continues to reduce motion
- *Back pain* may be accompanied by GI symptoms
- Symptoms relieved by heat, leaning forward, sitting up, lying motionless on side
- Symptoms worsened by walking, lying supine
- Eating and drinking is restricted to rest GI tract and reduce pancreatic stimulation

HPB System

- Cholelithiasis: Gallstones are stone like masses called calculi that form in the gallbladder as a result of changes in the normal components of bile
 - 75% are cholesterol stones, 25% are pigment stones (bilirubin salts:calcium)
 - Stones remain in the lumen of gall bladder or are ejected into the cystic duct
 - Affects 15 million people, mostly elderly

HPB System

- Most are asymptomatic
 - But 30% cause right upper quadrant pain
 - Muscle guarding
 - Pain radiating to the *upper or mid thoracic* region
- Other symptoms include:
 - heartburn
 - belching
 - Flatulence
 - food intolerance to fats

HPB System

Implications for the therapist:

- Loss of the gallbladder does not seem to have an impact on physical activity and exercise
- Usual postoperative exercises apply including breathing, coughing, leg exercises
- Early activity assists in the return of intestinal motility
- Consider scars from previous surgical interventions in your assessment



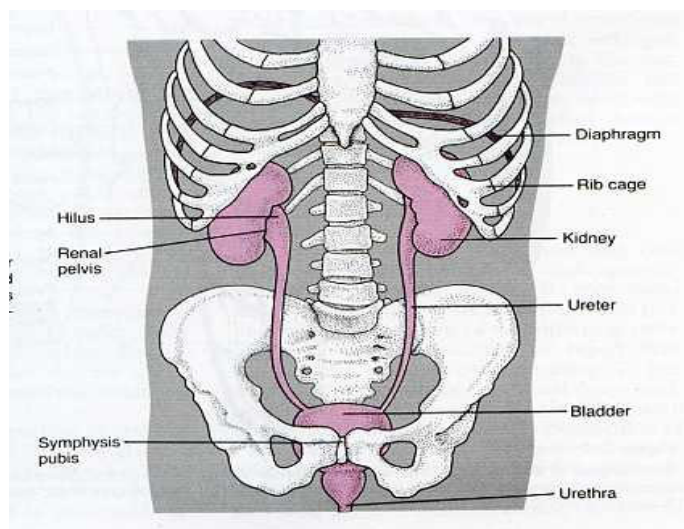
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Medical Screening and Care Management

Urinary System

UT Disorders



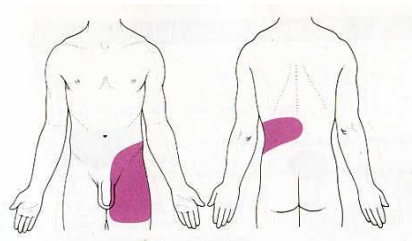
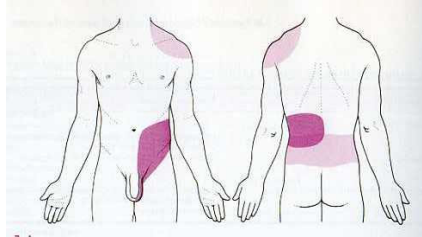
UT Disorders

- Lower Urinary Tract Infection: Cystitis
 - Common in geriatric population
 - More common in women because urethra lies close to vaginal and rectal openings allowing easier bacterial transport
 - Urinary tract instrumentation and catheterization are the most common predisposing factors
 - Urinary obstruction from calculi, **prostatic hyperplasia**, **pregnancy** also increase risk

UT Disorders

- Symptoms include frequency, urgency, dysuria, fever, chills, malaise
- Musculoskeletal symptoms including suprapubic, lower abdominal, or flank pain
- Treatment is antibiotics and increased fluid intake

UT Disorders



UT Disorders

- Special implications for the therapist
 - Client may not be able to participate in rehab until symptoms are under control
 - Early recognition of UTI may prevent more severe infection of upper UTI called pyelonephritis
 - UTI's risk the development of infection elsewhere including osteomyelitis, pleurisy, pericarditis

UT Disorders

- Kidney Stones (Renal Calculi): 3rd most common disorder behind infection and prostate disease
 - 80-90% of stones are calcium, others are magnesium, uric acid, cystine
 - Caused by increased blood flow and urinary secretion of the primary component
 - Men more than women, 4:1, ages 30-50

UT Disorders

- Symptoms of renal colic include:
 - Acute flank pain
 - Upper outer abdominal quadrant pain
 - May radiate to lower abdominal, bladder, perineal areas including scrotum and labia
 - Nausea, vomiting
 - Urinary urgency, frequency
 - Cool, clammy skin

UT Disorders

- Urinary Incontinence: Involuntary loss of urine
 - Total incontinence: lose urine at all times regardless of body position
 - Stress incontinence: during activities that increase intra-abdominal pressure
 - Urge incontinence: uncontrolled loss preceded by unexpected strong urge
 - Overflow incontinence: uncontrolled loss when intravesicular pressure exceeds outlet resistance

UT Disorders

- Factors include:
 - Pelvic relaxation disorders in women ie aging, birth, surgery
 - **BPH in men**
 - Drugs including diuretics, tranquilizers, sedatives
 - Bladder irritants like caffeine, alcohol, citrus fruits
- Special implications to the therapist:
 - Stress incontinence may be treated with pelvic floor exercises like Kegel's
 - Cures range from 30-75% with exercise

UT Disorders

Implications to the therapist:

- When severe symptoms will not be confused with mechanical dysfunction
- When mild or intermittent, symptoms may solely be unilateral back pain from iliac crest to thoracolumbar junction
- Be vigilant for complaints of urinary dysfunction, fever, chills, sweats



Thank you!



Medical Screening and Care Management

Conclusion

Internal Influences on the Musculoskeletal System: Review of Systems

- Musculoskeletal Disease
- Lymphatic System
- Integumentary System
- Cardiac System
- Respiratory System
- Brain Disorders
- Endocrine System
- Gastrointestinal System
- Hepatic/Biliary/Pancreatic
- Urinary Tract/Pelvic Systems



Patient Case

- A 48 y.o. male presents to PT with left shoulder pain. Pain began about 3 weeks. Pt. is left handed and believes that “time has finally caught up with him” as he played baseball through college. Pt. is overweight and has a positive medical history of hypertension and high cholesterol. Pt. is relatively sedentary. He does not exercise outside of playing catch with his sons and he works in IT. Pt. drinks an average of 10-12 beers per week and smokes 1-2 cigarettes per day.

What's on your hypothesis list?

What additional questions could you ask?

Systems Screen: OSPRO

• OSPRO-10

Have you recently experienced:

1. **abnormal sensations (eg, numbness, pins and needles)?**
2. **recently experienced headaches?**
3. **recently experienced night pain?**
4. **recently experienced sustained morning stiffness?**
5. **light-headedness?**
6. **trauma (eg, a motor vehicle accident, a fall)?**
7. **night sweats?**
8. **constipation?**
9. **easy bruising?**
10. **changes in vision?**

94.7%

Systems Screen: OSPRO

• OSPRO-23

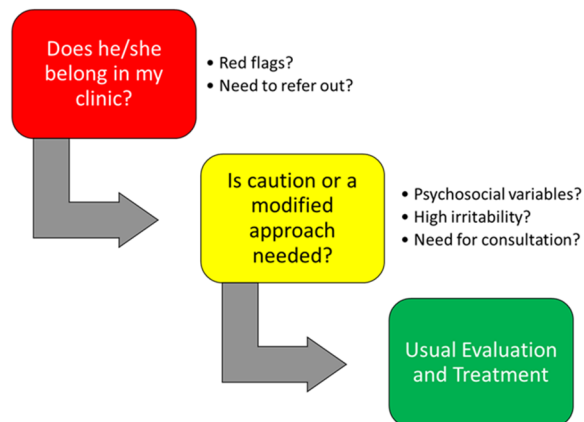
OSPRO-10+ these additional 13 questions:

11. (FEMALE ONLY) changes in menstruation patterns?
12. gait or balance disturbances?
13. chest pain with rest?
14. shortness of breath?
15. muscle weakness?
16. a failure of conservative intervention (failure to improve within 30 days)?
17. excessive sweating?
18. excessive swelling or weight gain?
19. a heartbeat in your abdomen when you lie down?
20. cramps in your legs when you walk for several blocks?
21. abdominal pain?
22. changes in the integrity of your nails?
23. prolonged use of corticosteroids?



Medical Screening and Triage

(Blanpied et al., 2017)



Medical Screening: Flag System

(Nicholas et al., 2011)

- Red – serious pathology
- Orange – psychiatric symptoms
- Yellow – beliefs, appraisals, judgements, emotional responses, pain behaviors and coping strategies
- Blue – perceptions about the relationship between work and health
- Black – system or contextual obstacles



Review of Systems: Screening Questions

- How do you screen these systems when needed?
 - Consider medical history
 - Consider side effects of medication
 - Utilize OSPRO
- Communication with medical care team
 - Utilize algorithms
 - Relay findings to referral source
 - Collaborative plan



Clinical Examination Guide

- Observation, Gait, Posture
 - Inspection
 - Functional Provocation
 - Active Motion (Repeated)
 - Passive Motion (O/P)
 - Resisted Motion (3P)
 - Palpation
 - Neurology
 - Special Tests
 - Segmental Mobility Test
- **Vitals**
 - Blood Pressure, HR, O2
 - Consider precaution or contraindicating to exercise
 - **Palpation**
 - Abdomen
 - Pitting Edema
 - Check of skin/nails
 - **Screening**
 - Fracture
 - Cranial Nerves
 - Vascular claudication

Conclusion

- Reflect upon how you can improve regarding medical screening and care management
 - Consider how other body systems influence MSK conditions and care
 - Consider best practice and the role of a therapist in the patient care team
- **Live Lab**
 - Abdominal palpation
 - Vitals
 - Cranial Nerve screen
 - Modification for manual techniques
 - Sub-max testing and HRR



Thank you!



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