Chronic Low Back Pain – focus on muscle imbalance and Exercise prescription

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objectives

- Review definition and incidence of chronic low back pain
- EBM review of current evidence for tx of LBP
- Introduce Greenman’s Dirty ½ dozen
- Focus on concepts of muscle imbalance
  - How to screen for muscle imbalance
  - Exercise Rx principles
Statistics

- LBP leading cause of disability between 19-45 years
- 5th most common complaint seen by PCPs
- 70% of population gets LBP during lifetime
- 50% better in one week, 90% better in 2 months regardless of treatment
- Physical work environment:
  - Speed, frequency, asymmetrical lifts, twisting
  - 35% increased pressure on discs if object held too far in front
  - Room temperature, noise, fatigue, floor surface, footwear
Incidence

- LBP is the fifth most common reason for all physician visits in the USA
- Approx. 25% of US adults report having LBP lasting at least 1 day in the past 3 months and 7.6% reported at least 1 episode of severe acute LBP in a 1-yr period
- Est. healthcare costs attributable to LBP $26.3 billion in 1998 and $100 billion in 2006
- Indirect costs related to days lost from work are substantial, approx. 2% of US work force compensated for back injuries each year

Qaseem, A et al "Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians." Clinical Guideline, Annals of Internal Medicine 2017;166: 514-530
Many pts have self-limited episodes of acute LBP and do not seek medical care. Most improve rapidly in first month.

Up to 1/3 of pts report persistent back pain of at least moderate intensity 1 yr after an acute episode.

20% report substantial limitations in activity.

Approx. 5% of people with back pain disability account for 75% of the costs associated with LBP.
Recommendation

- For patients with CLBP clinicians and patients should initially select nonpharmacologic treatment with exercise, multidisciplinary rehabilitation, acupuncture, mindfulness-based stress reduction, electromyography biofeedback, low level laser therapy, operant therapy, cognitive behavioral therapy, or spinal manipulation (low-quality evidence) (Grade: strong recommendation)

Imaging recommendation

- **Recommendation 2:** Clinicians should not routinely obtain imaging or other diagnostic tests in patients with nonspecific low back pain (strong recommendation, moderate-quality evidence).

- **Recommendation 3:** Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions are suspected on the basis of history and physical examination (strong recommendation, moderate-quality evidence).
- **Recommendation 4:** Clinicians should evaluate patients with persistent low back pain and signs or symptoms of radiculopathy or spinal stenosis with magnetic resonance imaging (preferred) or computed tomography only if they are potential candidates for surgery or epidural steroid injection (for suspected radiculopathy) (strong recommendation, moderate-quality evidence).

- **Recommendation 5:** Clinicians should provide patients with evidence-based information on low back pain with regard to their expected course, advise patients to remain active, and provide information about effective self-care options (strong recommendation, moderate-quality evidence).
What causes low back pain to become chronic?
The “Dirty Half Dozen”
-Greenman

1. Pelvic Tilt/Short Leg Syndrome
2. Non-Neutral Lumbar Mechanics
3. Pubic Dysfunction
4. Innominate Shear Dysfunction
5. Restricted Sacral Nutation
6. Muscular Imbalance
Pelvic Tilt/Short Leg Syndrome

- 55-70% incidence in patients with back pain
- Use of x-rays in diagnosis
- Evaluation of leg length difference: supine vs. functional assessment
- Use of heel lifts
Non-Neutral Lumbar Mechanics

- Type II Mechanics
- Commonly seen at L3, L4, L5
- Flexion lesions more common
Pubic Dysfunction

- Evaluate for tenderness and unlevelness
- Results in altered movement of the innominates during walking
- Check hip adductors
Innominate Shear Dysfunction

- Classic slip and falls, motor vehicle accidents
- See lumbosacral pain radiating into buttocks and sacroiliac regions
- See unleveled sacral base/iliac crest in all testing positions
Restricted Sacral Nutation

- Nutation/Counternutation
- Unilateral flexions
- Torsions
Theoretic Causes of Muscle Imbalance

- Malregulation of the CNS
  - Concept of facilitation
  - Impaired afference and efference
  - Altered proprioception
- Janda’s Theory of Muscle Imbalance
  - Pseudoparesis
  - Muscle firing patterns
  - Muscle imbalance syndromes
Lats/ Gluteus
Maximum Linkage

- Each mm can increase tension of TLF (thoracolumbar fascia) contralaterally and ipsilaterally
- "Cinching" the TLF by these two mm stiffens lumbar spine
- Also see compression between sacrum and ilium stabilizing the SI joints
Force Closure
Force Closure

- So, body then resorts to other tactics. Hamstrings get tight to pull on ST ligaments to tighten the SIJs.
- Also can tighten gluteus maximus.
- Tight hamstrings rotate pelvis backwards and flatten lumbar spine and decrease sacral nutation.
- This counter-nutation may be a pain withdrawal reaction that disengages the normal self-bracing of the pelvis. Lower spine then can become unstable and prone to impingement, causing LBP.
Ext oblique influences Upper lumbar

Int oblique influences low lumbar
TA – the SPANX of the abdominal muscles
Transversus Abdominis

- TA influences entire lumbar spine – Key lumbar stabilizer
- TA stabilizes spine to provide stable platform for UE and LE movement
  - Contracts PRIOR to trunk movements and rapid limb motion
  - Strong attachment of IO and TA to middle layer of TFA provides direct pull to lumbar transverse processes for stabilization
Fascia Lata System

- Glut max has powerful influence on pelvis via attachment to ST ligament, pelvis, lumbar spine
- Lumbopelvic extension from forward to upright position initially occurs primarily from HIP-depends on glut max which extends pelvis over hip
  - Also depends on tight fascia lata thru tight quads
Fascia Lata System

- Hamstrings act directly over pelvis by attachments at ischial tuberosities and thru ST ligaments
- Increased ST ligament tension minimizes sacral nutation and posterior rotation of ilium stabilizing SI joint
- Contraction of biceps femoris and/or glut max also tightens SI ligaments by controlling torque and shear of sacrum
Abdominal Fascial System

- Paired abdominals, transversus abdominus
- Recruitment of abdominal muscles is altered in LBP
- Contraction of these muscles increases tension to abdominal fascia
Shoulder Girdle and Abdominals
Notice how the lats and erector spinae connect the upper extremity all the way into the SI joints and into the lower extremity.
Psoas Major

- NOT a primary hip flexor! Iliacus is more active than PM in hip flexion. Primary role at the hip is STABILITY by maintaining femoral head in acetabulum.
- Other muscles also aid in hip flexion: TFL, rectus femoris, sartorius.
- Major function is lumbar compression and the neutral lumbar lordosis.
Psoas Major

Note pull on straight line down to pubes

Primary action of psoas is compression, not shear

Pull on lumbar induces lordosis
Sacrotuberous (ST) Ligament
Sacrotuberous Ligament Pain Pattern

How do you know if a positive straight leg raise is radicular or from the sacrotuberous ligament?
Repeat the test while applying pressure to the ST ligament. If it is improved/negative, the problem is the ST ligament!
Slump Test for Fascial Restrictions
Lower/Pelvic Crossed Syndrome
Pelvic Crossed Syndrome

- Tight hip flexors, erector spinae
- Inhibited, weak gluteals and abdominals
- See anterior tilt of pelvis, increased hip flexion, increased lumbar lordosis
- Can see weak gluteals on same or opposite side of tight hip flexor
Postural Muscles -"OVERWORKED"

- Iliopsoas
- Rectus femoris
- Tensor fascia latae
- Quadratus lumborum
- Short adductors
- Piriformis
- Hamstrings
- Lumbar erector spinae
Dynamic (Phasic) Muscles

- Gluteus maximus
- Gluteus medius and minimus
- Rectus abdominus
- External and internal obliques
- Peroneals
- Vasti (especially medialis)
- Tibialis anterior
Principles in Treatment of Muscle imbalance

1. Sensory Motor balance training
2. Stretching of short, tight, hypertonic muscles to symmetry **BEFORE** strengthening the weakened muscle
3. Re-educate movement patterns to prevent overactivation or substitution patterns
4. The quality of the movement is more important than quantity
Are you a Dumb Butt?
Muscle Firing Patterns: Hip Extension

- Normal Sequence
  1. hamstring
  2. glut max
  3. contralateral erector spinae
  4. ipsilateral erector spinae
Muscle Firing patterns – Hip abduction

- Have pt lay on side
  - Tighten lower abd muscles (between pubic bone and umbilicus)
  - Engage glut max
  - Slowly raise top knee into abduction (clam)
  - If QL fires instead of staying relaxed, the pt will need to work on gluteal strengthening.
Diagnose your partner!
Remember their sequence!
Principles in Treatment of Muscle Imbalance

1. Sensory motor balance training
2. Stretching of short, tight, hypertonic muscles to symmetry before strengthening (retraining) of inhibited weak muscles to balance
3. Re-educate movement patterns to prevent overactivation or substitution patterns
4. The quality of the movement (neuromotor control) is more important than the quantity
FIRST Stretch!

- Common inhibitors of gluteals (again – tight, postural muscles)
  - Quadratus Lumborum
  - Iliopsoas
  - Piriformis
  - Hip adductors
  - Tensor fascia latae
  - Hamstrings
Teach patients to stretch

- If a stretch hurts, the muscle won’t lengthen
- Muscles that hurt with a stretch will protect themselves from tearing by tightening and recruiting other muscles for protection.
Common Findings

- Motor action substitutions
  - Tensor fascia latae for gluteus medius in hip abduction
  - Hamstrings for gluteus maximus for hip extension
- Altered firing patterns
  - Shortened hip flexors due to weak glut max
  - Shortened erector spinae lead to weak abs
  - Shortened tensor fascia latae and quadratus lumborum from weak gluteus medius and minimus
HEP: Lumbar Twist

Different leg positions can be tolerated by different people and tend to stretch slightly different pathways. Do both sides. This can be done at least twice daily by performing it in bed at bedtime and before rising from bed in the morning.

The set in the middle is usually most easily tolerated. The legs should stay stuck together such that they do not slide past one another. That means the one foot will come up off the ground as soon as the knees start to rotate to the opposite side.
This is a subtle but profound stretch and can be used as a foundation for many other stretches. 6 and 12 are only the first, simplest part of this series for low back Home Exercise Program (HEP).
Note how bringing your ankle up to cross over your knee tends to bring your pelvis into the 12 o’clock position. Turn on the stretch by going back into 6 o’clock (by sitting up straight and tall and pooching belly forward with chest high). Some fine tuning can be done by rotating your trunk left or right.
HEP: Kneeling Psoas / TFL

By leaning away from your balancing knee, you stretch the TFL on your lateral leg.

Note 12 o'clock pelvic tilt to turn on stretch.
More Psoas Stretching...

- Standing Psoas Stretch
  - Make sure back foot is pointing straight forward
  - Hips are tilted back at 12 o’clock
  - Back is straight, not arched
HEP: Hamstrings / Calves

Keep in 6 o’clock pelvic tilt as bend forward and keep foot with toes pointed toward ceiling.

Lead with the heel toward the ceiling when doing this laying on your back. Push the opposite leg into the table at the same time.
Gluteus maximus should regain its status as the primary hip extender.

Strengthening glut max can now occur efficiently and without reinforcing abnormal firing patterns.
What about the weakened abdominals/gluteals?
Retraining Abdominals (especially Transversalis)

- Go find Yoga or Pilates 2 week trials
Re-training: Sit-Backs

- With back held straight, tighten lower abdominals (between belly button and pubic bone)

- And slowly sit back. Hold at 45 degrees for 30 seconds and roll back to the floor, one vertebrae at a time.
Re-training: Heel Glides

- Pull your pelvis back to 12 o’clock position (pressing your low back into the floor). Tighten lower abdominals,

- And slowly slide your heel away from your body. Repeat 10 times – slowly.
Re-training: Plank

- Hold your body in “push up” position – goal is 60 seconds. If you have wrist pain or a sharp sensation
- In your low back, drop down to the modified position, on your forearms. You should contract
- Your abdominal muscles for the entire pose.
Re-training: Pelvic Bridge

- Tighten your lower abdominals to pull them up to the 12 o’clock position, flattening your back on the ground. Draw your hips off the floor. The goal is to hold this position x 60 seconds.
Sensorimotor Balance

- Visual system
- Vestibular system
- Kinesthetic awareness through proprioceptors in skin, muscles, and joints, particularly in the lower quarter
  - One legged stance (eyes open and closed)
Quick Take-Away Concepts

- Check **gluts functioning** to assess for gluteus medius weakness
- Check the **psoas** to see if it’s tight and causing gluts weakness
- Check the **hamstrings**: if one side very tight, it’s probably protecting the low back
Quick Take-Away Concepts

- The tight muscles are **NOT** necessarily the cause of the pain...like Dr. Phil Greenman said, “don’t chase pain”
- Remember that the **tightness is caused by weakness someplace else, so look for the weakness**
- As physicians, we must understand the most recent research and rehabilitation techniques in order to treat our patients with back pain
Quick Take-Away Concepts

- Get to know your PT/rehab clinics near your office. Find someone who understands how to use these concepts. Don’t just use a “shake and bake” clinic. Give your patient the opportunity for the best outcome possible!
References


- Lectures by Drs J’Aimee Lippert, Darren Grunwaldt, Paul Dyball, Stephen Goldman


- Phil Greenman, Principle’s of Manual Medicine

- Google Images