



***LEG LENGTH INEQUALITY:
Sports Medicine Perspective***

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***18 Year Old Experienced Cross
Country Runner: Sept Sr Year***

- Pain in left lower leg with running*
- Pain now prevents all running*
- Spent summer in Costa Rica*
- Ran on local terrain*
- PE -> suspected LLI*
- Standing AP pelvis x-ray confirmed 3/4" (20mm) LLI-left long*
- X-ray tibia normal, presumed tibialperiostitis (medial tibial stress syndrome)*

**16 Year Old Female Soccer
Midfielder: Oct of Club Season**

- Pain in left mid-medial thigh
- First season back after fracturing tibia while skiing—healed uneventfully
- Pain with impact and kicking
- Deep tenderness over medial thigh, pain with Fulcrum Test (bending pressure on femur over edge exam table)
- Standing PE suggests LLI

Club Soccer Player

- Weakness and pain when testing core and hip musculature
- AP pelvis confirms LLI of 15mm (5/8")
- AP femur shows early callus over mid medial cortex (healing stress fx)



Leg Length Inequality

- Topic is rich in controversy
- Anatomic vs Functional
- Clinically significant vs insignificant
- Accurate measurement
- Treatment implications
- To “lift” or not to “lift”
- Impact athletes vs regular mortals

Leg Length Inequality

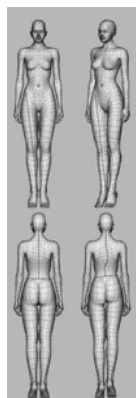
- *90% of population has some anatomic leg length inequality*
- *Mean LLI is 5.21 mm (3/16")*
- *Left leg is longer 53-75% of the time*
- *No differences between genders*
- *15% have LLI > 10mm*
- *2.4% > 15mm*

Anatomic (Structural) Limb Length Inequality



Functional leg length inequality due to scoliosis

- *Leg is of equal length to opposite side but pelvic obliquity resulting from spinal curvature makes it appear short*



Magnitude of Inequality

- Evidence suggests that for most people, anatomic leg-length inequality is not clinically significant until ~20mm
- LLI prior to skeletal maturity, body makes adaptive changes which become permanent in spine and pelvis
- LLI acquired after maturity (fracture, hip replacement), body does not make compensatory changes



- Mixed data on significance in military recruits and athletes
- Increased LLI associated with back pain, patellar tendinitis, patellofemoral pain, stress fractures, arthritis of hip & knee, balance deficits and decreased trunk (core) strength

How to Diagnosis LLI

- Best method initially is standing AP x-ray of pelvis centered on femoral heads done with computed digital radiography (PACS = Picture Archiving & Communication System)-less radiation & greater enhancement capabilities



- Level iliac crests first with block or book, then take x-ray (gives measure of LLI)

How to Diagnosis LLI

- *Scanogram only if necessary (standing x-ray from top hip down to ankle containing with a ruler present on the film for accurate measurement – requires more radiation and more time to interpret results*
- *Palpation and tape measure least accurate*



Body's Adaptation to LLI

- *In order to keep both feet flat on the ground and to stand upright ,body compensates for LLI as follows:*
- *LLI < 20mm: passive structural changes of pelvic torsion, mild lumbar scoliosis, facet angulation and change in muscle length*
- *LLI > 20 mm: in addition, active muscular compensatory occurs which if prolonged becomes painful*

***Treatment:
Distinguish true
anatomic LLI from
"Functional" LLI***



Functional LLI

- *Pelvic obliquity (scoliosis)*
- *Adduction or flexion contracture of hip*
- *Genuvalgum/varum/recurvatum*
- *Foot deformities:
Calcaneovalgus/Equinovarus*
- *Over pronation*
- *"Spasm" above the pelvis (erector
spinae/quadratulumborum)*
- *Roadway crown, banked running surface*
- *Asymmetric shoe wear*

Structural LLI

Long Side

- *ASIS high, knee flexion,
foot pronation*
- *Flank pain*
- *Hip & knee pain*
- *Psoas tendinitis*
- *Patellar tendinitis*
- *Plantar fasciitis*
- *Medial tibial stress
syndrome*
- *Metatarsalgia*

Short Side

- *ITB tendinitis with
lateral knee pain*
- *Trochanteric bursitis*
- *SI joint pain*
- *Achilles tendinitis*
- *Cuboid syndrome*
- *Early heel off during
walking or running*

To Lift or Not to Lift

- *LLI > ¾" requires muscle
compensation that over time becomes
painful—proven that lift can assist with
relieving pain*
- *With lesser LLI, best to allow therapist
to work on soft tissue elements first to
improve flexibility, alignment and
strength, then add lift if symptoms
don't resolve*

*Damned if you don't
& Damned if you do*



Sports

- *For impact athlete, if a lift is necessary, gradually correct up to 50% of LLI using an adjustable lift*
- *If > 20 mm (3/4") correction is necessary, must be added to outside sole of shoe*
- *Remember to consider running surface/shoes*
- *Gradual return to running program*
- *Change directions on track while training, esp if banked track*
- *Replace shoes after 400-500 miles of wear*
- *Gradual return to running program*

Treatment??????????

18 year old high school senior cross country runner with lifelong anatomic LLI of 20mm (3/4")

18 Year Old HS Senior CC Runner

Etiology

- Reason for symptoms: change from Illinois "flatland" running to mountainous terrain
- Worn out shoes
- Inflexibility and weakness
- LLI

Treatment

- Cross trained
- Replaced shoes
- PT for stretching and strengthening work--especially core
- Videotaped running eval
- Progressive lift (began @1/8") due to video showing he was unbalanced
- Missed CC but made Indoor & Outdoor Track
- Eventually d/c"ed lift

Treatment?????????

16 year old club soccer midfielder with newly acquired anatomic LLI of 15mm (5/8")

16 Year Old Club (& HS) Soccer Player

Etiology

- Reason for symptoms was newly acquired LLI due to inevitable shortening of her high energy (skiing) tibialfx
- Core and hip region weakness
- Intensity of practice & play 1st season back after injury

Treatment

- Corrected LLI, started at ~ 1/4"
- Began with adjustable lift --once sure that she was tolerant of lift and symptoms improved, she was provided with permanent orthotics for sports
- Corrected core weakness
- Gradually returned to spring practice with permanent lift in place

Additional Reference

Knutson, GA. Anatomic and functional leg length inequality: A review and recommendation for clinical decision-making, Parts I & II. ChiroprOsteopat 2005; 13 (12).

Thank you