Integrating Diagnostic Imaging Across Physical Therapy Disciplines: A Selection of Case Reports

MPTA 2018 Fall Conference

Objectives

1. Discuss a variety of physical therapy cases from the areas of orthopedic, neurologic, and pediatric physical therapy.

2. Discuss the integration of diagnostic imaging and physical therapy treatment interventions.

3. Discuss common imaging modalities including radiographs, CT scans, MRI, and diagnostic US as they pertain to the individual cases.

Diagnostic and Procedural Imaging in Physical Therapy

- "Historically, PTs have successfully employed imaging in multiple, but limited sectors of health care delivery."

- "Imaging instructional content is now foundational in PT educational programs and mandated by accreditation standards, allowing for basic competencies in imaging use and decision making at entry-level practice."

- "Effective use of imaging in daily PT practice is validated by a multitude of entries in the peer-reviewed literature."

- "There is a strong evidence-based foundation and need to support widespread adoption of imaging in PT practice."

Abnormal Findings in Asymptomatic Individuals

- 1211 Healthy volunteers, age 20-70, (Nakashima 2015)
  - Disc bulging present 87.6%

- 3110 asymptomatic individuals, age 20-80 (Brinjikji 2015)
  - Disc degeneration: 37% to 96%
  - Disc bulge: 30% to 84%
  - Disc protrusion: 29% to 43%
  - Annular fissure: 19% to 29%

- 51 subjects with no shoulder symptoms age 40-70 (Girish 2011)
  - Subacromial bursal thickening: 78%
  - AC joint OA: 65%
  - Supraspinatus tendinosis: 39%
  - Subscapular tendinosis: 25%
  - Partial thickness tear supraspinatus: 22%
  - Posterior glenoid labral abnormality: 14%
  - Asymptomatic shoulder abnormalities in 96% of the subjects

References


https://radiopaedia.org/
Outcomes post ORIF repair:

- Very high level of pain
- Retirement from job due to pain
- No relief with Physical Therapy or medical pain management
- Ambulation with walker or cane due to pain
- Poor quality of life

The next step:

- TKA proposed as potential solution to ongoing pain
- Barriers:
  - Patient age
  - Patient desire to use existing scar
  - Locating a willing Orthopedic Surgeon to complete repair

Prevalence:

- Definition of tibial plateau fracture failure:
  - Infection
  - Post-traumatic osteoarthritis (PTOA)
  - Conversion to TKA
- Prevalence: ~7.5% of tibial plateau repairs within 10 years after fixation
- Risk factors:
  - Tobacco use results in 2.3x more likely to fail
  - Older age (46-65)

TKA 2016

- TKA completed December 2016
- Complication: large hematoma resulting in longer hospital stay
- Pain level reduced relative to pre-tibial repair almost immediately.
- PT arrived for physical therapy evaluation approximately 5 weeks out of surgery (mid-January 2017) after completing ~2 weeks of home health physical therapy.
TKA images: 2017

Intervention

- Week 1: quad sets, glute squeezes, standing TKE, LAQ, hamstring and hip stretching and edema management. Initially needed education and encouragement to flex knee.
- Week 2: biofeedback 4-way quad sets to engage quads more efficiently, weighted LAQ, mini squats, low level balance training, hamstring curls- edema improved by 2nd week of therapy.
- Week 3-7: functional exercises including Sit → Stand, more advanced balance training, step ups, etc. Pt compliant with HEP and eager to improve each week.
- Pain largely controlled with Tramadol at night by week 4 of therapy.

Evaluation

- Limited knee flexion but was only lacking ~5° of knee extension
- Weak and tight hips, weak glutes, very tight hamstrings and poor Rt quad recruitment
- Well healing scar but significant edema around the knee joint.
- No adaptive equipment required for ambulation
- Poor balance: Clinical Test for Sensory Interaction in Balance- Modified (CTSIB-M): 60 sec
- Less than average functional strength:
  - 30 sec sit to stand: 9 (norm age 60-64 >14)
  - 2 minute walk: 250'
- Pt pain fairly well managed with low doses of oxycodone, but woke him at night. Pain was 5/10 at evaluation

Outcomes:

- Pain largely controlled with Tramadol at night by week 4 of therapy.
- Pt attained 0° knee extension, 115° knee flexion
- Pain reduced to 1 or 2/10, only needed medication occasionally
- Edema resolved to within 1 cm of non-surgical knee
- Flexibility of hamstrings improved, pt encouraged to continue to stretch ER due to limited improvement

Outcomes:

- Pt strength of 4+ or 5 globally throughout bilateral LE
- Balance improved:
  - CTSIB-M: 120 sec
- Functional strength improved
  - 30 second sit to stand: 18
  - 2 minute walk test: 500'
- Discharge at 7 weeks
What I missed:

- Pain science education
  - Red flags:
    - Chronicity of pain
    - Trauma leading to original injury
    - Fear avoidance of knee flexion
    - Pt report of immediate pain relief with TKA

References:


Medical and Diagnostic Testing in Rehabilitation

Femoral Facial Syndrome
Ebony Johnson, SPT
October 13, 2018

Team Members

- Ortho consult – abnormal bone/joint structure/development
- Plastics consult – reconstructive surgery to cleft palate/lip
- Genetics consult – determine if underlying genetic explanation
- Speech consult – address feeding and speech concerns
- Social work consult – determine best resources for mom/baby
- PT consult – educating on handling techniques and future mobility

Birth and Development History

- Caesarean section – severe oligohydramnios (low amniotic fluid)
- Gestational Age: 35w2d
  - Less than 38 weeks = premature
- Birth weight: 5lb 14oz = 2,664 grams
  - Low birth weight: >2,500 grams (Effgen, 2013)
- Methamphetamine use during pregnancy
  - Premature delivery, placental abruption, small size, lethargy, heart and brain abnormalities
  - Neurobehavioral: decreased arousal, increased stress, attention impairments (NIDA, 2013)
- Congenital anomalies:
  - Cleft palate/lip
  - Bilateral severe hypoplastic femurs
  - Bilateral club feet, R>L

Femoral Facial Syndrome

- 55 reported cases since 1993
- Typically sporadic
  - 2 recent – autosomal dominant genetic trait
- 1/3 – maternal diabetes
- Small, retracted jaw
- Poorly formed ears
  - Small, absent, low set
- Fused bones of the spine (rarediseases.org)
Typical Features

- Missouri First Steps Assessment – PT initiated at age 2 months
  - Medical equipment provided through First Steps
- Parents given handling strategies
  - Tummy time – neck and trunk mm. strengthening
  - Side lying – brings hands, legs, and vision to midline; positioning alternative
  - Reaching – awareness of hands by batting at hanging toys under play gym
- Resources – Capable Kids and Families
  - Learning equipment and educational materials
  - Play groups
  - Respite care

Independent Mobility

- Primary mobility
  - Roll to get to toys
- Scooter board
  - Pull self forward in prone
  - Limb disassociation
  - Crawling
- Structural challenges
  - PT set realistic goals
  - UE weightbearing

Initial Intervention

- July 2016
  - Femurs 3.1 cm
- Typically
  - 7.6 cm at birth
TIMELINE:

- **Birth**: May 2016
- **July 2016 Radiographs**: Femurs measured 3.1 cm
- **August 2016**:
  - Fit for Custom hip, knee, ankle, foot orthotic
  - Skin breakdown from brace delayed surgery on LE
- **September 2016**
  - Surgery B club feet
  - Cast from pelvis to toes 3 weeks
  - Braces with abduction bar 3 months
- **January 2017**
  - R ankle, foot orthotic
- **August 2017**: Femurs 5.1 cm

PT Intervention

- **Treatment**: 1x45min/wk; natural setting
- **Goals**:
  - Walking
  - Pull to stand
  - Cruise along furniture
  - Keep balance while standing
- **Move around environment independently** – ZipZac purchased through First Steps
- **Focus during sessions included**:
  - Transitions – weight shifts, dissociation of trunk from LE
  - Sit<>stand – strengthening LE
  - Balance – sitting/standing; foam roller/rocker board
  - Ambulation – progressed from HHA -> manipulating small objects during task

Outcomes

- **Pt. progressed to standing independently consistently**
  - Toy Food truck
  - Games and puzzles
- **Ambulated independently up to 12 steps consecutively when motivated**
- **Loss of Balance**
  - Protective response forward
  - Able to push back up into standing independently

Future Interventions

- **Florida – Femoral lengthening procedure**
  - Considerations
    - Could cause hip/femoral instability and motor impairment issues
    - Current treatment plan emphasizing motor memory of skills achieved prior to procedure to allow a “Start over” following procedure
- **Equipment needs following procedure to access environment independently until regaining mobility and motor skills**
  - ZipZac

References

- Radiopaedia.org
Relevant Patient History

- 11 y/o male
- PMH of prematurity, cerebral palsy, and Coats Plus Syndrome
- Attends PT and speech at school
- Has attended outpatient PT before for developmental reasons
- Lives at home with supportive family
- Multi-level home

Mechanism of Injury

Date of Injury: Fall of 2016
- Pt fell on playground at school
- Fractured R tibia/fibula; Lower leg casted

Also around the same time:
- Fractured L tibia, but L able to heal on its own (unsure of MOI for L)
- Fall of 2017 – fracture still not healed on R

Coats Plus Syndrome

- Rare (<1 in 1,000,000); autosomal recessive disease
- Progressive
- “Coats” disease affects eyes (Retinal Detachment)
- “Plus” means it also affects:
  - Brain: Calcification, cysts, movement disorders
  - Bones: Osteopenia
  - GI: Anemia
  - Immunosuppression

External Fixator placed 11/18/2017 to R LE

(Note: these pictures are just examples, not of actual pt)
### PT Intervention

- Seen both at home and in the clinic, 3x/week  
- AD: rear wheeled pediatric walker, wheelchair, B AFOs  
- Extension footrest placed  
- Sessions focused on getting pt moving, balance, weight bearing, strengthening (especially LES), ROM, coordination, & gait  
- Example activities: walking, basketball, stairs, NuStep, Wii fit, & dancing

### References


### Low Back Pain – Case Presentation

**Allison Easley, SPT**

### Past Medical History

- Pt. is a 42 year old female  
- Intermittent low back pain for several years  
- Pt. worked as critical care RN for 10 years prior to current desk job  
- Involved in minor MVA in February 2009  
- No other significant medical history

### To be continued...

- Last day of clinical 3/8/18  
- Pt re-fractured R LE the following week  
- Were hoping to discharge/cut back on number of times seen per week soon to “save” visits for later in the year, but continues to have PT

### Image

- R lower leg lateral view with visible pin sites  
- Image following removal of External Fixator 3/7/2018
**Symptoms**

- Progressively worsening symptoms from February to July of 2009
- Low back pain with R LE radicular symptoms
- Pt. reports pain going down entire R leg
- Reports pain is the worst when laying flat at night, interrupted sleep
- To relieve pain she had to sit up, cross her legs, and lean all the way forward

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**Fat Infiltration**


Conclusions: Fat infiltration in the Lumbar Multifidus Muscles (LMM) is strongly associated with LBP in adults (81% of adult study sample), less common in adolescents (14% of adolescent study sample).
PT Intervention

Abdominal strengthening
• Hooklying pelvic tilts
• Hooklying one knee fall outs
• Hooklying alternating heel lifts
• Standing trunk rot w/ med ball
• Seated on swiss ball:
  – Figure 8s
  – Alternating knee lifts
  – Rocking side to side
  – Trunk rotation w/ med ball
  – Diagonal raises w/ med ball

Modalities: massage, Estim, heat

Stretches
• Piriformis stretch
• Supine hamstring stretch
• Seated nerve glide in slump position

Hip strengthening
- Clam shells
- Mini squats
- Sit<>stands
- Wall squat with swiss ball

Other
• Double knee to chest
• Hooklying knee fall outs for lumbar rotation
• Forward lunges w/ arms overhead and w/ trunk rotation

Patient Quotes

• “I remember doing a lot of stuff on the Swiss ball”
• “PT told me everything we were working on was to strengthen my small abdominal muscles.”
• “I did some laying down leg exercises that seemed way too easy.”

Outcome

• Patient’s radicular symptoms resolved completely within 3 months
• However, intermittent low back pain continued from 2010-2016 when patient would over do it
• In late 2016 patient began walking approx. 4 miles 5x/week
• Patient currently walks 4-5 miles 3-5x/week
• Minimal to no issues with low back pain now
• Pt. reports noticing her back only bothers her when she hasn’t been able to exercise as much

Medical Imaging – Ankle Fracture
Kristi Lemenager, PT, DPT

MOI:
- 26 y.o. male fell 18 feet from tree stand
  - Pt. stated sharp, throbbing pain in R ankle immediately after fall
- 45 minutes later, pt. transported via ATV to truck then ED. Upon arrival to ED, pt. reported shooting pain ascending to low back

Ottawa Ankle Rules

Conventional radiographs should be ordered after trauma to the ankle for pt’s with any of the following characteristics:

Ankle:
  - Pain in malleolar zone

- Tenderness at posterior aspect or tip of lateral malleolus
- Tenderness at the posterior aspect or tip of the medial malleolus
- Inability to bear weight both immediately and in the ER
Ottawa Ankle Rules

https://www.aafp.org/afp/2012/0615/p1170.html
Compliance?
- Pt casted, NWB
- Pt received second cast, decided to go hunting, used camouflage duct tape to cover cast
- Pt walked through water and timber, cast developed “funk”
- Pt removed cast 2 weeks early with tin snips
- Reported to surgeon and stated having pain w/ gait and most movements at work
- Surgeon, PCP, and PA stated pt did not require PT

Current complaints
- Pt c/o pain with squats, rainy or cold weather, walking >1 mile, hiking on hunting trips, construction work
- Pt ankle ROM
  - L: WFL
  - R: DF 5d, PF 30d, Inversion 7d, Eversion 0d

MVA - Multiple Extremity Involvement
By: McKenzie Koelling, SPT
**Arrival to the ER:**
9/27/2017

- 24 year old Caucasian male
- Arrived to the ER by helicopter

**Right Upper Extremity (A/P Oblique)**

- External Rotation
- Internal Rotation

**A/P View R LE showing Comminuted Fracture**

**The days prior to ORIF placement:**
A turn for the worst

Delay in ORIF placement due to

- Series of over 30 mini strokes due to Patent Foramen Ovale
- Led to instability of vital signs
- In a coma for several days

**Left Lower Extremity (Lateral and A/P)**

**Timeline of surgeries**

9/27: B femur traction
9/28: External Fixators
10/5: PFO closure
10/6: Plates/screws (B femurs)
10/9: Tracheotomy
PEG
Plate/screws (R humerus)
Wound Vacs (bilateral femurs)
10/14: Ventilator removed
11/11: PEG removal
1/31: Leg (L) Rod
4/5: Tendon Transfer
Initial Physical Therapy Intervention

- Inpatient: Started ~ 2nd week of October
  - Sitting up required max A x 1
  - Co-treated with speech therapist
  - Transfers at end of stay (showering and WC)
- R Upper Extremity Radial nerve damage treated by OT
  - Unable to extend fingers and wrist
- D/C from inpatient, transferred to Rusk Rehabilitation
  - PT Emphasis on LE strengthening
  - OT and speech

Rod Placed in Left Femur

Why a rod?
- More stable option than plate
- Could immediately weight bear after placement

ORIF Placement – R Femur (9 days later)

ORIF Placement – R humerus 11 days later

HOME!

- D/C to home November 3rd
- HEP included
  - Heel slides
  - Quad sets
  - Short Arc Quads
  - Glute squeezes
  - Ankle pumps
  - Hip adduction/abduction
  - Hip ROM (focus on IT band)
- November 28th – stood Ind for the first time
- December 11th – returned to work!!

End of December pt felt that something wasn’t right...
Outpatient Physical Therapy

• Stretching (1st week)
  • Hip ROM
  • Gastroc
  • Hamstring
• Strengthening was added
  • Leg press/squats
  • Multi-directional Lunges
  • Heel raises
  • Balance
  • Single leg stance
  • Foam pad
  • Gait retraining
• Continue with HEP after discharge

Surgery #10 spring 2018 needed tendon transfer on R wrist

History

• 12/23/17 Pt is a 23 y/o female with no relevant pmh
• M.O.I. – 1.5 cm laceration over great toe MTP joint from dropping perfume container
• Minimal pain, moderate bleeding, no paresthesia noted at time of injury
• Pt taken to ER where PA and MD stated in report that the tendon was “visualized through flexion and extension without any evidence of laceration” to the tendon
• Sutures placed, 14 day follow-up for removal
• No imaging done
• Flat-sole shoe prescribed
Patient Follow Up

• 1/16 Outpatient Follow-Up
• Pt wound healed, but has no active great toe extension and passively hangs into flexion causing clearance issues due gait without shoes
• No active extension of distal great toe, pain with passive flexion and extension of distal joint, TTP over scar
• MD error – mistaken patient
• Radiographs and US taken after re-eval x2:

Diagnostic Ultrasound Results:
• Prominent scar tissue of 1st MTP
• EHL discontinuous at scar tissue, no retraction evident
• EHL/EHB insertions intact
• “Complete to near-complete tear of the EHL tendon at the level of the scar…”
  – No retraction due to scar tissue developing around tear and holding in place
Mechanism of Injury

- 15 y/o male, no relevant PMH
- Collision during baseball game
- Audible popping noise heard
- Sharp pain noted around L elbow
- Went to ER for radiographs

Post-OP Care/PT

- 6 weeks NWB; axillary crutches and knee scooter
- 2 weeks CAM boot WBAT
- Pt declined PT services due to insurance, sought assistance from SPT
- Assisted in PROM great toe flexion, AAROM/AROM great toe extension, progressing to resisted great toe extension; scar mobility and education; calf raises/DF with active great toe flexion and extension at DF end-range
- Currently pt is near-full recovery; returned to daily gym activities with infrequent (~1/month) complaints of tightness and discomfort with great toe end range flexion and extension
  - Some numbness distal to surgical site since repair

Clinical Presentation

- Exquisite pain to L elbow/forearm
- Global swelling noted around elbow
- Limited AROM of elbow
- Insensate L hand
- Radiographs yielded L elbow dislocation and humeral medial epicondyle avulsion fracture
- no neurovascular injury
Post-surgical A/P view

Two weeks s/p  
Ten weeks s/p

A/P view, ten weeks s/p, focused in on lateral epicondyle

Medical intervention

- ORIF L elbow
- Pin and screw to medial epicondyle
- Long arm splint with elbow in 90d
- Removable fiberglass cast worn for 6 weeks
- Hardware removed ~10 weeks s/p

PT Intervention

- PT beginning s/p 1-2 weeks
- Began with wrist and grip strengthening, elbow PROM
- Progressed to AROM, main focus of elbow flexion
- Bicep/tricep curls, cane supination/pronation
- Interferential current
- Discharged ~6 weeks

Outcomes

- Regained full ROM+ of involved joint
- Regained functional strength
- Returned to sport for fall
- No residual symptoms
- Some hypersensitivity
- Valgus stress test
- Scar management
Pt is a 14 y/o male athlete with no significant PMH

Mid 2007: Rolled ankle while hiking in Canada *1 night of high fever*
 – Given air cast and diagnosed with lateral ankle sprain
 – 4 weeks of PT focused on ankle strength and improved ROM
 – Function and pain improved, with persistent swelling
 – Radiographs negative

Late 2007 – Late 2008: Chronic swelling in ankle with intermittent pain.
Played 2 basketball seasons with ankle brace.

January 2009: Left Ankle lateral radiograph

January 2009: A/P and mortise view radiograph

January 2009: Follow-up MRI shows moderate sized cyst in the distal tibia
Post MRI: Exploratory surgery scheduled for May 2009 at STL Children’s

Pain began gradually increasing in intensity and duration

Not relieved with medication

Slight relief with limb elevated

Called STL Children’s February 26th once pain intensity became unbearable

Images, hospital admission, and surgery performed that night

Diagnosis:

- Osteomyelitis left distal metaphysis extending across epiphyseal plate

- Presumably caused through stress fracture during ankle sprain 2 years earlier giving the infection a place to “settle”

Treatment:

- IV antibiotics – 4 months through peripherally inserted central catheter (PICC line)

- Oral antibiotics – 2 years

- PT for 8 weeks focused on strength and ROM from muscle atrophy following casting/walking boot

  - Biomechanical Ankle Platform System (BAPS) board
  - Tilt boards
  - Single leg stance activities
  - Progressed to light jumping/jogging then increased intensity

  - ** PT and P.E. activities limited by PICC line**

  - No temporary bone filler was used because of age and growth

Diagnosis:

- Osteomyelitis can be diagnosed using:

  - Blood tests (only if infection originated in the blood)
  - X-Ray
  - MRI
  - CT
  - Bone biopsy “Gold Standard”

  - Acute osteomyelitis is typically Staph aureus
References:

