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Arthralgias, Myalgias and COVID-19
Dx & Tx of Shoulder, Low Back & Knee Pain
Complaints Of 71 Patients At PM&R Clinic During 20 Days

44% Shoulder pain & SS tendonitis.
Tx: Inject Steroid, RC exercises

34% LBP & pelvic obliquity.
Tx: Trunk rotation & SB exercises.

31% Knee pain with PFD.
Tx: Inject Steroid; Tape; Exercise.

Rx: Low cost & effective Tx.
COVID-19 Infection & Musculoskeletal Problems

• Tuzun S, et al. 2020
  • N=103: 68.7% non-severe; 31.3% severe.
  • Fatigue: 85.3%
  • Myalgia 68.0% not affected by COVID-19 severity.
  • Arthralgia: 43.3% wrist 16.7%, ankle 16.0%, knee 15.3% joints; significantly higher among the severe group.
  • Back pain 22.0%

• Batur, et al 2020
  – 80 patients hospitalized with COVID 19 infection.
  – 50% Fatigue
  – 46.1% Myalgia; increased CK & lymphocyte count P<.05

• Zhang, et al 2021. At one year post-COVID-19 infection:
  – Fatigue 27.7%; sweating 16.9%; chest tightness 13%; anxiety 10.4%; myalgia 7.9%
## Bakılan, et al. 2021

### Admissions Symptoms

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Frequency n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back pain</td>
<td>80 (28.6%)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>34 (12.1%)</td>
</tr>
<tr>
<td>Low back pain</td>
<td>30 (10.7%)</td>
</tr>
<tr>
<td>Neck pain</td>
<td>27 (9.6%)</td>
</tr>
<tr>
<td>Spinal pain more than one site</td>
<td>17 (6.1%)</td>
</tr>
<tr>
<td>Knee pain</td>
<td>15 (5.4%)</td>
</tr>
<tr>
<td>Joint pain more than one site</td>
<td>15 (4.6%)</td>
</tr>
<tr>
<td>Shoulder pain</td>
<td>11 (3.9%)</td>
</tr>
<tr>
<td>Widespread myalgia</td>
<td>11 (3.9%)</td>
</tr>
<tr>
<td>Radicular neck pain</td>
<td>6 (1.4%)</td>
</tr>
</tbody>
</table>

### Frequency n (%)

#### Musculoskeletal System

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Frequency n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue Initiated or aggravated with COVID-19</td>
<td>156 (55.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>201 (71.8%)</td>
</tr>
<tr>
<td>Neck pain</td>
<td>32 (11.4%)</td>
</tr>
<tr>
<td>Back pain</td>
<td>85 (30.4%)</td>
</tr>
<tr>
<td>Low back pain</td>
<td>45 (16.1%)</td>
</tr>
<tr>
<td>Spinal pain &gt; one site</td>
<td>36 (12.8%)</td>
</tr>
<tr>
<td>Initiated or aggravated with COVID-19</td>
<td>160 (57.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>198 (70.7%)</td>
</tr>
<tr>
<td>Muscle pain &gt; one site</td>
<td>143 (51.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>170 (60.7%)</td>
</tr>
</tbody>
</table>
  – NSAIDS, especially ibuprofen, is not recommended since it may increase ACE-2 expression.

  – ACE-2 receptors: for spike protein to enter cells; in skeletal muscle & CNS; ACE-2 decrease in CNS may cause spinal hyperalgesia (Yamagata et al.2020).
  – Cytokine storms. Myalgia with prostaglandin E2 (PGE2) production. Cytokines (IL2, IL6, IL7, IL10, TNF alpha, e lymphopenia) higher in COVID-19 patients.
Shoulder Pain, Supraspinatus tendonitis, & Adhesive Capsulitis

- 53 yr man, LH. Lifts & delivers food.
- 4/14/22 mRNA COVID Booster right deltoid.
- 5/17/22 Lt>R shoulder pain, ROM decreased.
- DDx:
  - Local Inflammatory Response with SIRVA
  - Systemic Inflammatory Response.
SIRVA
Shoulder Injury Related To Vaccine Administration

- Vaccines injected into subacromial or subdeltoid bursa.
- Shoulder pain & limited ROM within 48 hrs.
- Pain for 859 patients: 1 month for 65%; >3 mos for 25% (Shimabukuro. 2017)
- Claims to Vaccine Injury Compensation Program:
  - 504 FY 2013; 1,243 FY 2017
- SIRVA with COVID-19 vaccines.
  - Subdeltoid bursitis & RC tendinopathy, n=1; AstraZeneca vaccine (Cantarli Rodrigues, et al. 2021)
  - Massive shoulder effusion & synovitis, n=1; mRNA vaccine (Yuen, et al. 2022)
- Risk factors: Thin; female; small deltoid; poor injection technique.
- MOA: inflammatory cascade
- Tx: Corticosteroid injection within 5 d of symptom onset; Sx resolved < 1 month; n=1 pneumococcal polysaccharide vaccine; n=1 recombinant zoster vaccine (Macomb, et al 2020)
# Shoulder Adhesive Capsulitis With COVID-19 Infection or Vaccine

<table>
<thead>
<tr>
<th>Study</th>
<th>Vaccine or infection</th>
<th>Patients</th>
<th>Sites affected; Onset</th>
<th>Adhesive Capsulitis</th>
<th>SIRVA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present case</td>
<td>mRNA (Pfizer)</td>
<td>53 yr, LH man</td>
<td>Polyarthralgia after booster.</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Ascani, et al. 2021</td>
<td>COVID Infection</td>
<td>N=12; 8 female, 4 males;</td>
<td>Shoulder: 5 right, 6 left, 1 B/L. Onset 1.5-3 months post-COVID-19 diagnosis</td>
<td>Yes</td>
<td>No</td>
<td>COVID-19 symptoms: nil for 7; mild for 5.</td>
</tr>
<tr>
<td>Sahu &amp; Shetty. 2022</td>
<td>Covishield, n=9; Covaxin, n=1</td>
<td>N=10; 9F, 1M; 53±8 yrs;</td>
<td>Injected shoulder. Onset was: immediate for 6 &amp; 48h for 1; at 10 days for 3.</td>
<td>Yes 6/9 no resolution at mean 1.4 mos.</td>
<td>Yes for 7 No for 3</td>
<td>Normal MRI for 3.</td>
</tr>
</tbody>
</table>
mRNA COVID-19 vaccine, Joint Pain & Adhesive Capsulitis

- 53 y M, LH. Lifts & delivers food.
- Hx: DM2, Vitiligo; hypothyroid; shoulder pain.
- 4/2021 mRNA COVID-19 vaccine; no pain.
- 5/2021 mRNA COVID-19 vaccine; mild right hip intermittent pain.
- 11/4/21 “normal ROM all joints.”
- 12/22/21 Minor discomfort Lt hip & shoulder with movement, & behind Rt knee; possibly started 5/2021. ED X-rays normal.
- 1/31/22 Lt shoulder pain, PROM “restricted.”
- 4/14/22 Booster. Pain B/L shoulders, hips & knees; resolved except B/L shoulders.
- 5/17/22 Lt>Rt shoulder pain, ROM decreased.
- 6/9/22 PE LUE: limited AROM & PROM; TTP supraspinatus tendon of insertion.
- Dx: mRNA vaccine induced systemic arthralgias, left shoulder pain with supraspinatus tendonitis & adhesive capsulitis.
- No SIRVA since: right shoulder injected, and systemic arthralgias.
Treatment for Shoulder Pain, Supraspinatus Tendonitis & Adhesive Capsulitis. Post-mRNA COVID-19 vaccine Joint Pain & AC.
Dx: Shoulder Pain, Supraspinatus Tendonitis & Adhesive Capsulitis. 
Tx: 6/9/2022 Jointinjected Bupivicain & Triamcinolone. 

Pre- vs Post Injection:
TTP SS tendon at insertion: right 3/10; left 6/10 → 0/10.
PROM flex: 90 → 130; no pain. 

Home Exercises:
*SS tendinitis: Rotator Cuff Exercises
*Adhesive Capsulitis: Stretching
Adhesive Capsulitis (Frozen Shoulder)

- Glenohumeral capsule contracture. Synovial inflammation, capsule fibrosis, & vascular hyperplasia.
- Prevalence: 2-5% (Hand, et al 2008); 14% B/L.
- Risk factors: Age 40-70 yrs; Female; DM 1 or 2; Hypothyroidism; HLA-B27; autoimmune disease; cerebrovascular disease, especially SAH; COVID infection (MRI with AC was 16.7% vs 9.2% for 2020 vs 2019.Castro, et al. 2022)
Adhesive Capsulitis

• Stages (Le, et al. 2017; Patel, et al. 2020)
  – 1. Pre-freezing: Pain, especially qhs; inflammatory cells in synovium..
  – 2. Freezing: severe pain, progressive stiffness; synovial proliferation.; 2-9 months.
  – 3. Frozen: Loss ROM; less pain @ rest but persists with movement; capsule with dense collagenous tissue. 2-4 months.
  – 4. Thawing: recovery phase with ROM gradually increasing; 5-14 months.

• Tx:
  – Inject capsule steroid alone or with saline for hydrodilation; NS difference (Buchbinder et al.2008)
  – ROM exercise. HEP as effective or superior to supervised exercise (Tanaka et al 2010). Shoulder function improved for 90% with “gentle exercise” vs 63% with intensive PT. Exercise with & w/o joint mobilization improved ROM (Lee, et al. 2023)
  – Manipulation; MUA
  – Capsulotomy.

• Outcome: recovery 1-3 years
COVID-19 Infection, Exercise & Adhesive Capsulitis
N=72 with AC at Orthopedic Clinic. Naderifar, et al. 2023

<table>
<thead>
<tr>
<th></th>
<th>COVID +</th>
<th>COVID --</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 25-49.9 yrs</td>
<td>2 (11.11%)</td>
<td>20 (37.04%)</td>
<td>0.039</td>
</tr>
<tr>
<td>PA: Yes</td>
<td>18 (24.8%)</td>
<td>31 (57.4%)</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>13 (72.2%)</td>
<td>23 (42.59%)</td>
</tr>
<tr>
<td>Pain, months</td>
<td>4.39 ±3.36</td>
<td>10.44 ±9.64</td>
<td>0.01</td>
</tr>
<tr>
<td>Pain, VAS</td>
<td>7.33±1.61</td>
<td>4.26±1.06</td>
<td>0.012</td>
</tr>
</tbody>
</table>

Conclusions:
1. NS difference in incidence of AC for patients with or without COVID.
2. COVID-19 occurred less often for regular exercisers.
3. Pain was higher for COVID + patients; however, they were closer to onset of AC.
Roberts S, Dearne R, Keen S, et al. Routine X-rays for suspected frozen shoulder offer little over diagnosis based on history and clinical examination alone. Musculoskeletal Care. 2019

X-rays if trauma, dislocation, or r/o heterotopic ossification.
Supraspinatus (red) vs Deltoid (yellow):
Force vectors; Rotator Cuff Injury; Exercise Rx

- Supraspinatus pulls humeral head into glenoid fossa.
- Deltoid pulls humeral head toward acromion process; decreases subacromial space; increases risk for impingement syndrome with supraspinatus tendonopathy.
- Shoulder abduction increases EMG activity for both muscles.
- Dx SS tendinitis: palpate insertion on humeral head.
- Rx: Exercise supraspinatus w/o deltoid.
Shoulder Exam: Rotator Cuff Muscles
(Supraspinatus, Infraspinatus, Teres Minor; Subscapularis)

• Palpate supraspinatus tendon at the insertion with humerus hyperextended.
• AROM & MMT (0-5) for rotator cuff muscles: “Empty Can Test” for supraspinatus muscle; ER for infraspinatus & teres minor muscles:
IR for subscapularis muscle.
• If limited AROM, assess PROM to r/o contractures.
Muscle Fiber Types & Exercise Rx

- Type I: Slow twitch, high oxidative capacity.
- Type II: Fast twitch; high glycolytic metabolism.
- SS normally 54% type 1 fiber type.
- SS RC tear: atrophy of type 1 and 2 fibers; changes indicating a shift from type 1 to type 2 muscle fibers (Ravn, et al. 2020). Decreased endurance for SS muscle with RC tear.
- Rx: Endurance Ex (low resistance, many reps); advance to strength Ex (high resistance; few reps) when no pain & full AROM.
Infraspinatus Exercises:
One shoulder externally rotates with a concentric contraction.
The other shoulder resists with an eccentric contraction.
Supraspinatus Isometric Exercise: Shoulder is internally rotated & abducted about 20°

Avoid a Valsalva Maneuver

Left shoulder externally rotates against resistance by RUE.
Rotator Cuff Exercises
Low Back Pain: 30-80% prevalence (often non-specific). My patients: 34%, usually with a pelvic tilt.

- **Hx**: R/O conditions exacerbated with exercise.
  - nerve impingement (bulging or herniated disc [pain in dermatome or myotome distribution]), radiculitis, radiculopathy, cluneal nerves.
  - Vertebral compression fx
  - Tumors, infection, nephrolithiasis, endometriosis,

- **PE**:
  - Provocative maneuvers to increase & decrease pain (sitting & standing)
  - Assess asymmetry for pelvis when standing erect & with trunk flexion.

- **Dx**: Muscle strain/spasm if pelvic tilt (lateral, anterior) resolves with trunk exercises.

- **Tx**: Exercise with trunk rotation. & lateral flexion.

Muscles & Movements of Pelvis, Spine & Trunk

- **Multifidi & Rotatores**
  - Sidebend vertebra ipsilaterally
  - Rotate vertebra contralaterally
- **Ipsilateral pelvic elevation**
  - QL, ER
- **Ipsilateral pelvic depression & anterior pelvic tilt.**
  - Iliopsoas & Rectus Femoris
40y M. Pain: Right low back since 2020 (hit by car); severe when lifts heavy objects (construction work); mild relief with naproxen; no radiation to LE; transient relief with “pain Dr” injections.

Left iliac crest elevated via quadratus lumborum muscle & erector spinae.

After trunk rotation exercises, iliac crests symmetric; pain 6→4.
Lumbar Vertebrae:
SB right, Rotated left via Multifidus

Limited trunk rotation right; improved with repeated trunk rotations.
Trunk Rotation: Stretch, Contract, Relax. (Muscle Energy Technique)
Left LBP after yard work; unable to stand upright. “Strain – Counterstrain”

Anterior pelvic tilt by Iliopsoas “spasm.”

Pelvic tilt right as QL & ES elevate left iliac crest.
Stretch Rectus Femoris
With Knee Flexed & Hip Extended

“Tight” Hip Flexors
(RF & Iliopsoas)

Stand Upright &
“Lean Backwards”
Stretch Rectus Femoris
Stretch hip abductors & flexors (iliopsoas), & knee extensors

Use bottom leg to adduct & extend top hip.

Increase “stretch” by flexing knee.

- Conclusions-Manipulative therapy and physiotherapy are better than general practitioner and placebo treatment. Manipulative therapy is slightly better than physiotherapy after 12 months.
- N=256 patients; non-specific back and neck complaints ≥ 6 weeks. No physiotherapy or manipulative therapy in the past two years.
- Interventions-At the discretion of the manipulative therapists, physiotherapists, and general practitioners.
- Physiotherapy: exercises, massage, and physical therapy (heat, electrotherapy, ultrasound, shortwave diathermy).
- Manipulative therapy: manipulation and mobilization of the spine.
- General practitioners Tx : drugs (e.g. analgesics), advice about posture, home exercises, and (bed)rest.
Patellofemoral Dysfunction (PFD)
Patellofemoral Pain Syndrome (PFPS)

• Prevalence 25%; often <40 yrs & physically active.
• 31% prevalence for my patients.

Knee Pain 31%: Patellofemoral Dysfunction

Sunrise or Merchant view

Patella is pulled lateral to femoral groove by 4 muscles: RF, VL, VI, TFL-ITB

PE: skin temperature; palpate for crepitus; patella mobility; patella tendon compression test.

Tx: Aspirate & inject. Tape patella into groove. Exercise: stretch muscles that pull patella laterally; increase endurance for VM (type 1 fiber) to pull patella medially.
(A) Kinesio taping method.
(B) McConnell taping method.
Knee Pain & PFD

• Case: 59 yr man c/o B/L knee pain & difficulty walking.
• X-rays: tricompartmental OA
• 10/11/23: steroid injections at orthopedist office decreased pain from 10/10 to 8/10 B/L.
• 10/12/23: moderate crepitus. After patella taping, pain decreased from 8/10 B/L to 3/10 left and 1/10 right. Antalgic gait resolved.
• HEP: Self tape knees; Ex to stretch muscles that pull the patella laterally, & to increase endurance for Vastus Medialis (type I fibers).