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THORACIC SPINE CASE 1

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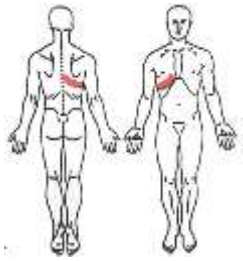
Orthopaedic Manual Physical Therapy Series
Richmond 2018-2019

Body Chart

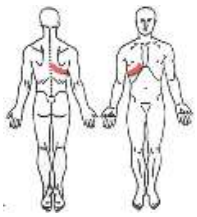


Body Chart – Initial Hypothesis:

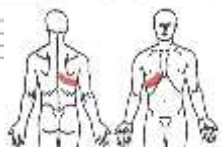
T8/9 Segmental Dysfunction (Somatic)
Intercostal Sprain/Strain
T8/9 Radiculopathy
Visceral Referral/Red Flag?
- Gallbladder?
- Liver?

Subjective History

- 43 y/o R handed male with thoracic spine and ribcage symptoms
- 2 wk history of thoracic symptoms after shoveling and moving 4 tons of gravel which took 5 hours
- Mid-back "ache" described towards end of shoveling and with difficulty sleeping that night
- Worsening in last 2 weeks with increased irritability
- 1st episode of thoracic area symptoms other than gallbladder "attack"
- Reports hx of low level but dull R lower quadrant symptoms, at times after he eats certain foods
- PMH significant for gallbladder dysfunction, gallstones and previous alcohol abuse



Subjective "Asterisks" Signs/Symptoms: (Aggravating/Easing factors, Description/location of symptoms, Behavior, Mechanism of injury):



- Symptom Behavior:
  - Constant, deep R thoracic ache/burning which intermittently radiates P-A
- Symptoms can occur together but appear unrelated
- Can have posterior thoracic pain without radiation anterior-laterally
- Currently still working as stone mason
- Aggs: Deep breath, twisting, cough/sneeze, reaching down towards floor, rolling in bed at night, certain foods
- Eases: changing position, rest, pillow under R arm, L SL with arm overhead
- Somewhat activity/positional dependent and worsens throughout day

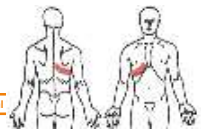
STRUCTURE at Fault:

Joints in/refer to the painful region	Myofascial tissue in/refer to the painful region	Non Contractile tissue in/refer to the painful region	Neural tissue in/refer to the painful region	Other structures that must be examined – non MSK
C7-T2 and T8/9 Z, CV, CT Jts T8/9 Costochondral Jt	T8/9 paraspinals and multifidus, intercostals, lower trap	T8/9 Capsule/IVD Ribs (Fx)	T8/9 nn root	Visceral: Gallbladder Liver Lung Ankylosing-Spondylitis

Primary HYPOTHESIS after Subjective Examination: T8/9 mechanical dysfunction (CV/CT) with somatic referral

Differential List (Rank List in order to rule out):

Visceral Referral, Cervical Somatic Dysfunction, Muscular Strain



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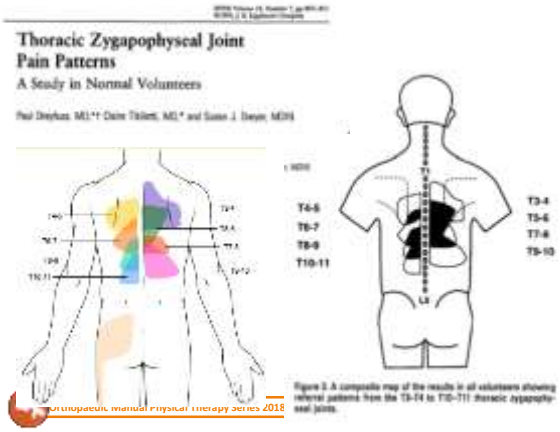

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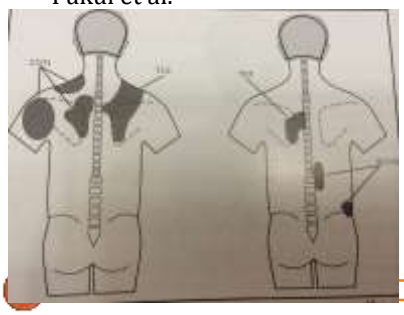
Thoracic Zygapophyseal Joint Referral Patterns C7/1-T2/3 and T11/12

- Fukui et al.



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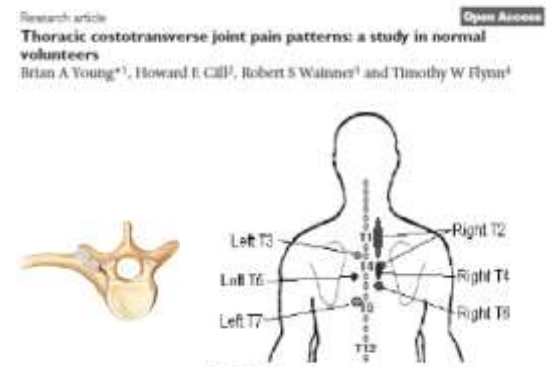

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Thoracic Pain Patterns

- Discogenic: complaint of central posterior pain which goes through the sternum. Often described as being "underneath sternum"
- Costovertebral, Costotransverse, or Z-Joint: complaint of a horizontal or lateral spread of pain
- Nerve Root: Pain around the line of the rib (T1 nerve root may give arm symptoms and pain across inferior angle of scapula) (Rule Out - Herpes Zoster Virus)
- Costochondral Joint: anterior chest pain (over the joint)
- Must rule out cervical referral to thoracic spine and scapular region (Facet/Disc)

Identify any potential risk factors (Yellow, Red flags, non MSK involvement, biopsychosocial)

- **History of Gallbladder dysfunction and alcohol abuse with potential non MSK/visceral referral**

- Must rule out serious pathological or visceral cause of symptoms
- Since presence of primary thoracic pain is low, 15%, must be suspicious of non-mechanical causes with thoracic spine and chest pain
- Visceral sources considered when no clear mechanical features exist
  - Myocardial ischemia, AAA, peptic ulcer, acute cholecystitis, renal colic, pyelonephritis
  - Majority of visceral organs innervated by T/S spinal nerves

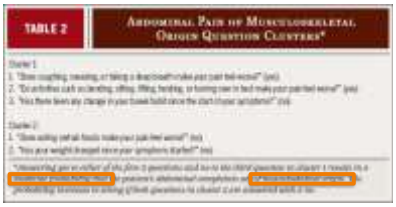
Thoracic Spine Differential Diagnosis

OR

[RESIDENT'S CASE PROBLEM]

Abdominal Pain in Physical Therapy Practice: 3 Patient Cases

- 46y/o female R groin & R lower abdominal P!
- Insidious onset x 6 weeks, deep dull ache with cramping
- Aggs: none
- Eases: NSAIDs
- B & B (-), excessive menstrual bleeding last 2-3 months
- No to all 5 questions in cluster
- ROM, Neuro, Provocation testing (-)
- (+) R LQ palpation



Visceral Referral Pattern

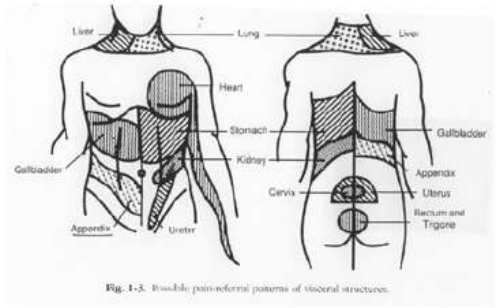
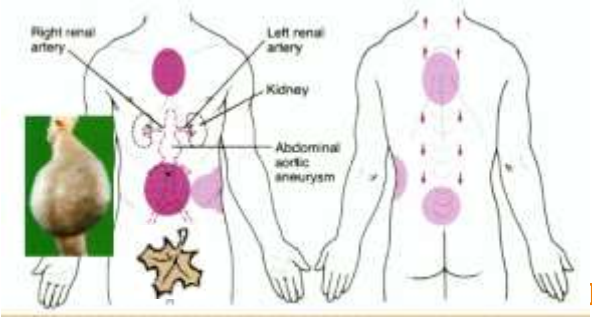


Fig. 1-3. Possible pain-referral patterns of visceral structures.

Abdominal Aortic Aneurysm

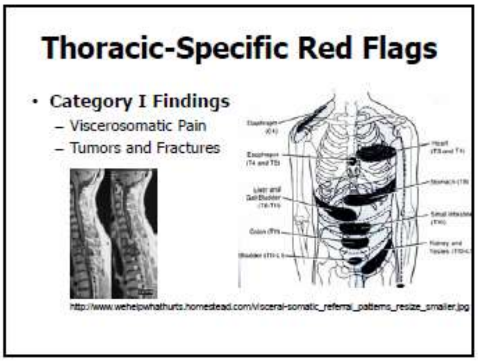


Lung Referral Pattern

Medical Screening

- Other Red Flags in T/S – infection, fracture, neoplasms and inflammatory disorders
  - Spinal metastases (usually breast, lung, or colon primary) are most common forms of cancer in thoracic spine (Primary tumors rare)
  - Ankylosing Spondylitis – affects thoracic spine and rib joints with limited ribcage and chest expansion (hallmark is less than 2.5 cm)
    - AM Stiffness, sacroilitis, peripheral joint involvement, M>F 3:1, 15-40 y/o
  - Fractures – traumatic or osteoporotic
    - Men OR Women 60 or older presenting with acute thoracic spine pain must rule out

Visceral Palpation and Assessment



Murphy's Sign for Cholecystitis

- Sensitivity = 97
- Specificity = 48
- (+) LR = 1.9
- (-) LR = .06

(-)

Liver Palpation

(-)

Study	Reliability	Sensitivity	Specificity	LR+	LR-	QUADAS Score (0–14)
Halpern et al.	NT	71	62	1.87	0.47	6
Joshi et al.	0.44, 0.49, 0.53	39–42	82–86	2.17–3.0	0.68–0.74	9
Blendis et al.	54%	50	47	0.94	1.06	6
Ralphs et al.	NT	36	83	2.18	0.76	10

Aorta Palpation

(-)

Study	Reliability	Sensitivity	Specificity	LR+	LR-	QUADAS Score (0–14)
Fink et al.	0.66	60	75	2.70	0.43	9
Lederle et al.	NT	50	NT	NT	NT	
Chervu et al.	NT	38 77	NT NT	NT NT	NT NT	7
Collin et al.	NT	44	91	5.00	0.62	8
Karkos et al.	NT	48	NT	NT	NT	4
Kiev et al.	NT	31	NT	NT	NT	7
Lederle&Simel	NT	39	96	12.0	0.72	NA

Appendix Palpation

(-)

Study	Reliability	Sensitivity	Specificity	LR+	LR-	QUADAS Score (0-14)
Campbell & McPhail[1]	NT	76	NT	NT	NT	8
Alvarado[7] (tenderness)	NT	100	13	1.14	0.00	8
Alvarado[7] (Blumberg's sign)	NT	55	78	2.5	0.58	8
Tzanakis et al.[?] (tenderness)	NT	90	19	1.19	0.17	9
Tzanakis et al.[?] (Blumberg's sign)	NT	66	75	2.61	0.45	9
Soda et al.[?]	NT	87	90	8.42	0.15	9

49

Spleen Palpation – Middleton's Maneuver

(-)

Study	Reliability	Sensitivity	Specificity	LR+	LR-	QUADAS Score (0-14)
Tamayo et al.[?]	0.31	35	87	2.69	0.75	11
Barkun et al.[?]	0.7, 0.36, 0.57	56	93	8.00	0.57	9

➤ Are the relationships between the areas on the body chart, the interview, and physical exam consistent? "Do the features fit" a recognizable clinical pattern? Yes No

Please explain areas that may need clarification: R T8/9 CV/CT jt Mechanical Dysfunction

Chapter 5

Acute Thoracic Spinal Pain

➤ There are currently no guidelines for the management of thoracic spinal pain. This document provides an overview of the evidence in this area to raise awareness of the need for formal population studies on the diagnosis and management of thoracic spinal pain.

Relative Prevalence of Local Causes of Thoracic Pain

Frequency	Entities	Prevalence
Rare conditions	Primary and secondary neoplasia	[illegible]
	Disc protrusion	[illegible]
	Rheumatoid arthritis	Unknown
	Spinal infection	[illegible]
Uncommon conditions	Traumatic fractures	Unknown
Common conditions	Somatic pain	[illegible]
	Osteoporotic fractures	[illegible]

Thoracic Spine/Ribcage Mechanical Dysfunction – Clinical Characteristics

- Scaringe and Ketner – Manual methods for the treatment of rib dysfunctions and associated functional lesions. *Topics in Clinical Chiropractic* (1999)
  - "Costovertebral or costotransverse jt dysfunction will present with localized pain to the posterior thorax that may radiate to the anterior chest or along the associated rib"
  - "Symptoms usually unilateral and painful upon deep inspiration, coughing or sneezing"
  - "Passive or active TL flexion, rotation, and/or lateral flexion may increase the symptoms"
  - "Palpable tenderness of the involved CT jt and rib angle is noted upon joint challenge"
  - "Adjacent thoracic vertebral and rib segments are usually restricted, may complicate the clinical picture, and stimulate or exacerbate protective spasm"

Thoracic Objective Examination

- Observation/Postural Assessment/Functional Testing
- Cervical shoulder and rib screening
- Thoracic AROM/PROM/Resisted Testing
  - Combined Motions
- Neurological Testing
  - Segmental
  - Central
- Neurodynamic Testing
- Biomechanical Examination
  - Thoracic PAIVM's
  - Rib Spring
- Specific Rib Examination
  - 1st rib CRLF test

Thoracic Exam Observation

- General appearance and willingness to move
- Head position
- Posture
  - Cervical curve (presence of lordosis)
  - Thoracic curve (sagittal and frontal planes)
    - Scoliosis (rib hump)
  - Scapular positioning
- Swelling
- Muscle girth and symmetry / changes in body contour
  - Atrophy, spasm, swelling
- Rib movement with breathing
- Skin
  - Scars (especially previous surgical scars)
  - Itchy/redness

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Thoracic Exam

- Screen neighboring joints
  - Cervical motion
    - Rotation with OP
    - Extension
    - Quadrant with OP
    - PAIVM
  - Shoulder functional movement screen
    - Active Elevation, Abduction, Abd/ER, Add/IR with Ops
    - Full Can and ER MMT
    - Passive Quadrant Testing
  - Can be good asterisks and help differentiate between cervical/thoracic/shoulder pathology

(-) adjacent jt clearing

Rib Screening with Respiration (+)

- Deep inhalation and exhalation
  - Rib excursion
    - Upper and lower ribs
    - Quantity
    - Symmetry
  - Pain reproduction
    - May indicate the need to examine the ribs in more detail

Thoracic Objective Examination

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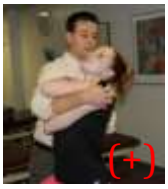
Thoracic AROM Assessment

- Thoracic AROM:
  - Flexion
  - Extension
  - Rotation
  - Side bending



Combined Motions

(+)

SB → Contra Rotation

Rotation →Ipsi SB

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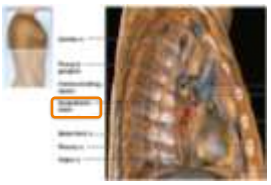
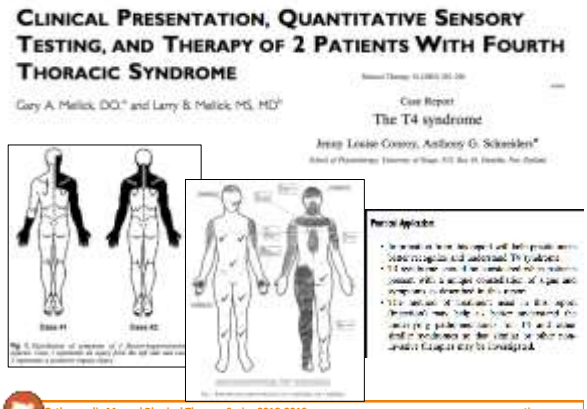


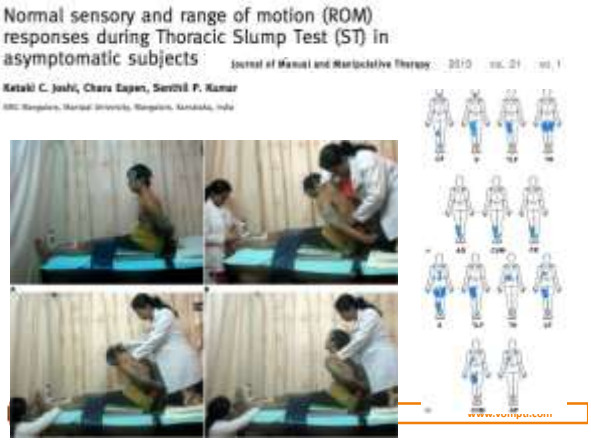
Neurodynamics

- Sympathetic chain – anterior along rib heads and CV joint
  - Loaded during flexion, contralateral SB and rotation
  - Further loading with thoracic flexion and contralateral SB in Slump type position (long sitting)
- Critical Zone (T4-9)
  - Narrow, decreased blood supply
  - T6 often considered tension point
  - Segmental stiffness of mid T/S could contribute to signs and symptoms (local and peripheral) associated with adverse neurodynamics
  - Symptoms associated with (+) Slump often are altered after manipulative treatment of mid T/S
  - Possible cord compression – large HNP

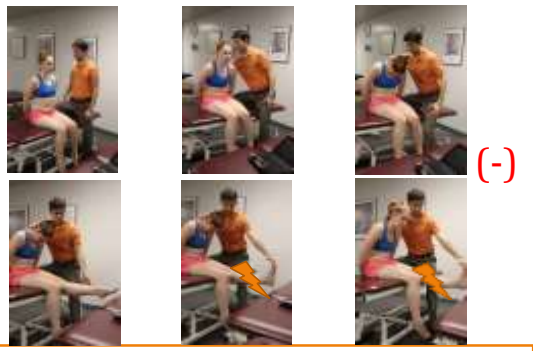
Neurodynamic Testing - Sympathetic (Long Sit) Slump Test

- Sympathetic trunk is unilaterally lengthened in the long-sit position (Butler and Slater)
  - More so with contralateral thoracic SB, thoracic rotation, cervical SB
- Often utilized to examine neural tissues in head, neck, thorax and lumbar spine (Butler, 2000)
  - Sympathetic System linked to CRPS II, T4 syndrome, TOS
    - Neurons T1-L2 (head/neck – LE)
  - Recommended when sympathetic trunk is suspected of contributing to symptoms such as hyper or hypohidrosis, altered skin color or temp, or slumped posture mechanism of injury
- Can be position of mobilization and treatment
- Reliability and Validity Unknown
  - Slater et al/Cleland et al – Increased skin conductance and decreased skin temperature following SST





Neurodynamic Testing – Slump Test



Neurodynamic Testing - Sympathetic or Long Sit Slump Test

(-)

Sympathetic (Long Sit) Slump Differentiation

- (+) test defined as reproduction of some or all of the patient's symptoms, asymmetry from uninvolved to involved sides and a (+) sensitizing maneuver
- (+) test suggests sensitivity of the SNS but does NOT indicate that the SNS is the cause of the symptoms or the source of the symptoms

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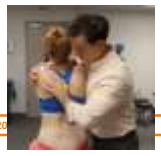
Practicality??
This Does Exist: PPIVMs/PAIVMs



Thoracic Biomechanical Examination

- Central PA
- Unilateral PA
- Transverse Pressure
  - CT Junction
  - Mid T/S
  - TL Junction
- Upper Thoracic
  - PA like cervical spine
- Mid and Lower Thoracic
  - PA like lumbar spine
- Rib Spring
  - Laterally at rib angles

(+) R T8/9

Thoracic – Rib Examination

- Rib Spring
  - Laterally at rib angles

Rib Joint Pathomechanics

- Theoretically could be dysfunctional at CV or CT joints
- 1st Rib – often subluxed cranially with trauma or repetitive overuse of UE, as well as TOS
- Commonly have posterior rotation of rib on same side as flexion restriction
  - Thought that restriction of rib movement anteriorly can lead to recurrence of unilateral flexion restriction
- Anterior subluxation
  - Blow to posterior chest wall
  - Prominence of rib anteriorly and concavity posteriorly
- Posterior subluxation
  - Blunt trauma to anterior chest wall

Pathomechanics

- No studies analyzing motion of T/S in subjects with primary or secondary spine disorders (based on anatomy and opinion/models)
- Flexion restrictions (inability of spinal unit to rotate forward in sagittal plane)
  - More common in upper to mid thoracic spine between T3/4 – T6/7 (flattened area and loss of normal posterior kyphosis)
  - Thought to occur after whiplash
  - (+) Flexion, contralateral SB and rotation combined ROM testing
- Extension restrictions (inability of segment to rotate backward in sagittal plane)
  - More common in upper thoracic spine and CT junction C7-T2
  - Also common in lower thoracic spine and TL junction
  - (+) Extension, ipsilateral SB and rotation combined ROM testing

Thoracic Spine/Ribcage Clinical Pearls

- Literature suggests that movement at CV joint creates movement at CT joint and that dysfunctions are rarely specific
- Several authors suggest adjacent thoracic facet, CV and CT joints are often restricted together
- Even though restricted together, treatment directed towards one joint may not result in improvement to other joint
  - Empirical evidence suggests sustained restriction may perpetuate dysfunction if only Facet, CV or CT joint is addressed independently

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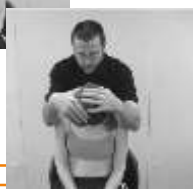
Rib Joint Pathomechanics – 1st Rib

- Ant/Middle Scalene insertion
- Lower plexus trunk
- Elevation > Depression
  - Scalene hypertrophy
  - Upper chest breather
  - Prone rotation sleeper
  - Computer/ergonomics
- Potential site of neurovascular compression of plexus, subclavian artery or vein (TOS)
- Hypomobile elevated 1st rib thought to play a role in upper trap symptoms
- "Jump Sign"

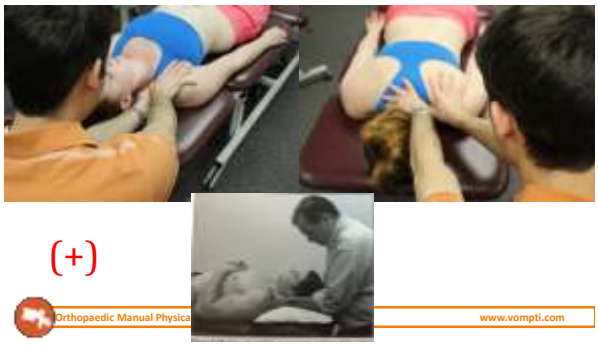
Cervical Rotation-Lateral Flexion Test

- Examine mobility of 1st rib
- Pt sitting
- C/S passively and maximally rotated **AWAY** from side being tested
- Gently flex as far as possible, moving ear toward the chest
- (+) if lateral flexion is limited or blocked (+ R and – L)
- Excellent interrater reliability K = 1.0 and good agreement with cineradiographic findings K = .84

(+)



1st Rib PAIVM Assessment



(+)

Physical Exam: 'Asterisks' Signs/Symptoms (Special tests, Movement/Joint Dysfunction, Posture, Palpation, etc)

- (-) Cervical and Shoulder Screening
- (+) Thoracic symptoms with deep breath
- Thoracic ROM: (+) Extension, R rotation, R SB, (+) R rot → R SB combined
- (-) Neurological Examination
- (-) Neurodynamic Testing
- (+) T8/9, Rib Spring to R9
- Palpatory changes along angle of R9
- (-) Visceral palpation
- Neck Disability Index = 22% perceived disability

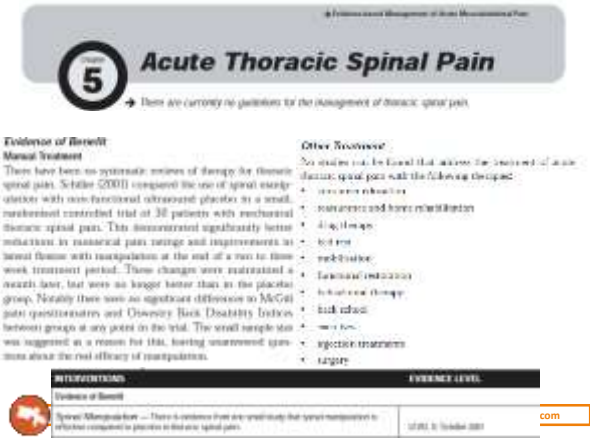
PICO

- In patients with mechanical thoracic spine pain/dysfunction, does the addition of manual therapy help reduce pain and improve function?
- Assessment of current evidence

- and thoracic pain??
- 3 somewhat relevant articles of 1st 100 searched

The Effectiveness of Thoracic Spine Manipulation for the Management of Musculoskeletal Conditions: A Systematic Review and Meta-Analysis of Randomized Clinical Trials

- 13 studies analyzed (RCTs) – 3 for shoulder, 9 for cervical conditions, 1 on lower trap function
- Identified need for additional studies to examine effectiveness of TSM
- NO studies investigated effect of thoracic spine manipulation on thoracic spine symptoms



Differential Diagnosis and Treatment in a Patient With Posterior Upper Thoracic Pain

Staas J Jr ruth
PHYS THER. 2006; 86:264-288

- Case study 35 y/o male with 4 month hx of symptoms
- Multifactorial manual therapy approach
- Discusses CV/CT joint assessment – 2 separate joints but assessed together due to proximity and shared movement with function
- Differential Diagnosis ruling out other musculoskeletal and visceral sources

Rationale for Treatment

According to Scaringe and Reinser[1] and Triano et al,[2] treatment of CV and CT joint dysfunction should include attempts to normalize mechanics by soft tissue and joint mobilization or manipulation, scapular stabilization and postural evaluation, and any necessary pain control measures. Based on this recommendation and

Thoracic Treatment - Mobilization


Central PA

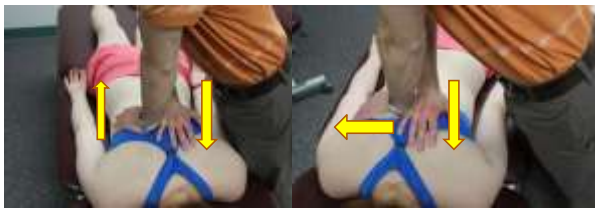

Unilateral PA


Transverse Pressures


Rotary PA Facet


Rotary PA Rib

Prone Rotary PA HVLAT (Facet T2-9 vs. R2-9 Costotransverse)



Costotransverse

Thoracic Spine Extension Mobilization with Foam Roller

Seated Mid Thoracic Distraction

Figure 1. Seated thoracic spine distraction thrust manipulation used in this study. The therapist uses his or her sternum as a fulcrum on the subject's middle thoracic spine and applies a high-velocity distraction thrust in an upward direction.

Supine Upper and Mid-Thoracic AP HVLAT

Alternate Thoracic and Ribcage Techniques

- Flexion Bias (T3/4 – T6/7)
- Extension Bias (CT Junc and TL Junc)
- Rib Manipulation
  - Exhalation (SB towards lesion, ½ breath in and breath out)


Mobilization in Sympathetic (Long-Sit) Slump Position

Prone CT Junction (C7-T3) Lateral Flexion HVLAT

Thoracic Treatment – 1st Rib



1st Rib Manipulation: "Snooker" Technique

Common OCS Question - Rib Subluxation MET

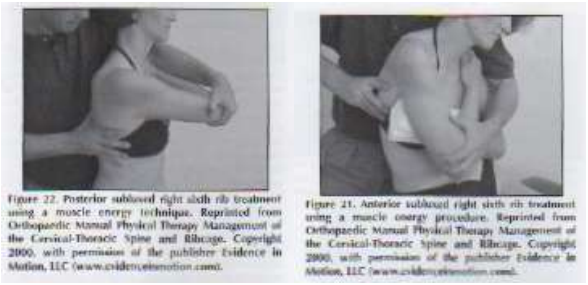


Figure 22. Posterior subluxed right sixth rib treatment using a muscle energy technique. Reprinted from Orthopaedic Manual Physical Therapy Management of the Cervical-Thoracic Spine and Ribcage. Copyright 2000, with permission of the publisher Evidence in Motion, LLC (www.evidenceinmotion.com).

Figure 21. Anterior subluxed right sixth rib treatment using a muscle energy procedure. Reprinted from Orthopaedic Manual Physical Therapy Management of the Cervical-Thoracic Spine and Ribcage. Copyright 2000, with permission of the publisher Evidence in Motion, LLC (www.evidenceinmotion.com).

Pattern Recognition

Identify the key subjective and physical features (i.e. **clinical pattern**) that would help you recognize this disorder in the future.

Subjective	Physical
Mechanical nature of symptoms **Somatic quality, even of referral** **Sensitivity to deep breath, twist, cough/sneeze (ribcage)** **Ergonomic/work posture component**	**Pain upon T/S ROM testing (Rot, SB, Ext)** **Palpatory changes along rib angle** **(-) Neurodynamic testing** **Associated dysfunction of same segment Z Jt** **Restriction and/or symptoms with PAIVM/PPIVM testing**