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Thoracic Pain in a Collegiate Runner (Case Report)

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Case report

Thoracic pain in a collegiate runner

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SUMMARY. This case study describes the process of examination, re-examination, and intervention for a collegiate runner with mechanical thoracic pain preventing athletic participation and limiting daily function. Unimpaired function fully returned in less than 3 weeks with biweekly sessions to re-establish normal and painfree thoracic mechanics via postural hygiene, exercise, mobilization, and manipulation. The outcome of this case study supports the original hypothesis that the pattern of impairments was in fact responsible for the functional limitations and disability in this athlete. At the time of publication the athlete was without functional limitations and had fully returned to competitive sprinting for the university track team. © 2002 Elsevier Science Ltd. All rights reserved.

INTRODUCTION

Thoracic pain can have numerous sources but pain originating from the local thoracic spine only accounts for <2% of spinal pain (Krämer, 1981). As with other regional spinal disorders, pain in the thoracic region may derive from soft tissue, visceral, disc, or articular structures and it is difficult to differentiate (Decina et al. 1992; Defranca & Levine, 1995; Wood et al. 1995; Erwin et al. 2000; Wilke et al. 2000; Lamb 2001). Of all disc lesions, thoracic disc lesions are believed to account for between 0.5% and 2% (Krämer, 1981; Vallo & Ransohoff, 1982). Whereas major thoracic disc lesions most commonly occur in the lower region, minor thoracic disc lesions typically occur in the upper and mid-regions (Skubic & Kostuik, 1991). Thoracic spine pain of facet joint origin is most common at the T3-5 segments in addition to the cervicothoracic and thoracolumbar junctions (Skubic & Kostuik, 1991).

Although thoracic dysfunction is less prevalent than either cervical or lumbar dysfunction, the associated impairments and functional limitations can be equally disabling. Pain of thoracic spine origin can manifest in the anterior and/or posterior thorax, lumbar spine, and the extremities (Defranca & Levine 1995; Wood et al. 1995; Erwin et al. 2000; Wilke et al. 2000; Lamb 2001). As the proximal anchor for the distal extremities, the thoracic spine influences, and is influenced by, active and resisted movements of the extremities, cranium, and lumbar and cervical spines. Accordingly, thoracic pain and the various associated impairments can result in broad limitations of function. Proper diagnosis and intervention are crucial to a complete, rapid, and lasting restoration of function. This case report will describe a male athlete with a painful thoracic dysfunction and present the clinical rationale for an eclectic treatment regimen including mobilization, short lever high-velocity low-amplitude manipulation (HVLA), self-mobilization, multiplanar therapeutic exercise, and postural education.

Examination

The patient was a 20 year-old right-handed male full-time junior in college (height: 1.7 m, weight: 65.8 kg). Prior to injury he was a sprinter for the university track and field team. He performed lower extremity resistance training four times per week and participated in intramural basketball, flag football, and soccer. Past medical history included permanent loss of vision in the left eye secondary to traumatic optic
nerve injury, radiculopathy right upper extremity, rotator cuff tendinopathy right shoulder, and right mid-thoracic spine pain (most recently one year ago).

The patient reported the sudden, non-traumatic onset of left-sided mid-thoracic pain following an episode of prolonged reclined sitting and left side lying approximately 10 weeks prior to the initial examination. This pain was not reduced or relieved by either rest or modification of activities. He described occasional radiation into the left axilla and anterior thoracic region in the fourth and fifth thoracic dermatomal distributions (William & Warwick 1980; Maitland 1986). The symptoms increased with trunk rotation (left greater than right), deep inhalation, and resistance training exercises (dumbbell and seated rows, pull downs, shrugs and upright rows). His chief complaint was pain preventing running, trunk and upper extremity resistance training, and prolonged sitting.

A systems review found normal cardiopulmonary, integumentary, and neuromuscular function, with normal affect, cognitive status, and speech/language skills (American Physical Therapy Association 2001). Observation of unsupported sitting posture revealed moderate forward head posture, increased thoracic kyphosis, and decreased lumbar lordosis. In standing, corresponding findings included increased lumbar lordosis without significant lateral spinal deviation (Milgrom et al. 1993). The shoulder girdles were protracted with the right depressed mildly. The right anterior superior iliac spine and posterior superior iliac spine were elevated. Lower extremity posture was unremarkable except for bilateral excessive pronation, left greater than right. Leg lengths were within normal limits upon measurement from ASIS to lateral malleoli in supine and long sitting (Woerman & Binder-Macleod, 1984).

Lumbar range of motion was within normal limits and pain free. Although cervical range of motion was within normal limits, end range flexion provoked mid-scapular pain, suggestive of dural involvement (Cyriax & Cyriax 1993; Ombregt et al. 1995). Thoracic range of motion was limited in a non-capsular pattern. Left rotation was painful (4/10) and limited to 75% whereas right rotation was less painful (1/10) but full. Although left-side bending was full, a mid-range painful arc was noted. Flexion, extension, and right-side bending were full and pain free. Passive joint mobility testing revealed normal end feel in all directions. Left postero-anterior unilateral vertebral pressure (UVP) at T4-5 was full but painful (McKenzie, 1990; Cyriax & Cyriax 1993; Ombregt et al. 1995; Magee 1997). Passive over-pressure for rotations revealed full right rotation with end range pain while left rotation was limited and painful.

In prone, active hyperextension provoked mid-thoracic pain (2/10) while passive hyperextension during a prone press-up was full and painless (McKenzie, 1990). Active scapular elevation was pain free, however, active scapular retraction in sitting was mildly painful in the mid-thoracic region, suggestive of dural involvement (Cyriax & Cyriax 1993; Ombregt et al. 1995). Resisted testing of muscle performance was remarkable for strong and painful right trunk rotation (2/10). Screening of the extremities revealed normal deep tendon reflexes and sensorimotor function (Hoppenfeld 1976). Lastly, the patient denied headaches or numbness, paresthesias, and pain in the extremities (Defranca & Levine 1995; Lamb, 2001).

Evaluation, diagnosis, and prognosis

Evaluation of the examination findings (insidious onset, unilateral segmental pain distribution, lack of spontaneous recovery, non-capsular pattern, dural signs, equally provocative resisted and passive tests) suggested a type 3 derangement of the T4-5 intervertebral segment (McKenzie, 1990). Problems associated with this mechanical thoracic pain included impairments of posture, joint mobility, muscle performance, and range of motion (American Physical Therapy Association 2001). This pattern of impairments may be responsible for functional limitations with resistance training, running, and prolonged sitting. Furthermore, these impairments rendered the patient disabled with respect to his ability to train for and participate in track and field activities (American Physical Therapy Association 2001). Goals for termination of this episode of care were: (1) 0/10 pain at rest and with activities, (2) full and pain free active cervicothoracic ROM, (3) negative dural signs, (4) normal, pain free thoracic passive joint mobility, (5) pain free resisted right trunk rotation, (6) independence in resistance training, and (7) return to competitive track and field if so desired, and (8) independence with self-mobilization. Full return to function within 4 weeks was expected and the plan of care included bi-weekly sessions of patient/client instruction, therapeutic exercise, spinal mobilization, and spinal manipulation.

Intervention

Based upon the examination findings and subsequent evaluation, intervention was planned so as to test the hypothesis that the pattern of impairments was responsible for the functional limitations and disability present in this patient. A response driven-intervention strategy was employed utilizing mobilization in a weight bearing position (Mulligan 1999), self-mobilization (McKenzie 1985; Mulligan 1999) and manipulation (Maitland 1986; McKenzie 1990; Cyriax & Cyriax 1993; Ombregt 1995; Mulligan 1999).
as adjuncts to therapeutic exercise and postural education.

To enhance the examination and make the transition to the intervention, we evaluated the response to the following mobilizations. Based on the examination findings and changes in range of motion and pain in response to these mobilizations we confirmed type 3 derangement at the T4-5 intervertebral segment. The initial mobilization was a left T4 sustained natural apophyseal glide (SNAG) with left rotation which restored full left rotation, however, end range pain persisted with left and right rotations (Mulligan 1999). Although a right T4 SNAG with left-side bending abolished the painful arc, limited left rotation recurred and bilateral rotations were painful.

Neither a left T4 SNAG with left-side bending nor a right T4 SNAG with left rotation were able to effectively restore simultaneous full left rotation and left-side bending because restoring one motion adversely affected the other motion. As challenging as thoracic pain can be to differentiate, it is equally difficult to explain this atypical response to mobilization. The possible explanations are numerous and may include segmental irritation secondary to the examination, an unstable migration of disc material, or concurrent involvement of one or both facet joints. In retrospect, the equally distributed force generated during a central SNAG may have addressed both limitations simultaneously (Mulligan pers. comm.).

The initial session concluded with postural education to improve sitting posture and avoid slouching and forward head postures using a lumbar roll for sitting, the slouch-overcorrect maneuver, and regular position changes (McKenzie 1985).

Due to the transient improvement with the mobilizations a T-5 extension HVLA manipulation (Maitland 1986; Bergmann et al. 1993) during session 2 restored full left rotation and abolished the painful arc with left-side bending. However, end-range pain persisted with both motions. Full and pain free left rotation and side-bending were restored following a left T4 SNAG with left rotation. Therapeutic exercise prescribed at this juncture included sustained thoracic extension supine using a towel roll and resisted exercise. The session concluded with reminders of the postural education offered during the initial evaluation.

Prior to session 3 the patient exhibited limited motion, recurrent pain, and positive dural signs. The patient also noted pain with diagonal pull downs and pull-ups. Additionally, left psoas pain at T4-5 was painful. A prone T5 right rotational manipulation (McKenzie 1990) abolished the painful UVP and end-range pain with cervical flexion and increased left thoracic rotation to full with end-range pain (2/10). When a repeat manipulation was ineffective, a left T4 SNAG with left rotation restored full left rotation and a left T4 SNAG with left-side bending restored pain free left-side bending. The session culminated with reverse natural apophyseal glides (NAG) from T3–T9 to minimize residual soreness (Mulligan 1999). To maintain the benefits of the treatment session we concluded with patient instruction in a self-SNAG at T4 for left rotation using a towel, to be repeated 6 times per 1–2 h (see Fig. 1).

Prior to session 4 the patient reported some muscle soreness/stiffness. However, he reported all exercises were pain free. Pre-treatment examination findings revealed slight end-range pain with bilateral rotations and left-side bending, which was unresolved with a self-SNAG. Full and pain-free cervicothoracic motion in all directions was restored by a supine left rotation-extension HVLA manipulation (Gibbons & Tehan 2000).

Treatment then focused on progression of therapeutic exercise (see Table 1) to emphasize muscle groups which are both postural and produce trunk motion, i.e. scapular elevators and retracted, hum-
eral external rotators, thoracic extensors and abdominals. Strengthening of the rhomboid, middle and upper trapezius, latissimus dorsi, infraspinatus, and posterior deltoid has been shown to decrease flexion in the lower cervical and upper thoracic spine in a resting seated posture (Wang et al. 1999). The abdominal muscles contribute to trunk rotation as well as to the control of the lumbar lordosis in standing. Pulleys and dumbbells were used, rather than exercise machines, to recruit active participation of the trunk stabilizers as the extremities worked against the resistance. Exercises were performed in a weight bearing position (either in an upright or slightly flexed posture) in accordance with our preference for mobilization in a weight bearing posture. Exercises involving thoracic extension (upright row, shoulder retractions, diagonal pull-up/pull-down, and single-arm row) also included an inhalation during the concentric phase to facilitate thoracic extension. Additionally, exercises were performed unilaterally so as to promote utilization and stabilization of the available trunk rotation. Lastly, stance was progressed from a more stable bilateral stance to a less stable unilateral stance to create additional demands on the stabilizers of the trunk.

Re-examination findings for the final session revealed full and pain free active and resisted cervicothoracic motion in all directions. The patient denied pain at rest and with activity. Although the patient reported mild soreness following participation in a touch football game, he was able to independently relieve this with a self-SNAG.

DISCUSSION

 Movements of the upper extremities, either alone or in combination with the lower extremities require both motion and stability in the thoracic spine. This, in part, may account for the substantial loss of function associated with the minor disc lesion in this case. Although rare (Krämer 1981; Vallo & Ransohoff 1982) and difficult to differentiate, minor thoracic disc lesions can be related to such impairments as pain, limited thoracic joint mobility, postural abnormalities, altered muscle performance, functional limitations, and disability. A full return to function would therefore require a comprehensive approach. In addition to the restoration of normal mechanics and joint mobility via mobilization and manipulation, the unique structural and functional characteristics of the thoracic spine suggest the need to enhance static posture and promote dynamic stability via the introduction of forces to the thoracic spine via the extremities.

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Table 1. Multiplanar therapeutic exercise prescription and progression

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Volume*</th>
<th>Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upright row</td>
<td>Light weight, 10 reps, 1 set</td>
<td>15 reps, 3 sets; unilateral stance on each leg</td>
</tr>
<tr>
<td>Standing shoulder retraction</td>
<td>Light weight, 10 reps, 1 set</td>
<td>15 reps, 3 sets; unilateral stance on each leg</td>
</tr>
<tr>
<td>Shoulder extension (elbows extended)</td>
<td>Light weight, 10 reps, 1 set</td>
<td>15 reps, 3 sets; unilateral stance on each leg</td>
</tr>
<tr>
<td>Standing trunk hyperextension</td>
<td>Body weight, 10 reps</td>
<td>30 reps each in bilateral stance with feet: equal, right advanced, left advanced</td>
</tr>
<tr>
<td>Diagonal pull up</td>
<td>Continue as per previous volume (20 lb., 10 reps, 2 sets)</td>
<td>Gradual T in intensity, ↑ to 15 reps, 2 sets; ↑ each on each leg</td>
</tr>
<tr>
<td>Diagonal pull down</td>
<td>Continue as per previous volume (20 lb., 10 reps, 2 sets)</td>
<td>Gradual ↑ in intensity, ↑ to 15 reps, 2 sets; ↑ each on each leg</td>
</tr>
<tr>
<td>Single arm row**</td>
<td>Continue as per previous volume (10 lb., 10 reps, 2 sets)</td>
<td>Gradual ↑ in intensity, ↑ to 3 sets, 15-20 reps</td>
</tr>
</tbody>
</table>

*Volume = reps x sets x intensity.

References

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Valio MB, Ransohoff RJ 1982 Thoracic Disc Disease, edn 2. WB Saunders, Philadelphia, p 500