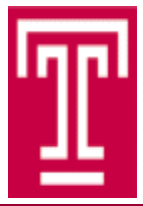




Costovertebral Articulation Injections for Treatment of Posterior Shoulder Girdle Pain

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ABSTRACT

This is a patient with a medical history of CNS glioma, neurofibromatosis and thoracic scoliosis requiring fusion of C7 and T1, who presented with chronic right posterior shoulder girdle and interscapular pain following a traction injury at work. On examination, she had tenderness over the right medial scapular border, T2 to T7 costovertebral articulations and paraspinal musculature. There were also 3+/5 strength deficits noted in the right biceps and flexor digitorum indices and bilateral triceps. Imaging revealed cervical spine degenerative disc disease and dextroscoliosis of the thoracic spine. Shoulder radiographs were negative for any pathology. An EMG showed C6 and C7 radiculopathies. Her shoulder girdle pain failed to respond to conventional therapies, including physical therapy and a subacromial bursa corticosteroid and lidocaine injection. She subsequently underwent fluoroscopy-guided injections of the right T3, T4 and T5 costovertebral articulations with 0.5 cc of Celestone Soluspan and 0.5 cc of 1% Lidocaine at each level.

Assessment/Results: Following the costovertebral articulation injections, the patient noted near complete resolution of her right posterior shoulder girdle pain, which continued to improve and was maintained at her 1 month, 3 month, 1, 2 and 5 year follow-up interviews.

Discussion: The costovertebral articulation is a synovial joint with limited excursion secondary to a fibrous capsule and three costovertebral ligaments. It is innervated by ventral rami of the spinal nerve. When ribs undergo structural dysfunction, thoracic stability is compromised and nonphysiological motion patterns incur. These aberrant movements irritate the ventral rami and generate localized discomfort

Conclusions: This case illustrates that the costovertebral articulation can serve as a pain generator and should be taken into consideration when a patient has paraspinal thoracic discomfort. Further studies to evaluate the effectiveness of costovertebral articulation injections would be of benefit.

CASE DESCRIPTION

This is a 37 year-old female who presented to the outpatient PMR clinic with a chief complaint of chronic right posterior shoulder pain. The pain became worse following a traction injury at work and began to hurt with range of motion of the shoulder. The pain was described as a near-constant ache. It was exacerbated by movement of the thoracic spine and inspiration. Use of anti-inflammatory agents provided only minimal relief. She has a past medical history of a CNS glioma, neurofibromatosis and thoracic scoliosis. Her past surgical history was pertinent for spinal fusion of C7 and T1. On physical exam, she was a healthy appearing female. She had a notable thoracic scoliosis with a convexity to the right and the apex of the convexity at T4. Range of motion of the thoracic spine was limited in right rotation and lateral bending. There was tenderness to palpation over the right medial scapular border, paraspinal musculature and T2 to T7 costovertebral articulations. Muscle testing revealed 3+/5 strength deficits in the right biceps brachii, right flexor digitorum indices and bilateral triceps brachii. Magnetic resonance imaging of the cervical and thoracic spine revealed degenerative disc disease, post-surgical changes from her spinal fusion and dextroscoliosis of the thoracic spine. Shoulder radiographs were negative for any pathology. Electromyography demonstrated C6 and C7 radiculopathies. Based upon the patient's clinical presentation, a differential diagnosis was created as listed in Table 2. She was initially prescribed a course of physical therapy to strengthen and improve range of motion of shoulder and thoracic musculature followed by subacromial bursa lidocaine injections, but this did not improve her symptoms. Once these treatments were unsuccessful, a rib dysfunction was considered as the source of the patient's pain, which was supported with the clinical history. Therefore the patient underwent steroid injection into the right T3, T4 and T5 costovertebral joints. After obtaining full consent the patient was brought into the fluoroscopy suite, placed in the supine position and the skin prepped with betadine. Using Isovist 2000 Radiographic Contrast and fluoroscopic guidance, the skin was punctured with a 22-gauge needle, which was then advanced over the proximal posterior aspect of the rib and walked medially into each costovertebral articulation. Each of the three joints was injected with 0.5 cc of Celestone Soluspan and 0.5 cc of 1% lidocaine without complication. Following the procedure, the patient reported near-complete resolution of her right posterior shoulder girdle pain, which continued at her follow-up interviews at 1 month, 3 months and 1, 2, and 5 years out.

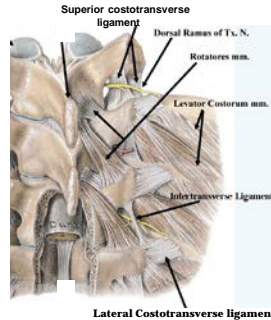


Figure 1. Picture representation of the complex costovertebral articulations. Note the small diameter of the aperture through which the dorsal ramus of the spinal nerve transmits.

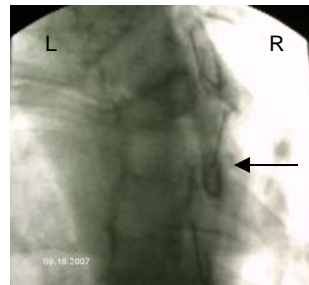


Figure 2. Intraoperative fluoroscopic image of needle placed in costovertebral articulation. Note the thoracic dextroscoliosis, which contributes to the patient's altered rib cage mechanics.

Differential Diagnosis of Posterior Shoulder Girdle Pain

- Rotator Cuff Injury
- Frozen Shoulder
- Subscapular bursitis
- Rheumatic, such as arthritis or polymyalgia rheumatica
- Cervical pathology
- Muscle strain/Myofascial injury
- Rib subluxation/torsion
- Rib dislocation/fracture
- Complex regional pain syndrome

Table 2. Differential Diagnosis of Posterior Shoulder Girdle Pain

DISCUSSION/CONCLUSION

The costovertebral articulation is a synovial joint attaching the tubercle of the first ten ribs to the transverse process of the corresponding vertebrae. Ribs eleven and twelve have only a costovertebral articulation. The joint is innervated by ventral rami of the corresponding spinal nerve. The joint has a thin and relatively weak articular capsule with an associated synovial cavity. There are three ligaments, which in synergy with the fibrous capsule, limit the degree of movement of the ribs (1).

The superior costovertebral ligament is divided into anterior and posterior segments and attaches the rib to the transverse process of the segment above it. This ligament creates an aperture in conjunction with the vertebral body through which the spinal nerve and intercostal vessels transmit. The middle costovertebral ligament, also known as the intersosseous ligament, is a short, strong ligament connecting the rib to its' corresponding transverse process. It limits anterior-posterior movements, as well as rotation of the rib about the transverse process. Attaching the nonarticular portion of the tubercle to the lateral border of the transverse process is the lateral costovertebral ligament, which also serves to limit the degree of rotatory motion, but also prevents excessive gliding in the transverse plane.

Movement of the ribs about the vertebrae is influenced not only by the costovertebral articulation and its' associated ligaments, but also by the costovertebral articulation (2). The orientation of the articular surface determines the direction of movement. This changes as you descend the thoracic spine. The convex tubercle of the first six ribs articulate in a concave groove on the anterior portion of the transverse process, allowing the upward and downward movement of the tubercle in the sagittal plane. The tubercles of ribs seven through ten have an oblique orientation and articulate with the more superior portion of the transverse process. In this region, the neck of the rib moves upward, backward and medialward with elevation of the tubercle, or downward, forward and lateralward with depression of the tubercle.

The thoracic spine is much more rigid in comparison to the cervical and lumbar region in order to provide added support to vital structures within the chest wall. The main stability of the thoracic spine lies in the coupled costovertebral and costovertebral articulations. It is thus logical that these joints will sacrifice motion for stability. It can also be reasoned that the costovertebral joint bears a great deal of stress to maintain this stability. Slipman, et al. demonstrated this in a competitive rower, in which as osseous stress reaction was found precisely at the costovertebral joint via positron emission tomography (PET) as a result of repetitive microtrauma (3). Being a true synovial joint, the costovertebral articulation can suffer degenerative and inflammatory changes common to such joints and as such be pain generators. There is also a theoretical risk of injury to neurological structures within this region because of the small diameter of the passage for the spinal nerve and intercostal vessels. Inflammation, ligamentous injury, repetitive physiological rib motions, or pathological rib motion about the transverse process can also induce inflammatory reactions, creating a chemical irritation to the spinal or intercostal nerve. In addition, the thoracic ventral rami have an intricate relationship with the autonomic nervous system, connecting to the sympathetic trunk via rami communicantes, thus potentially inducing hyperexcitability of the local soft tissue and musculature. This, in combination with the dual innervation of the ventral rami to the joint and posterior thoracic myofascial structures, can create a chronic myofascial pain and dysfunction syndrome.

The patient in this case report has multiple reasons for local irritation to the costovertebral articulation. She had a thoracic scoliotic deformity since childhood, causing an imbalance of intrinsic back muscle stabilizers, as well as restrictions in range of motion. In addition, her spinal fusion surgery may have increased the degree of stress placed in this region. With these joints already under strain, even small movements, such as the traction injury she incurred at work, can lead to acute or chronic injury and pain. This case identifies the costovertebral articulation as a potential pain generator in the thoracic region. Further studies to evaluate the effectiveness of costovertebral articulation injections would be of benefit.

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