0008-3194/2010/271–275/$2.00/©JCCA 2010

Chronic costochondritis in an adolescent competitive swimmer: a case report

Jeff Cubos BPHE DC*
Angela Cubos BSc DC*
Fabio Di Stefano BKIN (Hons), DC†

A search of the literature revealed that the torso sustains very few swimming injuries. Costochondritis is a poorly understood condition that presents as pain and tenderness on the costochondral or chondrosternal joints without swelling, and may result from increased pulling by adjoining muscles to this region of the chest wall. This case study describes the conservative treatment (spinal manipulative therapy, Active Release Techniques therapy, rehabilitative exercise, and clinical acupuncture) and positive outcome of anterior chest wall pain in a competitive swimmer diagnosed as chronic costochondritis.
(JCCA 2010; 54(4):271–275)

KEY WORDS: costochondritis, chondrosternal, swimming, adolescent

Une recherche dans la documentation révèle que la natation cause très peu de blessures au torse. Le syndrome de Tietze est une affection mal comprise dont les symptômes sont une douleur et une sensibilité aux articulations costales ou chondrosternales sans enflure, qui peuvent causer un étirement accru par les muscles adjacents de cette région de la paroi de la cage thoracique. Cette étude de cas décrit le traitement conservateur (thérapie manuelle de l'épine dorsale, techniques de relâchement actif, exercice de réhabilitation et acupuncture clinique) et les résultats positifs pour un nageur professionnel souffrant de douleur à la paroi thoracique antérieure qui avait reçu un diagnostic de syndrome de Tietze chronique.
(JCCA 2010; 54(4):271–275)

MOTS CLÉS : syndrome de Tietze, chondrosternal, natation, adolescent

Introduction

The risk of injury in any sport is governed by its nature and among other variables, such risk is inherent in the participation in competitive swimming. Most reported swimming injuries are classified as "minor" (i.e. bruises, lacerations, etc) and injuries are generally well distributed among all age groups. In particular, 3% of bodily injuries are sustained by the torso and those in the 13–14 year old age group constitute approximately 20% of all reported injuries.[1] Injuries to the chest wall and specifically the costochondral region in swimming have not yet been reported in the literature.

Costochondritis is a poorly understood, self-limiting[2] condition that is more common in women,[3] and generally presents as pain and tenderness on the costochondral or chondrosternal joints without swelling.[4] While the exact mechanism of this condition has yet to be defined, inflammation in this area is generally caused by an increase in pulling at this joint, likely from adjoining muscles to the rib or dysfunction at the costotransverse joints.[5]

We present a case study of a female competitive swimmer with anterior chest pain, diagnosed as chronic costochondritis, and managed conservatively. Treatment modalities consisted of high-velocity, low-amplitude

* 1-101 First Ave, Spruce Grove, AB. T7X 2H4
† 300 John St. Suite 320, Thornhill, ON. L3T 5W4

(HVLA) spinal manipulation, soft tissue therapy including Active Release Techniques (A.R.T.), rehabilitation exercises, and clinical acupuncture.

Case

This 14-year-old female competitive swimmer presented for treatment of chronic anterior chest pain of almost two years duration. The pain was localized to the midline along the lower aspect of the sternum and was described as sharp and burning while swimming, and throbbing at rest. The pain intensity was reported to range from 6/10 during a regular swim practice, to 10/10 while performing sprints. When the pain was especially severe, she reported it limited her breathing. The pain was reported to have developed as a result of performing numerous consecutive push-ups during swim practice, approximately 21 months prior to presentation. She noted ongoing aggravation throughout the rest of the swim season (approximately six months) with relief during the summer months of the off-season (complete rest). No other relieving factors were revealed and the patient did not report receiving any prior physical therapy. However, the pain returned at the start of the next swim season, at which point she presented for care. In addition to swimming, the pain was reported to occur during dry-land training, including push-ups, seated rows, and medicine ball toss, and was said to be relieved with rest. She reported having to miss consecutive swim practices when the pain increased. Past medical history included gall-stones at four years of age, at which point she underwent laproscopic surgery. Her family history was unremarkable.

Examination revealed a fit-looking young woman with slight anterior head carriage, a depressed right shoulder, and an elevated right iliac crest, with bilateral pes planus. Active thoracic range of motion, performed in a seated position with the arms crossed in front of the chest, was full and pain-free in all directions. Kemp's test (active extension with rotation in a seated position) of the thoracic spine produced local pain along the spine in the mid-thoracic region when performed bilaterally as well as pain in the lower left sternum when performed on the right. Seated motion palpation[6] of the thoracic spine revealed local pain and restriction with lateral spinous process challenge from T3-T9, as well as local pain and restriction in the costovertebral joints bilaterally at T3-T4 and T6-T7 (worse on the right with posterior to anterior challenge). Anterior to posterior challenge of the third to six sternocostal joints was performed with the patient in a supine position with the patient's hands placed in between the clinician's hands and the patient's chest. Pain was noted locally on the left-hand side. Static palpation revealed pain and tightness in the thoracic erector spinae muscles bilaterally, the pectoralis major and minor bilaterally, and the third to seventh anterior intercostal muscles bilaterally. The left lower sternal pain was reproduced with pressing the palms of the hands together, as well as with resisted unilateral horizontal adduction. Upper limb sensory, motor, and reflex testing were unremarkable.

At the request of her physician, plain radiographs, MRI, and cardiac stress testing were performed but reported to be unremarkable. Swelling, heat, and erythema were absent ruling out a diagnosis of Tietze syndrome.[2] Additionally, in the absence of a palpable "slipped rib", such diagnosis was excluded.[2] As a result, the patient was diagnosed as suffering from chronic costochondritis with associated mechanical thoracic spine pain.

The patient undertook a course of conservative treatment for eight weeks at a frequency of two to three times per week for five weeks, followed by once per week for three weeks. The treatments consisted of manual sternocostal joint mobilizations, manual spinal manipulative therapy[7,8] of the thoracic spine[9,10] and costovertebral joints,[9,11] A.R.T.[12,14] therapy of the thoraco-humeral musculature (pectoralis major and minor), and scapular stabilization exercises (scapular retraction and push-up with plus).[14–18] As described in the instructional manual, A.R.T. is a tissue specific, manual manipulative therapy that takes a tissue from a shortened position to a fully lengthened position while the contact passes longitudinally along the soft tissue fibers and the lesion.[19]

The patient reported decreased frequency and intensity of her pain during regular swim practices with this treatment, but re-aggravation of her symptoms with intense swim practices. The patient chose not to rest from swimming, but agreed to refrain from dry-land training until the symptoms had resolved. While her symptoms had improved, recurrent re-aggravation prompted a course of acupuncture treatment (nine weeks following initial presentation). This modality was applied to the urinary bladder (12–15), large intestine (1–4), kidney (25–27), and conception vessel (19–21) meridians (Table 1), and performed for three weeks at a frequency of two times

Table 1 *Acupuncture points*

Meridian	Point	Description
Bladder Meridian (BL)	12	1.5 cun lateral to midline level with the spinous process of T2
	13	1.5 cun lateral to, and level with, the spinous process of T3
	14	1.5 cun lateral to midline level with the spinous process of T4
	15	1.5 cun lateral to, and level with, the spinous process of T5
Large Intestine Meridian (LI)	1	On radial side of index finger, 0.1 cun to corner of nail
	2	On radial side of index finger, distal to MCP joint
	3	On radial side of index finger, proximal to MCP joint
	4	Between 1st and 2nd metacarpal bones at midpoint of 2nd metacarpal bone
Kidney Meridian (KI)	25	2nd intercostal space 2 cun lateral to CV19
	26	1st intercostal space 2 cun lateral to CV 20
	27	In depression on lower border of clavicle 2 cun lateral to midline
Conception Vessel Meridian (CV)	19	On the midline level with the 2nd intercostal space
	20	On the midline level with the 1st intercostal space
	21	On the manubrium midline, 1 cun below CV22 (0.5 cun superior to the suprasternal notch, in the center of the depression)

* Cun = Measurement of one "body inch" utilized to locate acupuncture points and always taken from the patient's hand. 1 thumb = 1 cun

per week, in combination with ongoing soft tissue therapy and spinal manipulative therapy. The patient reported further improvement in her symptoms and although a follow-up was not performed at the commencement of the following season, she was able to complete the rest of her current season with little discomfort.

Discussion

As demonstrated in the present case, costochondritis commonly presents as a local,[2] sharp pain adjacent to the sternum and most often affects the second to fifth costal cartilages.[20,21] Often the result of repetitive physical activity,[22] movement of the chest and ribcage generally reproduces this pain,[23] and symptoms are usually elicited by pressure over one of the costochondral junctions of the sternum.[24] Crepitus during chest wall palpation is another common physical exam finding,[24] as well as costovertebral and costotransverse joint restrictions upon joint play assessment[25] and motion palpation[26,27] similar to that discovered in the current case.

Due to the location and nature of these complaints, the importance of ruling out cardiovascular conditions in patients presenting with such anterior chest pain cannot be understated.[28] Similarly, the evaluation of costovertebral joints is also imperative since they often may be the etiologic source of anterior chest pain as in cases of pseudoangina.[11] While previously reported as self-limiting in nature that generally resolves within one year, usual medical management has generally consisted of relative rest for 4–6 weeks.[5]

Costochondritis has previously been reported to be diagnosed in 14–30% of patients with chest pain presenting to physicians[24,29] and, through their prospective analysis of 100 adolescent patients with chest pain, Pantell and Goodman reported that 31% of chest pain complaints appeared to be musculoskeletal in etiology.[24] The specific

history of pain and discomfort resulting from both high intensity and high volume of training, as well as the presence of reproducible pain objective findings confirms the musculoskeletal nature of a costochondritis diagnosis in this patient with anterior chest wall pain.

Although rarely published in the sporting literature, this condition had previously been reported in a 21 year old collegiate volleyball player who presented with right anterior chest pain and mid-thoracic stiffness of 8 months duration.[9] This female athlete's pain was particularly made worse with volleyball and weightlifting (i.e. bench presses, bent flies, etc). In addition, this typically benign and self-limiting condition had also been described to likely occur in rowing sports due to the increased moment of rotation at the catch position[5] (when the oar / blade is placed in the water with the elbows in full extension and arms in horizontal adduction).[5] Specifically, combined adduction of the arm and ipsilateral rotation of the head may aggravate this position.[5] By comparison, since the pectoralis major provides the strongest contribution to initial and powerful humeral adduction, extension, and internal rotation of the early pull phase of the swim stroke,[30] the involvement of the structures within the thoraco-scapular-humeral joint complex in the act of swimming makes it plausible that a case of chronic costochondritis was present in this competitive and athletic patient.

While this condition has previously been reported as self-limiting in nature, various therapeutic approaches have been described in the management of costochondritis of musculoskeletal origin. Two cases, in particular, described a combination of manual therapy, modalities, and rehabilitative exercise. Hudes reported a low-tech rehabilitation protocol in the management of a 64 year old male patient with acute idiopathic onset of costochondritis.[15] This protocol utilized consisted of HVLA manipulation to the zygapophyseal joints of the thoracic spine, costotransverse, and costochondral joints, acupuncture, ischemic compression, cross-fibre friction massage, and cryotherapy. In particular, specific exercise prescription (low tech rehabilitation) was prescribed, and un-weighted supine arm pushes, wall push ups, full push ups, and plusses (end-range, closed-kinetic chain scapular protraction) were used.[15] Similarly, the therapeutic approaches involved in the management of a volleyball player included HVLA manipulation of costovertebral, costotransverse, and intervertebral zygapophyseal joints, instrument assisted soft-tissue mobilization applied directly to the costal cartilage, and Kinesiotaping of the fifth costal cartilage and along the third through sixth chondrosternal joints. Reassurance and exercise modification were also used in their management protocol.[9]

The following approaches were utilized in our competitive swimmer: mobilizations applied to affected sternocostal joints as well as HVLA spinal manipulative therapy of the symptomatic thoracic zygapophyseal and costovertebral joints. A.R.T. of the affected pectoralis major and minor, scapular stabilization exercises, and acupuncture treatment were also performed. It is recognized that this and those previously reported case reports cannot prove with certainty that the respective treatment protocols administered directly resulted in relief from pain, however, relief provided from the above approach rendered an outcome that differed from that of the preceding season as well as the previously reported self-limiting nature of costochondritis.[2] Case series and case-control studies comparing the above treatment protocol with other forms of management (e.g. relative rest) may therefore be the next logical progression for contribution of knowledge pertaining to costochondritis in the literature.

Summary

Although poorly understood, costochondritis is a musculoskeletal condition that should be included in the differential diagnosis of any person presenting with anterior chest wall pain. Conservative therapeutic approaches for this condition were utilized, and consisted of manual spinal manipulative and mobilization therapy, Active Release Techniques therapy, and rehabilitative exercise. Still, more studies are required to improve our understanding of costochondritis and certainly, the reporting of unique cases are strongly encouraged.

References

1 Richardson AB. Injuries in competitive swimming. Clin Sports Med. 1999;18(2):287–91.
2 Stochkendahl MJ, Christensen HW. Chest pain in focal musculoskeletal disorders. Med Clin N Am. 2010; 94:259–273.
3 Brown RT, Jamil K. Costochondritis in adolescents. A follow-up study. Clin Pediatr (Phila). 1993; 32(8):499–500.
4 Gregory PL, Biswas AC, Batt ME. Musculoskeletal

problems of the chest wall in athletes. Sports Med. 2002; 32(4):235–250.
5 Rumball JS, Lebrun CM, Di Ciacca SR, Orlando K. Rowing injuries. Sports Med. 2005; 35(6):537–555.
6 Byfield D, Kinsinger S. A manual therapist's guide to surface anatomy & palpation skills. London: Butterworth-Heinemann; 1998. Chapter 4, Basic thoracic spine palpation and landmark identification skills; p. 73–78.
7 Gross AR, Hoving JL, Haines TA, et al. A cochrane review of manipulation and mobilization for mechanical neck disorders. Spine. 2004; 29(14):1541–1548.
8 Bronfort G, Haas M, Evans RL, Bouter LM. Efficacy of spinal manipulation and mobilization for low back pain and neck pain: A systematic review and best evidence synthesis. Spine J. 2004; 4(3):335–356.
9 Aspegren D, Hyde T, Miller M. Conservative treatment of a female collegiate volleyball player with costochondritis. J Manipulative Physiol Ther. 2007; 30(4):321–325.
10 Yelland MJ. Back, chest and abdominal pain. how good are spinal signs at identifying musculoskeletal causes of back, chest or abdominal pain? Aust Fam Physician. 2001; 30(9):908–912.
11 Erwin WM, Jackson PC, Homonko DA. Innervation of the human costovertebral joint: Implications for clinical back pain syndromes. J Manipulative Physiol Ther. 2000; 23(6):395–403.
12 Spina AA. External coxa saltans (snapping hip) treated with active release techniques(R): A case report. J Can Chiropr Assoc. 2007; 51(1):23–29.
13 Drover JM, Forand DR, Herzog W. Influence of active release technique on quadriceps inhibition and strength: A pilot study. J Manipulative Physiol Ther. 2004; 27(6):408–413.
14 Howitt S, Wong J, Zabukovec S. The conservative treatment of trigger thumb using graston techniques and active release techniques. J Can Chiropr Assoc. 2006; 50(4):249–254.
15 Hudes K. Low-tech rehabilitation and management of a 64-year-old male patient with acute idiopathic onset of costochondritis. J Can Chiropr Assoc. 2008; 52(4):224–228.
16 Mottram SL. Dynamic stability of the scapula. Man Ther. 1997; 2(3):123–131.
17 Burkhart SS, Morgan CD, Kibler WB. The disabled throwing shoulder: Spectrum of pathology part III: The SICK scapula, scapular dyskinesis, the kinetic chain, and rehabilitation. Arthroscopy. 2003; 19(6):641–661.
18 Reinold MM, Escamilla R, Wilk KE. Current concepts in the scientific and clinical rationale behind exercises for glenohumeral and scapulothoracic musculature. J Orthop Sport Phys. 2009; 39(2):105–117.
19 Leahy PM. Active release techniques soft-tissue management system for the spine (manual). 1998.
20 Fam AG. Approach to musculoskeletal chest wall pain. Prim Care. 1988; 15(4):767–782.
21 Verdon F, Burnand B, Herzig L, Junod M, Pecoud A, Favrat B. Chest wall syndrome among primary care patients: A cohort study. BMC Fam Pract. 2007; 8:51.
22 Habib PA, Huang GS, Mendiola JA, Yu JS.. Anterior chest pain: musculoskeletal considerations. Emerg Radiol. 2004; 11:37–45.
23 Semble EL, Wise CM. Chest pain: a rheumatologist's perspective. South Med J. 1988; 81:64–8.
24 Pantell RH, Goodman BW. Adolescent chest pain: A prospective study. Pediatrics. 1983; 71(6):881–887.
25 Fruth SJ. Differential diagnosis and treatment in a patient with posterior upper thoracic pain. Phys Ther. 2006; 86(2):254–268.
26 Humphreys BK, Delahaye M, Peterson CK. An investigation into the validity of cervical spine motion palpation using subjects with congenital block vertebrae as a 'gold standard'. BMC Musculoskelet Disord. 2004; 5:19.
27 Pringle RK. Guidance hypothesis with verbal feedback in learning a palpation skill. J Manipulative Physiol Ther. 2004; 27(1):36–42.
28. Freeston J, Karim Z, Lindsay K, Gough A. Can early diagnosis and management of costochondritis reduce acute chest pain admissions? J Rheumatol. 2004; 31(11):2269–2271.
29. Disla E, Rhim HR, Reddy A, Karten I, Taranta A. Costochondritis. A prospective analysis in an emergency department setting. Arch Intern Med. 1994; 154(21):2466–2469.
30. Zachazewski JE, Magee DJ, Quillen WS. Athletic injuries and rehabilitation. Philadelphia: W.B. Saunders Company; 1996. Chapter 16, Biomechanics of swimming; p. 317–331.