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Acute Torticollis After Isolated Stress Fracture of the First Rib in a Child

A Case Report

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Isolated stress fractures of the first rib have previously been reported in adults and adolescents who participate in sports such as rugby[1], baseball[2], weight-lifting[3], basketball[4], and tennis[5] as well as in individuals who carry a heavy schoolbag[6]. Stress fractures of the first rib in children are rare, and only five fractures in four patients have been reported (Table I)[1,7-9]. The clinical presentation usually ranges from mild vague discomfort to acute pain in the shoulder region, cervical triangle, or clavicular region. Pain also may radiate to the sternum or the pectoral region. No cases of painful torticollis due to a stress fracture of the first rib in a child have been reported, to our knowledge. Common causes of acquired painful torticollis are trauma (atlantoaxial rotatory displacement[10], os odontoideum[11], and C1 fracture[12]), inflammation[13] (Grisel syndrome[14], juvenile rheumatoid arthritis[15], discitis[15]), and tumor (eosinophilic granuloma[16], osteoid osteoma[17], osteoblastoma[18], leukemia[19]). Less common causes include calcified cervical disc[20], Sandifer syndrome[21], and bacterial meningitis[22].

The present report emphasizes that the diagnosis of isolated stress fracture of the first rib should also be considered when a child presents with an acute painful torticollis. The patient was informed that data concerning this case would be submitted for publication.

Case Report

An eight-year-old, right-hand-dominant boy was evaluated in our department for acute torticollis. He had intense pain in the left side of the neck; the pain radiated to the left scapula. He had been an avid karate student for the previous four months. He was also an active participant on a basketball team. He regularly carried a schoolbag that weighed approximately 7 kg, with one strap slung over the left shoulder. He reported that, while sitting in a classroom, he had heard what he described as a "pop" and felt a sharp pain in the left side of the neck.

The patient complained of neck pain and torticollis. There was no history of trauma, coughing illness, or family abuse. He mentioned having performed karate intensely for two to three days before the acute onset of pain. He had intense pain in the neck, accompanied by a rotation of the chin to the contralateral side as well as a left lateral cervical tilt. During the examination, it was established that the pain was dull and extended from the left side of the neck into the left scapular region and the posterior aspect of the corresponding shoulder. Physical examination of the head, shoulder, and up-

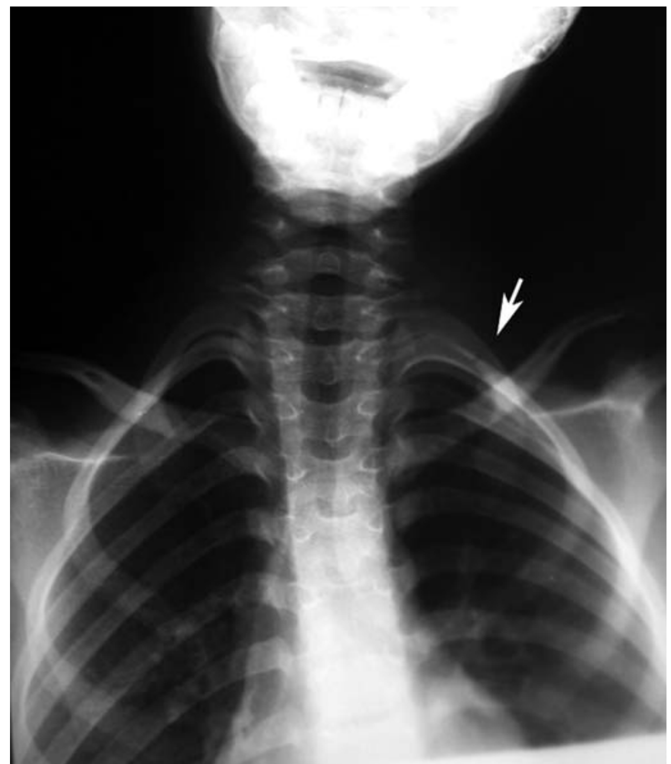

Fig. 1-A

Initial anteroposterior radiograph of the cervical spine, demonstrating left lateral cervical tilt. A faint fracture line of the left first rib (arrow) was missed on the initial reading but was visible on secondary review.

TABLE I Previous Cases of Stress Fractures of the First Rib in Children

Study	Gender, Age *(yr)*	Side of Fracture	Location of Fracture	Clinical Presentation	Etiology
Moon et al.[9]	M, 11	Bilateral	Anterolateral	Shoulder pain	Nervous tic with violent shrugging of shoulder
Devas[7]	F, 12	Left	Middle	Shoulder, neck, and arm pain	Sports activity, overuse
Prasad and Baur[8]	M, 11	Right	Middle	Sudden chest pain	Coughing illness
Vikramaditya and Pritty[1]	F, 12	Left	Middle	Shoulder pain	Participation in rugby

per extremity revealed normal findings. Infraclavicular tenderness and intense palpable sternocleidomastoid spasm were identified on the left side. There was no obvious deformity or swelling. The patient had a full range of motion of the left shoulder, without evidence of instability or pain. Neurological examination revealed normal findings. There was no weakness or paraesthesia of the involved extremity.

Initial anteroposterior and lateral radiographs of the cervical spine demonstrated abnormal cervical tilting to the left but revealed no obvious fractures (Fig. 1-A). Hematologic studies revealed normal findings, including a white blood-cell count of 9.000 c/mL (9.0×10^9/L), an erythrocyte sedimentation rate of 12 mm/hr, and a C-reactive protein level of 0.3 mg/dL (3.0 mg/L).

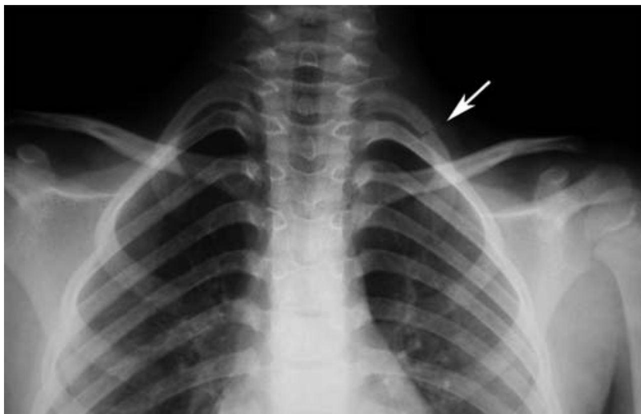

Fig. 1-B
Repeat anteroposterior radiograph of the cervical spine, made twenty days later. The fracture of the left first rib (arrow) is minimally displaced and more evident. No callus formation is present.

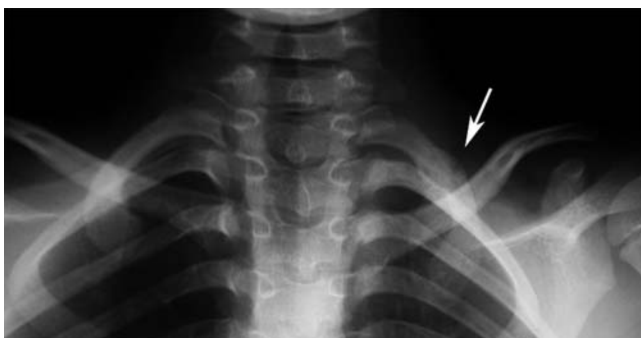

Fig. 1-C
Radiograph, made one year later, demonstrating uneventful healing of the fracture.

The parents refused admission of the patient, additional studies, and intervention. The patient was given a soft cervical collar and oral analgesics and was discharged with the diagnosis of acute torticollis. He was instructed to return for follow-up the following week and was advised not to participate in sports or recreational activities.

He returned three weeks later with vague persistent pain on the left side of the neck; the pain radiated to the scapula and, to a lesser extent, into the shoulder. Repeat radiographs of the cervical spine revealed a minimally displaced fracture involving the posterior aspect of the left first rib (Fig. 1-B). Comparison of these radiographs with the initial radiographs confirmed that the fracture initially had been barely visible and had been missed. No callus formation was evident. At this time, the patient was given a hard cervical collar to provide better support and immobilization of the head. In addition, a sling was prescribed for the affected side. The pain resolved within next two weeks. Radiographs made after three months of follow-up revealed a healing callus, and radiographs made one year later revealed that the fracture had healed completely (Fig. 1-C).

Discussion

Stress fractures of the first rib in children are rare: only five fractures in four patients have been reported, to our knowledge (Table I). Those fractures were attributed to repetitive coughing[8], a nervous tic[9], and sports activity[1,7]. The patients in those studies had a mean age of 11.5 years (range, eleven or twelve years); in contrast, our patient was eight years old. The symptoms described by those patients ranged from shoulder pain to chest pain. Shoulder pain and infraclavicular tenderness on physical examination seem to be the most constant findings. Most of the patients in those reports were managed with rest and the use of a simple sling, and healing consistently occurred in approximately eight weeks.

During vigorous sports activity or respiratory distress, there is a need for maximum increase in the capacity of the thoracic cavity with forced inspiration. The serratus anterior and scalene muscles are the major accessory breathing muscles used to achieve increased lung volume. An additional factor is the overhead use of the upper extremity, which strains the serratus anterior muscle. The first rib is under constant repeated

TABLE I ***(continued)***

Physical Examination Findings	Treatment	Time to Healing *(wk)*	Outcome
Not conclusive because of multiple stress fractures (acromion, clavicle, and second rib)	Soft figure-of-eight wrap and simple sling	8	Uneventful
Tenderness in infraclavicular region	Rest	Not found	Uneventful
Tenderness in clavicle and infraclavicular region	Rest and intercostal block	8	Uneventful
Painful shoulder movements	Collar and cuff, analgesics	6	Uneventful

upward pull by the anterior and medial scalene muscles and downward pull by the intercostal and serratus anterior muscles. It has been theorized that stress fracture of the first rib results from this chronic repetitive muscle action[4]. The mechanism of injury in our patient was presumably osseous fatigue due to repetitive muscular pull from the scalenus anterior muscle. The repeated karate strikes and the use of a heavy schoolbag may have contributed to this stress fracture. The deep fascial interconnection of the spaces between the first rib and the sternocleidomastoid may explain why the fracture hematoma around the first rib may have induced pain, creating the clinical presentation of torticollis[23].

Liew and Cunningham[6] reported on the occurrence of a stress fracture of the first rib in a seventeen-year-old male student who carried a heavy schoolbag. Lai and Jones[24] demonstrated that there is a restrictive effect on lung volume when a schoolbag load is >10% of a child's body weight. This restriction in lung function is greater for a single cross-chest strap than for a more conventional double-strap harness[25]. In adults, loads of as much as 20% of body weight can be carried with no additional increase in oxygen consumption[26]. In children, loads of between 10% and 20% of body weight cause increased oxygen uptake and energy expenditure[27]. Our patient carried a schoolbag weighing 21% of his body weight, with one strap slung over the left shoulder. Carrying a backpack with use of only one strap causes a substantial elevation of the strap-bearing shoulder and also causes lateral bending of the spine away from the weight[28]. The asymmetrically applied forces on the first rib may have contributed to the stress fracture in this child.

Isolated fractures of the first rib can be easily missed radiographically[29]. Stress fractures of the first rib have been associated with complications such as nonunion[30,31], pseudarthrosis[5], brachial plexus palsy[32] (due to pressure exerted by excessive callus formation following nonunion), thoracic outlet syndrome[33], and Horner syndrome[34,35]. To our knowledge, no complications have ever been reported after a stress fracture of the first rib in a child. We suggest that stress fracture of the first rib should be included in the differential diagnosis for a young patient who presents with acquired painful torticollis and neck pain. ■

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References

1. Vikramaditya, Pritty P. Two cases of isolated first rib fracture. Emerg Med J. 2001;18:498-9.

2. Lankenner PA Jr, Micheli LJ. Stress fracture of the first rib. A case report. J Bone Joint Surg Am. 1985;67:159-60.

3. Mikawa Y, Kobori M. Stress fracture of the first rib in a weightlifter. Arch Orthop Trauma Surg. 1991;110:121-2.

4. Sacchetti AD, Beswick DR, Morse SD. Rebound rib: stress-induced first rib fracture. Ann Emerg Med. 1983;12:177-9.

5. Mithofer K, Giza E. Pseudarthrosis of the first rib in the overhead athlete. Br J Sports Med. 2004;38:221-2.

6. Liew SM, Cunningham R. An unusual cause of stress fracture of the first rib. Aust NZ J Surg. 1996;66:55-7.

7. Devas M. Stress fractures. New York: Churchill Livingstone, 1975.

8. Prasad S, Baur LA. Fracture of the first rib as a consequence of pertussis infection. J Paediatr Child Health. 2001;37:91-3.

9. Moon BS, Price CT, Campbell JB. Upper extremity and rib stress fractures in a child. Skeletal Radiol. 1998;27:403-5.

10. Lin CJ, Lin RM, Wu MH. Atlantoaxial rotatory instability secondary to odontoid hypoplasia as a cause of acute torticollis in children: report of one case. Zhonghua Min Guo Xiao Er Ke Yi Xue Hui Za Zhi. 1995;36:448-51.

11. Fielding JW, Griffin PP. Os odontoideum: an acquired lesion. J Bone Joint Surg Am. 1974;56:187-90.

12. Mazur JM, Loveless EA, Cummings RJ. Combined odontoid and jefferson fracture in a child: a case report. Spine. 2002;27:E197-9.

13. Nemet D, Gottesman G, Pomeranz A, Shenkar V, Ofir D, Wolach B, Uziel Y. [Acute acquired non-traumatic torticollis in hospitalized children]. Harefuah. 2002;141:519-21, 579. Hebrew.

14. Wurm G, Aichholzer M, Nussbaumer K. Acquired torticollis due to Grisel's syndrome: case report and follow-up of non-traumatic atlantoaxial rotatory subluxation. Neuropediatrics. 2004;35:134-8.

15. Herring JA, editor. Tachdjian's pediatric orthopaedics. 3rd ed. Philadelphia: W.B. Saunders; 2002.

16. Schroers C, Donauer E, Laudan M, Herbst EW, Barz H. [Symptomatic Langerhans-cell-histiocytosis of the cervical spine in a child: case report]. Klin Padiatr. 2000;212:121-5. German.

17. Molloy S, Saifuddin A, Allibone J, Taylor BA. Excision of an osteoid osteoma from the body of the axis through an anterior approach. Eur Spine J. 2002;11:599-601.

18. Floman Y, Milgrom C, Kenan S, Sabato S, Robin GC. Spongious and cortical osteoblastoma of the axial skeleton. Orthopedics. 1985;8:1478-84.

19. Rauch R, Jungert J, Rupprecht T, Greil J. Torticollis revealing as a symptom of acute lymphoblastic leukaemia in a fourteen-month-old girl. Acta Paediatr. 2001;90:587-8.

20. Mac-Thiong JM, Leduc S, Marton D, Duhaime M, Morin B. Herniation of a calcified cervical disc into the foramen transversarium in an 8-year-old child. Spine. 2004;29:E349-52.

21. Greco F, Finocchiaro M, Spina M, Rotolo N, Incorpora G. [Sandifer's syndrome: a rare form of torticollis in childhood. A report of a patient]. Pediatr Med Chir. 1997;19:227-30. Italian.

22. Mukherjee S, Sharief N. Bacterial meningitis presenting as acute torticollis. Acta Paediatr. 2004;93:1005-6.

23. Gray H, Warwick R, Williams PL, editors. Gray's anatomy. 36th ed. New York: Churchill Livingstone; 1980.

24. Lai JP, Jones AY. The effect of shoulder-girdle loading by a school bag on lung volumes in Chinese primary school children. Early Hum Dev. 2001;62:79-86.

25. Legg SJ, Cruz CO. Effect of single and double strap backpacks on lung function. Ergonomics. 2004;47:318-23.

26. Borghols EA, Dresen MH, Hollander AP. Influence of heavy weight carrying on the cardiorespiratory system during exercise. Eur J Appl Physiol Occup Physiol. 1978;38:161-9.

27. Hong Y, Li JX, Wong AS, Robinson PD. Effects of load carriage on heart rate, blood pressure and energy expenditure in children. Ergonomics. 2000;43:717-27.

28. Pascoe DD, Pascoe DE, Wang YT, Shim DM, Kim CK. Influence of carrying book bags on gait cycle and posture of youths. Ergonomics. 1997;40:631-41.

29. Bigliani LU, Craig EV, Butters KP. Fractures of the shoulder. In: Rockwood CA, Green DP, Bucholz RW, editors. Rockwood and Green's fractures in adults. 3rd ed. Philadelphia: Lippincott; 1991. p 946.

30. Edwards TB, Murphy C. Nonunion of a dominant side first rib stress fracture in a baseball pitcher. Orthopedics. 2001;24:599-600.

31. Proffer DS, Patton JJ, Jackson DW. Nonunion of a first rib fracture in a gymnast. Am J Sports Med. 1991;19:198-201.

32. Ochi M, Sasashige Y, Murakami T, Ikuta Y. Brachial plexus palsy secondary to stress fracture of the first rib: case report. J Trauma. 1994;36:128-30.

33. Suh JT, Park BG, Yoo CI. Hypertrophic non-union of the first rib causing thoracic outlet syndrome: a case report. J Korean Med Sci. 2001;16:673-6.

34. Gurtler R, Pavlov H, Torg JS. Stress fracture of the ipsilateral first rib in a pitcher. Am J Sports Med. 1985;13:277-9.

35. Barrett GR, Shelton WR, Miles JW. First rib fractures in football players. A case report and literature review. Am J Sports Med. 1988;16:674-6.