

## CASE REPORT

# Pseudarthrosis of the first rib in the overhead athlete

K Mithöfer, E Giza

*Br J Sports Med* 2004;**38**:221–222. doi: 10.1136/bjism.2002.002998

Fractures of the first rib are uncommon in athletes and present a different clinical entity from traumatic first rib fracture associated with high energy thoracic trauma. These fractures are stress induced and precipitated by chronic muscular forces acting on the first rib. Typically they heal with conservative treatment. This report describes a fracture of the first rib in a tennis player that developed into a symptomatic pseudarthrosis as a result of persistent overhead activities. Symptoms mimicked ipsilateral shoulder injury. Pseudarthrosis of the first rib should be included in the differential diagnosis of chronic persistent shoulder pain in the overhead athlete.

### CASE REPORT

A 21 year old, right dominant competitive tennis player presented with persistent low grade, right shoulder pain of several months' duration. He recalled a popping sensation during preseason serving practice six months previously. At that time he was practicing five times a week, up to twice a day. The initial diagnosis was rotator cuff impingement and he was treated conservatively. Despite initial improvement, he continued to experience activity related right shoulder and neck pain, particularly with overhead activities, which progressively interfered with his ability to compete. His medical history was unremarkable, without previous shoulder or neck symptoms. Cervical spine and neurovascular examination of the right upper extremity were normal. Shoulder range of motion was painful particularly with resisted forward flexion and abduction. Impingement signs and cross arm adduction test were positive, and point tenderness was present in the right supraclavicular fossa. Radiographs showed hypertrophic pseudarthrosis of the right first rib (fig 1). After initially avoiding overhead activity for two weeks, the patient progressed to a supervised, sport specific exercise programme below pain threshold for four weeks. At six weeks, he gradually advanced to overhead activity and returned to competitive tennis at two months. At the 12 month follow up, the patient remained free of pain and without limitations, with all overhead activities despite radiographic persistence of the pseudarthrosis.



**Figure 1** Plain radiograph showing hypertrophic pseudarthrosis of the right first rib in a tennis player after repetitive overhead activity.

### DISCUSSION

Fractures of the first rib in athletes are rare and have been reported after baseball,<sup>1,2</sup> rugby,<sup>3</sup> gymnastics,<sup>4</sup> basketball,<sup>5</sup> and American football.<sup>6</sup> Aitken and Lincoln<sup>7</sup> first pointed out that stress fractures typically occur in the subclavian groove, which presents the anatomically thinnest portion of the first rib and is located between the insertions of the scalenus anterior and medius and serratus anterior muscles. They suggested that fracture may result acutely from powerful muscle contraction or gradually as the result of repetitive muscle pull causing fatigue failure of the first rib. Mintz *et al*<sup>8</sup> noted considerable involvement of serratus anterior muscle activity in the development of first rib fractures in athletes. In our case, the athlete experienced a sudden activity related snapping sensation, which probably resulted from a combination of acute forceful muscular contraction and fatigue of the first rib from chronic muscular stress caused by repetitive overhead tennis practice. First rib fracture in athletes has often been described in baseball pitchers<sup>1,2</sup> but not in tennis players. This is surprising as a striking similarity exists in the upper extremity motion and eccentric muscular forces during the deceleration phase in both pitching and tennis service.<sup>9</sup>

Symptoms are usually non-specific and include diffuse pain in the region of the shoulder girdle, upper chest, and base of the neck.<sup>1–7</sup> Pain is often reported with range of motion of the shoulder and, as in this case, may mimic symptoms of shoulder impingement. Barrett *et al*<sup>6</sup> has pointed out that this injury is probably overlooked as a cause of shoulder pain in athletes. The possibility of a fracture or non-union of the first rib should therefore be included in the differential diagnosis of chronic shoulder pain, particularly in the overhead athlete. The diagnosis of a first rib pseudarthrosis can be obtained from plain radiographs, computed tomography, bone scan, or magnetic resonance imaging.<sup>6,8</sup> Acute neurovascular complications have not been reported with stress fractures of the first rib. However, chronic complications such as thoracic outlet syndrome or Horner's syndrome<sup>2,6</sup> may result from excessive callus formation.<sup>10</sup> As most stress fractures of the first rib heal spontaneously, only a few cases of pseudarthrosis following first rib fractures have been described in athletes.<sup>1,4</sup> Our case shows a rare symptomatic pseudarthrosis which was due to repetitive overhead activity preventing bony healing of the first rib fracture by continued muscular pull. Although other authors have reported successful surgical treatment, using trans-axillary first rib resection,<sup>4,10</sup> we report that non-operative treatment can be successful in returning the symptomatic athlete to even high level competitive sports. Conservative treatment with activity modification and physiotherapy was also successfully used in a baseball pitcher with non-union of the first rib in the pitching arm.<sup>1</sup> This suggests that healing of the first rib fracture is not necessary before return to athletic activity. Our case shows that the athlete may gradually return to the sport specific activities at below symptom threshold level, thereby successfully avoiding long periods of inactivity and prolonged absence from competition.

.....  
**Authors' affiliations**

**K Mithöfer**, Shoulder and Sports Medicine Service, Hospital for Special Surgery, New York, USA

**E Giza**, Massachusetts General Hospital, Harvard Medical School, Cambridge, MA, USA

Correspondence to: Dr Mithöfer, Shoulder and Sports Medicine Service, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021, USA; Mithoefek@HSS.EDU

Accepted 14 January 2003

**REFERENCES**

- 1 **Edwards TB**, Murphy C. Nonunion of a dominant side first rib stress fracture in a baseball pitcher. *Orthopedics* 2001;**24**:599–600.
- 2 **Gurtler R**, Pavlov H, Torg JS. Stress fracture of the ipsilateral first rib in an pitcher. *Am J Sports Med* 1985;**13**:277–9.
- 3 **Kemp SPT**, Targett SGR. Injury to the first rib synchondrosis in a rugby footballer. *Br J Sports Med* 1999;**33**:131–2.
- 4 **Proffer DS**, Patton JJ, Jackson D. Nonunion of a first rib fracture in a gymnast. *Am J Sports Med* 1991;**19**:198–201.
- 5 **Sachetti AD**, Beswick DR, Morse SD. Rebound rib: stress-induced first rib fracture. *Ann Emerg Med* 1983;**12**:177–9.
- 6 **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.
- 7 **Aitken AP**, Lincoln RE. Fracture of the first rib due to muscle pull. *N Engl J Med* 1939;**220**:1063–4.
- 8 **Mintz AC**, Alabano A, Reisdorff EJ, *et al*. Stress fracture of the first rib from serratus anterior tension: an unusual mechanism of injury. *Ann Emerg Med* 1990;**19**:411–14.
- 9 **Kibler T**. Biomechanical analysis of the shoulder during tennis activities. *Clin Sports Med* 1995;**14**:79.
- 10 **Ochi M**, Sasashige Y, Murakami T, *et al*. Brachial plexus palsy secondary to stress fracture of the first rib. *J Trauma* 1994;**36**:128–30.