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Stress Fracture of the Sixth Rib in an Elite Athlete

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We report on a previously unreported site of rib stress fracture in an elite athlete. A 27 year old sweep rower, a National champion and an Olympic finalist, presented with a 3-day history of the left-side thoracic pain. Technetium 99m bone scintigraphy showed increased focal uptake of the radioisotope, leading to the diagnosis of stress injury of the anterolateral part of the sixth rib. The probable mechanism of this injury was that strong muscle force itself was great enough to produce a fracture. In the case of our rower, the precipitation cause was only a slight change in the rowing technique, in contrast to all other reports on such rib fractures among rowers where the primary cause was an increase in the level of strength training. The treatment included a complete rest of the affected area and upper extremities, while the cardiovascular and strength fitness was maintained. The athlete was able to resume with his standard training routine less than four weeks after the onset of the symptoms.

Key words: athletic injuries; rib fractures; stress fractures; sports medicine; Technetium 99m

Modern sports require from the top athletes to exert their maximal efforts, pushing their physical and psychological abilities to the limits. Even athletes with apparent peak physical fitness get injured. Since joints and muscles are under great stress, they are prone to injuries. However, on some occasions even the bones have been reported to suffer (1). Rib fractures are more encountered in contact sports, like judo, weightlifting, basketball, football, etc. (2,3). However, there are several reports on rib fractures in non-contact sports, such as baseball, volleyball, tennis, golf, dancing, gymnastics, canoeing, swimming, and rowing (3-6). There are only few reports on rib fractures in rowers, and they are all, apart from one (7), related to female rowers (6,8).

In this case report, the stress fracture of the sixth rib of an elite sweep rower is presented and discussed. Our patient was a highly competitive rower, national champion and an Olympic finalist for several years. This is a unique case of the stress fracture in the antero-lateral portion of the sixth rib, which occurred due to a slight change in the rowing technique.

Case Report

A 27-year-old elite rower presented with complaints of the left-side chest pain that appeared three days before his visit to the department. He was a member of our National team, rowing in a sweep oar boat (coxless pair) on the left (stroke) side. At the time, he was at an early stage of preparing for the World Championship.

He described the pain as a dull ache that was of moderate intensity in the beginning, but soon progressing into an intense pain which not only prevented him from rowing or weight lifting, but also caused pain when sleeping on the left side. The night before the visit to our department, he was experiencing pleuritic pain even during normal breathing. The pain was located in the antero-lateral part of the thorax, radiating towards his back. There was no history of similar episodes. He had good dietary habits and was not taking any hormonal or dietary supplements.

On physical examination, we found him to be a well developed male with excellent osteomuscular development. There was a full range of motion in the thoracic spine and in the left shoulder. On palpation, there was obvious discomfort anteriorly in the whole region of the left hemithorax. There were no signs of sensory symptoms, motor deficit or any cardiovascular abnormalities.

X-ray examination showed no signs of fracture. A radioisotope study with Technetium-99m (methylidiphosphate, MDP) was then performed. It demonstrated a well defined focus of increased isotope uptake in the antero-lateral part of the sixth rib, confirming a stress injury in this area (Fig. 1).

Figure 1: The 99m-Tc-MDP bone scan (anteroposterior view) demonstrated focal uptake on the left sixth rib. [\[view this figure\]](#)

After establishing the diagnosis, the patient stayed away from rowing for about three weeks. During that time physical fitness was maintained in the weight-lifting room, working on the lower part of the

body. In three weeks time he gradually returned to rowing, and after less than four weeks he was in full training. During a two year follow-up, no symptoms were recorded.

Discussion

Previously reported stress fractures of the ribs in many athletes in different sports have mostly been on the first rib (2-4,9,10). In all articles referring to rowers (male or female), including our case, stress fractures of the ribs occurred on the other (lower) ribs. There are only three articles on stress fractures of the ribs in rowers (6-8). One of them is a review of four cases of female rowers (6), and the other two refer to a male (7) and a female rower (8). Our patient is thus the second reported case of rib stress fractures among male rowers.

It has long been known that a major cause of such fractures is a change in the training program (6,7,11). Other possible factors include the lack of muscle strength and flexibility, inadequate equipment, and errors in the stroke mechanics (12-14). In all six cases described above, the primary cause of stress fracture was a rapid increase in the level of strength training (either in the water or in the weight-lifting room, or both). Our athlete did not change the intensity of the training, but was working at the time on a slight change in the rowing technique. His coach thought that he could improve his stroke if he slightly changed the way he twisted his wrist. He was intermittently practicing the new routine over. We believe that this change, however small it seemed, resulted in a severe overuse injury.

In the diagnosis of this stress fracture of the rib the result of x-ray was negative; however, bone scintigraphy showed increased uptake of Tech- netium 99m MDP at the site of fracture.

Although the total number of the reported cases on stress fracture of the ribs in rowers is small, it is possible to find some pattern in these injuries. All the previous reports on stress fractures of the ribs in rowers were in the postero-lateral region, apart from the case of an elite oarsman reported by McKenzie (7). However, all five female rowers were single scullers, using two oars. In this discipline, biomechanics is such that the highest bending stress is in the postero-lateral region of the thorax (15). Holden et al (6) postulate that the inadequate strength and resistance training background in women is the cause for the apparent increased susceptibility of women to these postero-lateral skeletal injuries. However, since there is not a single report on the posterolateral stress rib fractures in male scullers, we believe that constitutional gender differences may play a role as well.

In our case, as in the only other reported oarsman, the rib injury occurred to a sweep rower. In this discipline, the rower uses only one oar causing more rotational forces on the body. Our rower was a port (left or stroke side) rower and his stress fracture was on the left. The other oarsman with rib fracture (7) was rowing on the starboard side (right or bow side) and had a fracture of the rib on the right side. This could be explained by the fact that on the side of the body opposite to the oar, the intercostal spaces are much wider and the muscles attached are stretched out, whereas on the side closer to the oar ribs are closer together and the related muscles are very tense. This stronger muscle pull might predispose that side of the thorax for the stress injury of the ribs.

Two major theories are used to explain the etiology of stress fractures in athletes. According to Nordin and Frankel (cf. 12,14,16), repetitive load and consequent strain lead to muscle weakness which causes muscles to lose their ability of shock absorption and right distribution of forces to the bone, increasing the stress at focal portions of the bone. The other theory introduced by Stanitski et al. (cf. 12,14,16) is that the strong force of the muscles itself acts on the bone in a way that produces a stress fracture. Although it is probable that both mechanisms exist, the second hypothesis seems to be more appropriate in our case since the ribs were not under direct strain. Furthermore, it is indicative that all the reported cases refer to top athletes, and not a single injury was reported for recreational or lower ranking sportsmen. This fact makes the second hypothesis more plausible in general, since untrained rowers are more likely to overburden their (much weaker and less trained) muscles.

This fast diagnosis was made possible thanks to the mentioned reports (6-8) which have alerted us to suspect the stress fractures of the ribs. The potentially long interval from the onset of the symptoms to the time of diagnosis (typically 2-6 months) (1,7) with consequent interruptions of a training schedule was evaded. More importantly, unnecessary diagnostic and inappropriate treatment (cortisone injections, heavy pain killers) was avoided.

We believe that stress injuries of the ribs are more common than it has generally been recognized. It is plausible that many of these injuries, especially at the lower level of competition, are often neglected because athletes simply stop the activity which causes pain, until their symptoms resolve. Therefore, this case highlights the need for awareness of this condition as a possible cause of back or rib pain.

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