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Bilateral first rib fracture in 45 year old male- A case & Review of literature

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Abstract
The fracture of the 1st rib is extremely rare and bilateral fractures are even less common. The management of the 1st rib fractures has been a challenge to the surgeons. We reported a case of bilateral first rib fracture in 45 year old male.

Keywords: first rib, fracture, management

Introduction
The fracture of the 1st rib is extremely rare and bilateral fractures are even less common. The management of the 1st rib fractures has been a challenge to the surgeons, ever since its first description in the year 1869. It has been noted and documented that whenever 1st ribs are involved in traumatic fractures of the thoracic cage, there is also an associated injury of the clavicle and the scapula [1]. 1st rib fractures are noted in major thoracic trauma and are commonly associated with injury of brachial plexus, subclavian vessels, and mediastinal structures. The mechanism involved in the impact which leads to the 1st rib fractures is different for unilateral and for bilateral fractures as noted from the fact that unilateral fractures are more commonly associated with fatal complications as against bilateral ones which are not [2].
The most common cause of rib fracture is trauma. Shoulder girdle (anteriorly clavicle, posteriorly scapula and laterally arms and upper thoracic muscles) protects the first three ribs from the injury [3]. Fracture of these ribs point out the likelihood of serious internal damage. Especially brachiocephalic vascular injury is likelihood in this region and requires further diagnostic procedures. The incidence of isolated first rib fracture and related major vascular injury is about 3%. Symptoms resulting from fractures without an obvious history of trauma can commonly be overlooked and diagnosed as a muscle strain or joint sprain. Although rare, first rib fractures should be included in the differential diagnosis of patients who present with scapular, upper thoracic, and/or sternal pain [4]. We reported a case of bilateral first rib fracture in 45 year old male.

Case Report
A 45 year old male reported to the orthopaedic department clinic with a 1 week history of constant upper back, right medial scapular, and sternal pain. The patient denied any injury or trauma to the region. He first noticed an intense sharp stabbing pain in the right scapular region while doing daily routine functions. He noted a sharp pain with deep breathing, especially during exhalation.
General physical examination revealed that patients was healthy, well oriented to time, place and person. Patients was subjected to chest x-rays. Postero-anterior (PA) view revealed fractures of bilateral 1st ribs. Other bones in the thorax found to be normal. The patient did not have evidence of neurovascular deficit. The patient was admitted and as the patient was hemodynamically stable he was kept under observation for 48 hours. IV analgesics were given to decrease the patient's discomfort. After 48 hours the patient was discharged. The patient was placed on light duty at work, with restrictions limiting overhead activities, and no other treatment was rendered. and followed up on out-patient visits. By the end of the second week the patient was back to his work.

Discussion

Several theories have been suggested for etiology of the first rib fractures. Traumatic isolated first rib fracture is usually infrequent and often accompanied by scapula and clavicula fractures. Because scapula and clavicula are well protected by the soft tissues, first rib fractures require a significant force to occur [5]. Non-traumatic fractures are considered as stress fractures occurred without an effectual trauma and usually emerge in the weakest point of rib whereas most of the spontaneous fractures are caused by advanced age, renal failure, metastatic tumors or osteoporosis [6]. Atraumatic isolated first rib fractures are quite rare. The muscular contraction force to be applied on a rib will create a stress on the rib. Rib will undergo inelastic deformation if the force applied exceeds its elastic limit. In inelastic deformation, particularly the trauma applied on the same point is crucial. Stress fractures occur when the opposite forces that are repeated due to lifting or carrying heavy weights exceed the strength limits of the bone [7]. Fractures related to paroxysmal cough generally develop between the 5th and 10th ribs, while stress fractures due to the other reasons frequently occur in the first rib. Most authors advocate the first rib stress fracture to be resulted from the anatomical structure of that rib. Other authors believe the mechanism of 1st rib fracture is that; contraction of the anterior scalene muscle and the front-upper parts of the M. serratus anterior with a sudden and strong traction of the arm produces opposite traction forces in the subclavian sulcus. The force applied by these muscles to repeat and exceed the strength limit of rib results in the fractures [8]. We reported a case of bilateral first rib fracture in 45 year old male.

Barrett *et al*. [9] reported a case of first rib fracture in 17 years old female patient who had not a history of trauma except lifting a heavy weight was examined in details in terms of the potential complications and followed-up for a long time. In our case, the age of the patient was 45 years and it was male patient.

It is important to examine the anatomy of the first rib to understand the non-traumatic mechanisms of injury that can result in isolated fractures. The first rib is the shortest of all ribs, circumscribing an arc of 1808 as it passes forward in the transverse plane a distance of 3 in in adults. In its vertical dimension in situ, it is the broadest flattest rib with surfaces facing cranially and caudally. It attaches anteriorly to the manubrium sterni through costal cartilage. The first rib is deeply placed and protected on all sides by the muscular and bony structures at the root of the neck and shoulder girdle. In its midportion, the rib's cranial surface has a tubercle for the attachment of the scalenus anterior muscle [10]. Anterior to the scalene tubercle is the groove for the subclavian vein. Posterior and lateral to the scalene tubercle is the groove for the subclavian artery. Continuing postero-laterally on the cranial surface of the first rib is a roughened area, which serves as the attachment site for the scalenus medius muscle. The caudal surface of this bladelike bone provides attachment sites for the first interdigitation of the serratus anterior muscle, the subclavius muscle, and the costoclavicular ligament. The convex anterior border of the first rib is the margin of insertion for the intercostal muscles [11].

Even after an extensive research the exact mechanism of injury in bilateral first rib fracture remains questionable. According to some authors, since it is a relatively benign condition clinical endeavors should be directed at associated complications, especially of the thoracic structures and spinal cord. On the other hand, others suggest that bilateral first rib fracture is a hallmark of major thoracic trauma and direct urgent investigation to rule out the possibility of injury to the great vessels [12].

Conclusion

Authors concluded that the management needed for cases of bilateral first rib fracture may vary from analgesics and rest to an emergency thoracotomy if a major vessel is involved in the injury.

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