Thoracic and Abdominal Wall Injuries in Sports

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25.1 Introduction

Specific imaging literature on abdominal and thoracic wall injuries is relatively uncommon compared to the overall incidence in sports medicine. This is because the clinical diagnosis is usually straightforward and imaging is only needed to exclude anatomical variants (scapulothoracic crepitus) and concomitant lesions (rib fractures, handle bar trauma of the abdomen).

However, radiological grading and follow up of musculo-tendinous unit (MTU) strains may be significant in athletes. Moreover, radiological diagnosis is relevant in specific circumstances. Rectus abdominis sheath haematoma has to be excluded in cases of muscular strain as it does not self-tamponade. Clinical diagnosis of groin lesions is difficult and therefore radiological procedures may be of additional help in the diagnosis of sports hernia and groin disruption.

A thorough knowledge of the anatomy and biomechanics of the thoracic and abdominal wall is a prerequisite for understanding the pathological conditions of this area. The anatomy and biomechanics of the thoracic and abdominal wall is summarized in Figure 25.1 and Tables 25.1 and 25.2, respectively.

Fig. 25.1. Superficial muscles of the groin and abdominal wall: AL, adductor longus muscle; GR, gracilis muscle; LI, ligamentum inguinale; LD, lattisimus dorsi; OE, obliquus externus abdominis muscle; APO, aponeurosis, external inguinal ring; PECT, pectineus muscle; PM, pectoralis major; RA, rectus abdominis muscle; SART, sartorius muscle; SIAS, spina iliaca anterior superior

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Rib Cage and Thoracic Wall

Rib and sternum injuries are relatively rare in athletes. Rib fractures can be divided into two main categories: traumatic fractures and stress fractures.

25.2.1 Rib Fractures and Chondral Lesions

Rib fractures are the most common injury of the chest wall. Mostly, they occur at the middle and lower ribs with blunt trauma. Lateral rib fracture or injury to the costochondral junction is caused by a direct force to a small area most often coming from an anterior direction. Compression of the entire thorax results in fractures of multiple ribs.

Fractures of the first four ribs or the last two ribs, multiple fractures and flail segments have a less benign cause than other rib fractures, as they may result in injury to surrounding structures. In lower left or right rib fractures associated splenic or hepatic trauma is reported in up to 20% and 10%, respectively. Ultrasound is an excellent tool to detect occult fracture. The term “Flail chest” is used if three or more ribs are fractured in two or more locations provoking paradoxical motion during respiration.

Rib fractures also may be caused by violent muscle contractions. First rib and floating rib fractures are uniquely athletic fractures; caused by a sudden vigorous contraction in different directions of pull (Miles and Barret 1991; Coris and Higgins 2005). Fractures of the first rib have been reported in basketball players.

Fracture diagnosis is generally straightforward on standard radiographs (chest series and rib series). The differential diagnosis includes severe rib contusion, costochondral separations, muscle strains and pneumothorax. The focal pain area points to the fracture site (Fig. 25.2).

Furthermore, chondral lesions and costochondral separations may be dynamically examined with ultrasound (Fig. 25.2). By using ultrasonographic palpation to detect the pain at the region of interest (ROI) the accuracy of the technique is improved. Examination of the painful ROI is performed during inspiration, expiration and pain provoking manipulations. A short video sequence can be used to capture the intermittent step off at a costochondral separation or the snapping movement at the region of interchondral friction.

### Box 25.2. Scintigraphy
- Sensitive but non-specific in chronic osseous stress of the ribs

### Box 25.3. Ultrasound
- Detection of occult rib fracture and chondral injury
- Acute muscle strain – accurate, fast and dynamic. Particularly useful in grading. Can be negative in grade 1 injury
- Probably useful in the detection of sports hernia
- Evaluation of abdominal wall injury and (rectus sheath) haematoma
- Endofibrosis of the iliac arteries: greyscale and power Doppler demonstrate tapering – Doppler only useful after exercise

### Box 25.4. MRI
- Chronic groin disruption and sports hernia – probably useful in defining subtle atrophic changes and “osteitis”
- Accurate and useful in athletes with large muscle bulk

### Box 25.5. CT
- Handlebar injury – evaluation of visceral injury

### Box 25.6. Angiography, MR angiography, CT angiography
- Endofibrosis – specific diagnosis