

IMAGING OF CHEST TRAUMA IN CHILDREN

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Introduction

During 7 years at the common trauma centre of the hospital 7831 patients were evaluated radiologically. The local multitrauma protocol was based on helicopter transport with trauma physician and nurse on board. At arrival, after venous access, intubation etc. ultrasound examination including the chest was performed for detection of fluid etc. in pleura or pericardium. A plain antero-posterior chest x-ray was performed and in most cases a multislice CT including the chest was performed. Interruption at any time for emergency surgery in the same room as ultrasound, X-ray and CT scanner occurred frequently.

432 (5.5 %) of all the trauma cases were children 0-15.9 years (median 12 years), 264 boys (61 %) and 168 girls. These children had chest X-ray (100 %) and multislice CT (83 %) of the chest performed in the emergency room according to our local multitrauma protocol mentioned above. 93 patients (26 %) had 156 traumatic injuries to mediastinum, pulmonary parenchyma, pleura or chest wall. Mediastinal haemorrhage, atelectasis, pulmonary contusion, pneumothorax, and rib fractures were the most common findings.

About half of the pathology concerned the pulmonary parenchyma, one fifth each pleural/mediastinal and fractures and about one tenth was due to various external findings. The fractures were equally well assessed on chest films as with CT but pneumothorax (difficult to see on supine films), pneumomediastinum, pulmonary contusion (causing air space shadowing), and pleural haematoma were all better visualized with CT.

Blunt trauma

Blunt trauma to the chest is mostly caused by traffic accidents. The elasticity of the chest wall in smaller children means that major internal injuries can occur without rib fractures. Dislocated rib fractures are rarely seen in smaller children and the frequency increases with energy of the trauma and age.

Fractures of the upper ribs are often combined with severe either vascular or oesophago-tracheo-bronchial injuries. Fracture of the trachea or of a bronchus can give different radiological findings. Most common is a misplaced endotracheal tube, but a deformed bronchial contour can also be helpful in the diagnosis. In the most advanced cases the so called fallen lung sign with collapse of the lung not to the hilum but towards the diaphragm can be seen.

Lower rib fractures are often combined with lacerations of the upper abdominal organs. Without contrast enhanced examinations the injuries of the parenchyma may be difficult to diagnose and there may be a delay in the diagnosis. The fractures of the upper ribs, clavicles, sternum, scapulae, and vertebral bodies or processes are all better assessed with CT than with plain films.

The momentary chest compression and re-expansion of the chest at a traffic accident or other high energy chest trauma may lead to mediastinal injury and a pneumo-mediastinum with airtracking and sometimes extending into the neck as subcutaneous emphysema. Another sign of pneumo-mediastinum is the so called continuous diaphragm outlined by air under the heart. Cardiac injuries are rare but may include both myocardial laceration with ventricular shunting or pericardial haemorrhage and possibly a cardiac tamponade.

Chest radiographs can demonstrate most of the occurring injuries but they are generally more accurately assessed by CT. Pneumothorax is common. If resistant to treatment laceration of oesophagus or the tracheo-bronchial airways should be suspected. Tension pneumothorax should be clinically obvious. Subcutaneous emphysema anywhere around the thoracic cage of varying degree can be seen in high energy trauma to children with or without penetration from the outside.

Combined gas and fluid in the pleural space is common after pediatric chest trauma. Haemo-thorax is mostly secondary to bleeding from a pulmonary or pleural rupture. They are mostly venous in nature but if arterial from an intercostals artery or the internal mammary artery, the bleeding may compress the lung and cause a mediastinal shift.

The radiological findings in pulmonary contusion can vary considerably from child to child. There is no air bronchogram but the pattern and extent varies. There are many different radiological appearances. They can be patchy or extensive and confluent, they can be solitary or multifocal, and they can be unilateral or bilateral. Simultaneous aspiration can sometimes confuse the radiological assessment and complicate the outcome.

Solid opacification can cavitate with time and are different from traumatic pneumatoceles due to pulmonary laceration. Cavitation of contusions or haematomas, sometimes with air-blood levels on upright chest films or on CT occurs earlier in time in children than in adults. They can be seen as residual infiltrates for months. Traumatic ruptures of the diaphragm are more common on the left side but are generally speaking rare. They tend to occur more with lateral traumatic impact compared to frontal.

Penetrating trauma

Penetrating chest injuries in children varies markedly in frequency between countries. When they involve the lungs, heart or great vessels they produce similar findings to those that occur with blunt chest trauma. Gun wounds are relatively common and the pellet is most often accompanied by a pulmonary consolidation. Even if the pellet has passed through the body a circular tube-like consolidation around the track of the bullet can be seen.

Specifically penetrating paediatric chest trauma tends to produce air within the pleural space, heart, mediastinum or great vessels. Metallic and sometimes other foreign bodies may be seen. Delayed complications such as haemopericardium are infrequent.

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