

Rib osteomyelitis in children. Early radiologic and ultrasonic findings

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Abstract. The earliest radiographic changes of osteomyelitis in the long bones is deep-seated edema manifesting as soft tissue swelling and obliteration of the intermuscular planes adjacent to the affected bone. Similarly, the early change of rib osteomyelitis is pericostal edema demonstrated by soft tissue swelling of the thoracic wall accompanied by an adjacent inward pleural displacement. In both osteomyelitis of the rib and the long bones, the bony changes will appear 1-2 weeks later. Pericostal edema can be readily diagnosed by ultrasound scan. Pericostal edema, although non specific and can occur in other conditions, yet it is a strong warning sign, set within the overall clinical picture of osteomyelitis.

Recently a few articles appeared in the radiological literature, dealing with osteomyelitis of the rib in children [1-3]. Rib osteomyelitis is a rare disease with an incidence of 1% or less of all hematogenous osteomyelitis [4, 5]. The radiological bony changes are peculiar as there is expansion of the affected bone with lytic areas [2, 3]. These bony changes are typical but appear 1-2 weeks from the beginning of the disease. Soft tissue swelling adjacent to the affected rib is always present, and an extrapleural soft tissue density has been observed at the same level as well [2]. We wish to report our experience with four cases of rib osteomyelitis in children and to comment on the earliest radiographic and ultrasonic findings of this condition.

Case reports

Case 1

AZ, a 5-month-old male baby presented with a 2-day history of soft tissue swelling of the right chest wall and high fever. On admission, a non-tender 2 x 3 cm soft tissue mass was evident at the

anterolateral aspect of the right chest wall. His body temperature was 38.5°C and his pulse rate 120/min. Otherwise the physical examination was within normal limits. The laboratory tests revealed a WBC of 10.900 mm³ with a shift to the left, Hb of 9.4 g%, HTK of 29.3%, sedimentation rate 14/25. The chest radiograph showed a soft tissue swelling of the right lateral chest wall with a minimal adjacent pleural thickening which was not present in a previous

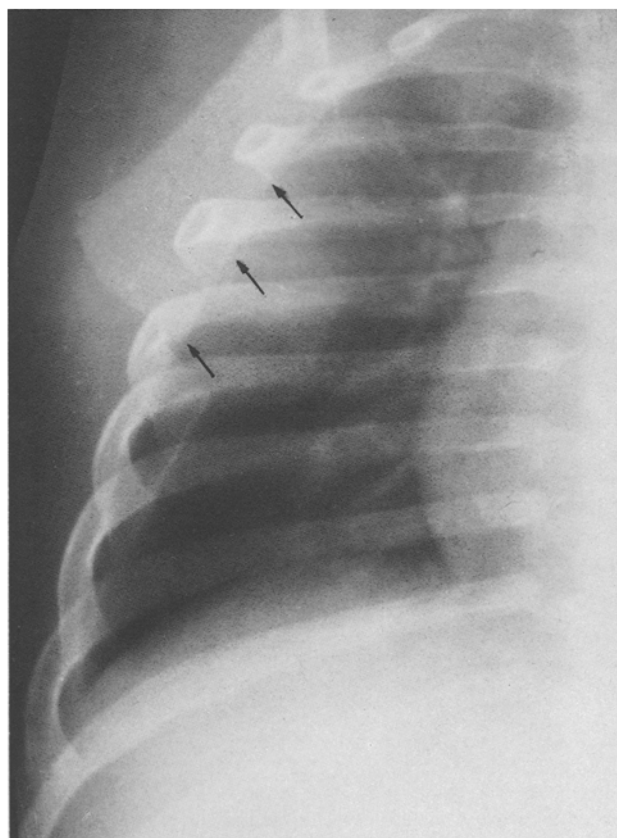


Fig. 1. Case 1. Chest radiograph 2 days after admission. There is obvious inward displacement of the pleural line adjacent to the soft tissue swelling in the lateral chest wall. The diagnosis of osteomyelitis of the rib was entertained although no bony changes are seen

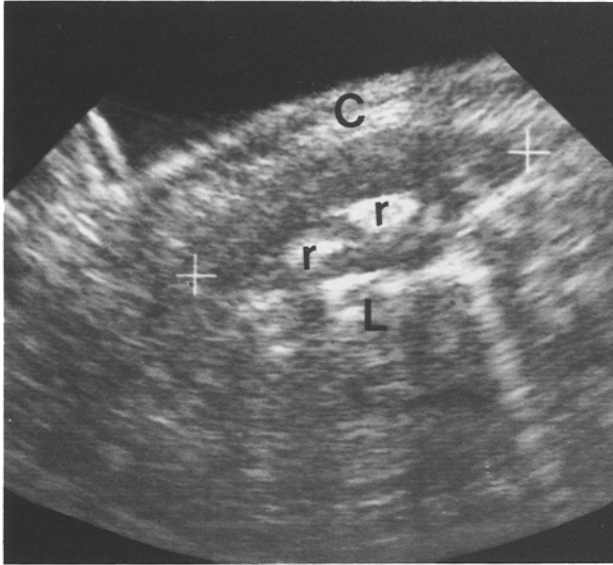


Fig. 2. Case 1. Longitudinal ultrasound scan of the right chest wall at the site of the soft tissue swelling. There is an obvious ovoid medium level echogenic structure around the ribs (r) indicating pericostal edema. C - chest wall. L = lung

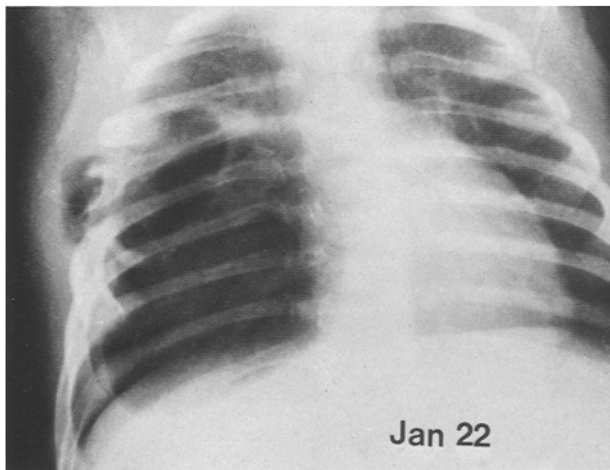


Fig. 3. Case 2. Chest radiograph. Typical osteomyelitis of the fourth rib. Notice the expansile lytic lesion at the axillary portion of the rib, with narrowing and absence of the anterior part of the same rib. A large pneumatocele is present in the right middle and lower lung fields, partly protruding into the chest wall via the deficient rib. Periosteal reaction is noted in the third, fifth and sixth ribs on the right

chest X-ray. Two days later the soft tissue swelling in the right chest wall slightly increased in size but still without obvious inflammatory changes over the skin. A chest X-ray at that time revealed an obvious inward displacement of the pleural line adjacent to the soft tissue mass (Fig. 1). An ultrasound scan revealed the presence of pericostal edema (Fig. 2). The diagnosis of rib osteomyelitis was entertained although no bony changes could be seen, and the nuclear medicine study did not show evidence of bone pathology. The baby was treated with i. v. antibiotics (Ampicillin and Cloxicillin) for 3 weeks during which time the soft tissue

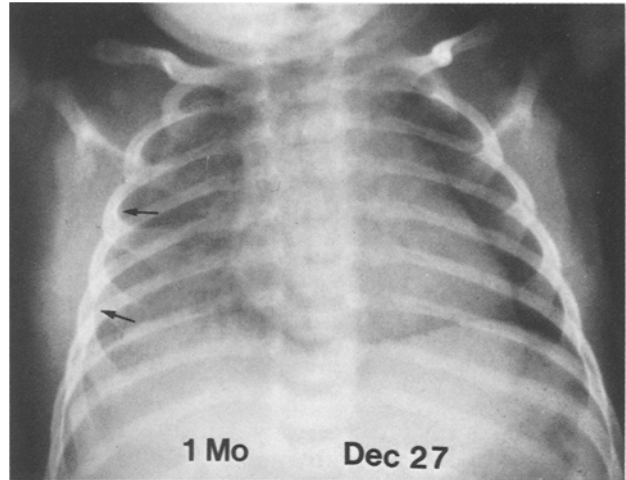


Fig. 4. Case 2. Chest radiograph three and a half weeks earlier than Figure 3. There is a soft tissue swelling in the right chest wall. The arrows point at a minimal adjacent pleural thickening

swelling gradually subsided and disappeared. Repeat chest X-ray 10 days after admission showed a typical osteolytic lesion of the fourth right rib accompanied by periosteal reaction in the same rib as well as in the third and fifth ribs. Oral antibiotics were continued for three additional weeks. He was discharged in excellent condition on the 25th day following initiation of the treatment. A control X-ray 6 weeks from the beginning of the disease showed almost complete healing of the rib osteomyelitis.

Case 2

YO, a 1-month-old male infant was seen in the Emergency Room with a 2-day history of restlessness and fever. Physical examination was within normal limits except for a temperature of 38 °C. His white count was 28.000 mm³ with a shift to the left. Chest X-ray was considered to be normal. He was referred to his family physician for further observation but failed to present for this check up. He was seen again and admitted at the age of 7 weeks with a 10-day history of increasing edema of the upper extremities and the trunk. His body temperature was 37 °C. A non-tender soft tissue swelling, 3 × 3 cm, was noted in the right chest on the anterior axillary line. This mass changed in size during inspiration and expiration. The fourth rib was not palpated in the region of the mass. Two pustular lesions were found in the right elbow and left knee. Laboratory data showed a haemoglobin of 8.3 g%, WBC 19,500 mm³, sedimentation rate 112 in the first hour, total proteins 6.1 g% and albumin 2.6 g%. Chest X-ray showed an expansile lytic lesion in the axillary part of the right fourth rib with diminution in size and absence of part of the rib anteriorly, typical of osteomyelitis. A large pneumatocele was noted in the middle and lower lung fields and part of it was protruding outside the confinement of the rib cage (Fig. 3). On re-evaluation of the previous chest radiograph taken 3.5 weeks earlier, a soft tissue swelling of the right chest wall was present and also a minimal adjacent pleural thickening (Fig. 4) Radiograph of the right elbow was normal but a small osteomyelitic lesion was evident in the right tibia. The infant was treated vigorously with antibiotics parenterally. A lumbar puncture was normal. Blood cultures revealed hemolytic *Streptococci*.



Fig. 5. Case 3. Chest radiograph. There is a soft tissue swelling of the left lateral chest wall with an adjacent inward pleural displacement but with no obvious rib changes

group A. The same organism grew from one of the pustules. The baby fully recovered and was discharged home after 3 weeks. Three months later the chest X-ray revealed disappearance of the osteomyelitic lesion, remodelling of the right fourth rib as well as resolution of the pneumatocele.

Case 3

EH, a 5-month-old female infant presented with a 1-day history of soft tissue swelling in the left lateral chest wall. She had a fever of 37.8 °C and a pulse rate of 104/min. A 2 × 3 cm non-tender soft tissue mass was felt at the mid-axillary zone of the left lateral chest wall adjacent to the fifth rib. The mass was “cystic” with no evidence of an inflammatory reaction over the skin. The laboratory tests revealed WBC of 28,600 mm³ with a shift to the left and haemoglobin of 10.8 g%.

The chest radiograph showed a soft tissue swelling at the left lower lateral chest wall with an inward displacement of the adjacent pleural line, with no obvious rib abnormality (Fig. 5). On the third day of admission her fever reached 39.2 °C and the soft tissue swelling increased in size with obvious characteristics of an abscess. Incision and drainage of the abscess yielded 15 ml of yellow-gray thick pus which grew *Streptococcus pyogenes* beta hemolyticus. The baby received appropriate antibiotic therapy. On the eleventh day after admission the control X-ray of the chest revealed an expansile lytic lesion in the left fifth rib characteristic of rib osteomyelitis. This subsequently healed completely and the baby had fully recovery.

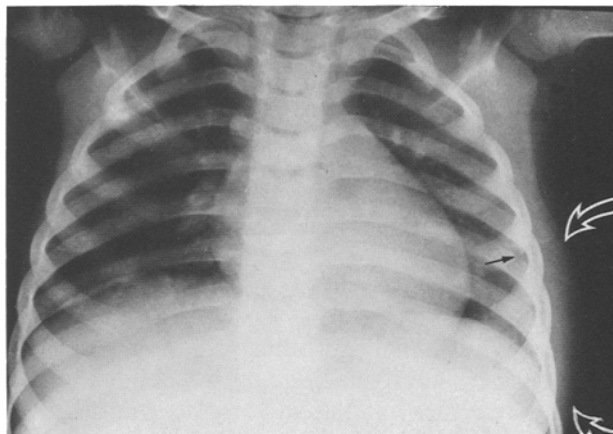


Fig. 6. Case 4. Chest radiograph. Soft tissue swelling at the left lateral chest wall (curved arrows), and minimal adjacent pleural thickening (arrow)

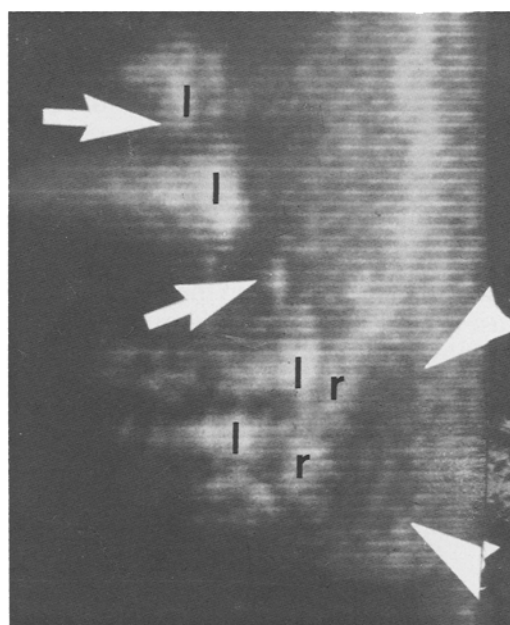


Fig. 7. Case 4. Longitudinal ultrasound scan over the left midaxillary line. Extrathoracic soft tissue swelling is seen distally and laterally (arrow heads). Proximally pericostal edema and inwards displacement of lung echoes (arrows) are prominent (r = ribs; l = lung echoes)

Case 4

TS, a 3.5-year-old girl was admitted after a 4-day history of increasing left-sided chest wall pain, limitation of voluntary motion of the arm, a fever of 39 °C and vomiting. Physical examination revealed marked swelling without local redness or heat at the left mid-axillary area. The laboratory data showed WBC of 21,800 mm³ with a shift to the left and a sedimentation rate of 100 after 1 h. The chest radiograph revealed a soft tissue swelling of the left lateral chest wall and adjacent minimal inward displacement of the pleural line, without bony changes in the rib (Fig. 6). Four days later the inward pleural displacement increased, still with no visible rib changes.

Ultrasonic study showed an echo-free, well-defined (6 × 2 cm) non-transonic extrathoracic mass. Adjacent to the mass and proximally, the reflective echoes of the lung were pushed away from the thoracic wall (Fig. 7). Under general anesthesia a mid-axillary line incision was done and 50 cc of pus were drained. Periosteal edema was noted at the level of the sixth rib. Cultures showed *Staph. aureus* to be the causative agent. The child was treated with appropriate antibiotics and recovered completely.

Discussion

The earliest radiological findings of osteomyelitis in long bones are soft tissue swelling and obliteration of the intermuscular planes adjacent to the affected bone. No bony abnormality is usually seen until 1–2 or more weeks have elapsed. In practice, in the proper clinical setting, deep-seated edema adjacent to long bones should be considered to represent osteomyelitis until proven otherwise. This is especially true since osteomyelitis cannot always be diagnosed by nuclear medicine (Case 1).

Equivalent to the deep-seated edema of the long bones is the edema occurring around rib osteomyelitis. This is exemplified by our cases where a soft tissue mass was present at the beginning of the disease in association with an inward displacement of the pleura at the same level (Figs. 1, 4, 5, 6). The pleural displacement can be very subtle in the earliest phase of the disease (Figs. 4, 6) but increases in size and becomes more obvious later on (Figs. 1, 5). In all our cases no bony changes were present at this stage but they appeared seven or more days later (Fig. 3). The ultrasonic examination can readily demonstrate this

pericostal edema (Figs. 2, 7). Pericostal edema is not specific to osteomyelitis and can occur in other conditions such as, traumatic, inflammatory (e.g. Caffey's disease) or neoplastic disease.

We conclude that in every pediatric case presenting with a pericostal soft tissue mass, osteomyelitis should be considered regardless of the absence of bony changes. Although pericostal edema is not specific, yet is it a strong warning sign, set within the overall clinical picture of osteomyelitis. The ultrasonic examination affords a quick, easy and reliable method to diagnose pericostal edema.

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