

Birth-related neonatal rib fracture: a case report

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Abstract

Rib fractures due to birth trauma are rare, other mechanisms of trauma need to be considered. We report the case of a large for gestational age newborn in the maternity ward with an isolated rib fracture due to birth trauma. Birth was complicated with shoulder dystocia after a vacuum extraction.

Introduction

Bone fractures resulting from birth trauma are not uncommon. Clavicle fractures are the most common with an incidence of up to 3.2% (1). Fractures also occur at other sites, such as the femur, humerus or skull. Rib fractures, however, are rare. Rib fractures are usually localised in multiple ribs and are often accompanied by clavicle fractures (2,3). In this article, we present a case study of a newborn with an isolated rib fracture, aiming to draw attention to this less common form of birth trauma.

Case report

Following an uncomplicated pregnancy a boy was born at a gestational age of 40 weeks and 5 days to a G1P0 mother. During vaginal delivery, vacuum extraction was necessary because of prolonged second stage of delivery. In total three tractions were needed. The delivery was complicated by shoulder dystocia. Suprapubic pressure and McRoberts manoeuvre were needed to lift the shoulder dystocia. APGAR-score was 7 at 1 minute and 9 at 5 minutes after birth. Birth weight was 4,220 gram (93th centile). Physical examination immediately after birth (day 1) showed normal, symmetrical movements and reflexes, and a caput succedaneum. Twelve hours after admission to the maternity ward, the mother heard a cracking sound during movement of the right arm, which reappeared the day after. A second physical examination on the first day was normal. On day 2, however, physical examination revealed a distinct cracking sound when the right arm was moved and a 'crack' could be felt under the right scapula. Range of motion of the arm was normal, apart from abduction of the right shoulder, which was limited to 75°. There were no signs of Erb's or Klumpke's paresis. There was no sign of pain during the clinical examination. A chest radiograph showed no clear fractures of the humerus and scapula, but there was uncertainty regarding a possible fracture at the level of the anterior part of the third and fourth rib. According to the radiology department, a rib fracture following a complicated birth would be expected to occur posteriorly rather than anteriorly. The familial history was negative for underlying diseases causing bone fractures. There were no arguments for non-accidental injury. On day 3, the cracking sound was still heard during spontaneous, painless movements. There was no residual limitation of movement of the right arm and shoulder. The boy was discharged from the hospital. Conservative treatment with physiotherapy was started. At follow-up after one week, the parents reported that their child sometimes cried when changing clothes, but there were no signs of pain when picking him up. The cracking sound diminished, but was still present. Clinical examination withheld a cracking feeling at the right side

Figure 1: fracture of posterolateral side of the right 7th rib.



Figure 2: Fracture of posterolateral side of the right 7th rib, anterior-posterior oblique view.



of the back, but no movement limitations. An anterior-posterior oblique ('3/4') radiograph (Figures 1 and 2) showed a minimally displaced fracture posterolateral to the seventh rib on the right side. As full recovery was expected, no clinical follow-up was scheduled. A telephone follow-up at nine months reported that the 'crack' had disappeared and motor development was normal.

Discussion

The incidence of fractures in the neonatal period varies amongst different studies. A single centre study in the United Kingdom by Rehm et al. mentioned a 0.075% fracture rate amongst all live births (1). In a nationwide Swedish study, conducted by Högberg et al., a 0.29% fracture rate was observed in all newborns (2). Another single centre study, conducted in Wales by Wei et al., reported a fracture rate of 1.6% in the neonatal intensive care department, which included more premature infants having metabolic bone disease (4). The incidence of fractures is possibly underestimated because children might lack symptoms and not every child will get a radiological evaluation.

Up to 95.5% of all neonatal fractures are located in the clavicle, with maternal short stature or obesity, large for gestational age child, instrumental delivery and shoulder dystocia being the main risk factors (2).

Very little literature is available on rib fractures due to birth trauma in the neonatal period. Van Rijn et al. reviewed all 10 published cases of rib fractures caused by birth trauma until 2008 and added 3 new cases. In all cases rib fractures were located in multiple ribs; in 6 cases an associated ipsilateral clavicle fracture was found and 9 out of 13 neonates were large for gestational age with birth weight >4 kg (3). In the study conducted by Rehm et al., one rib fracture was found in a total of 66 fractures in 84,761 live births. (1) In the nationwide Swedish study mentioned above, only 10 out of 5,336 fractures (= 0.002%) found in 1,855,267 live born neonates were rib fractures. In all of the cases rib fractures were associated with an ipsilateral clavicle fracture. Half of them had a birth weight over 4kg, four of them had shoulder dystocia and in four cases vacuum extraction was used. (2) In our case the neonate was large for gestational age (>4kg) and birth was complicated by shoulder dystocia. The rib fracture was not associated with a clavicle fracture and it was localized in only one rib, which is rare considering in all previously published cases, multiple rib fractures were found.

Birth trauma as a cause of rib fractures is very rare, therefore it is always necessary to consider other differential diagnoses. Firstly, non-accidental injury (NAI) has to be excluded. No studies on NAI and rib fractures that includes only neonates are available. Barsness et al. reported a positive predictive value of 95% for rib fractures as an indicator of NAI in children under the age of 3 (5). In two studies in infants by Bulloch et al. and Cadzow and Armstrong, respectively 82% and 83% of rib fractures were caused by NAI (6,7). Differentiating birth trauma from non-accidental injury is difficult, since both have similar trauma mechanisms and predispose to a similar type of rib fractures. In some forms of NAI, the abuser applies anterior-posterior compression to the thorax when encircling the thorax with both hands, shaking and gripping the child with consequent anterior displacement of the vertebrae. This pressure results most often in posterior rib fractures, but also lateral fractures. Childbirth also circularly exerts pressure on the thorax through the narrow birth canal, combined with rotational forces, leverage over the pubic symphysis and relative fixation of one side of the thorax, resulting in mid-posterior, unilateral rib fracture (3,8). A second differential diagnosis for neonatal rib fractures is cardiopulmonary resuscitation (CPR). CPR results in rib fractures in 0-2% of resuscitations. After changing the technique of CPR from the two-finger technique to the two-thumbs method, some studies reported an increase in rib fractures, while others did not (9). Thirdly, accidental injury can result in neonatal rib fractures as well. In the study by Högberg et al. 7.4% of fractures in neonates were caused by accidental trauma, 92.6% by birth trauma (2). At last, several underlying conditions and diseases can predispose to rib fractures. In premature neonates metabolic bone disease facilitates fractures. Osteogenesis imperfecta (OI), hyperparathyroidism and familial hypocalciuric hypercalcemia (FHH) have also been described as predisposing to neonatal rib fractures (3).

Chest radiograph is the golden standard for diagnosing fractures. Considering the fracture site is mainly posterior, anterior-posterior oblique views are necessary to image rib fractures as they might be missed in normal anterior-posterior views, as was in our case. Ultrasound can be a safe alternative to X-ray in diagnosing fractures. A recent study by Liu indicates 100% sensitivity and specificity of ultrasound for detecting fractures in infants (10).

No specific guideline is available for treatment of rib fractures in neonates. In general a conservative approach is chosen with adequate analgesia and physiotherapy for mobilisation and positioning.

We suggest the following work-up for neonates with rib fractures. First, it is important to conduct a thorough anamnesis to detect risk factors of NAI and to screen for genetic predisposition to underlying conditions such as OI or FHH. Secondly, a full clinical investigation is carried out, searching for other fractures, bruises or signs of associated diseases such as blue sclerae in OI. Severe hyperparathyroidism and OI often result in multiple fractures, although in NAI also multiple fractures can be found (3). Associated clavicle fractures can point to birth trauma. Thirdly, when in doubt of the diagnosis of rib fractures, X-rays with oblique views can be helpful; if necessary additional radiographs can be made to exclude fractures in other sites. Finally, in cases with an aberrant family history, multiple fracture sites, other clinical features and no indications for traumatic birth, a blood test for underlying diseases is indicated, including calcium, phosphorus, alkaline phosphatase, parathormone and vitamin D levels (3). Additional genetic testing can be considered.

In our case, the lack of arguments for NAI, the negative family history and clinical investigation were reassuring. X-rays for the diagnosis of the posterior rib fracture showed no other fracture sites. The birth weight was high (>4kg), vacuum extraction was carried out and birth was complicated with shoulder dystocia, three arguments that increase the risk of birth trauma. Therefore no further work-up was carried out.

Conclusion

Rib fractures in neonates due to birth trauma are rare. Risk factors might be a large for gestational age child, instrumental delivery, shoulder dystocia and associated clavicle fractures. Always consider alternative trauma mechanisms such as non-accidental injury or underlying diseases. The golden standard for diagnosing rib fractures due to birth trauma is chest X-ray, including oblique views since the fracture site is usually posterior.

Conflict of interest

The authors have no conflict of interest to declare.

Informed consent

Written informed consent was obtained from the parents of the patient for publication of this article.

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