

Neonatal Rib Fracture: Birth Trauma or Child Abuse?

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Fractured ribs in the neonatal period have not been recognized in the past as a consequence of birth trauma,¹⁻⁵ possibly because they are exceedingly rare or because they are often not clinically recognized. Although chest radiographs taken later in infancy would be expected to reveal evidence of healed rib fracture, they are infrequently done, and past fractures, if any, would go undetected. The finding of healed rib fracture during infancy would be more likely to raise the question of possible child abuse than of birth trauma. The following is a case report of rib fractures in a neonate believed to be secondary birth trauma.

CASE REPORT

The mother was a 37-year-old woman who had two previous pregnancies, both culminating in first trimester elective abortions. Her past medical history was unremarkable except for obesity and mild hypertension not requiring drug treatment. During the pregnancy she developed mild gestational diabetes, which was controlled by diet. She had mild pretibial edema throughout the pregnancy, and at 35 weeks gestation she required bed rest to control the edema and her blood pressure. She did not develop other changes consistent with preeclampsia. Starting at week 35, she had weekly non-stress tests to document fetal well-being. These tests remained reactive.

At 38 weeks she spontaneously went into labor. Early first stage was uneventful, but at 6-cm to 8-cm cervical dilation, the baby developed some variable decelerations. During the second stage the fetus developed late decelerations, and the vertex failed to descend. Obstetric consulta-

tion was obtained, and the treatment options were discussed with the patient.

It was decided to attempt immediate delivery using vacuum extraction. The head was in the right occiput anterior position. After delivery of the head by vacuum extraction, shoulder dystocia occurred, requiring significant traction force to deliver the shoulders. The left rib cage passed under the symphysis pubis, and the thorax was flexed upward as the remainder of the body emerged. The child weighed 3300 g, and Apgar scores were 6 at 1 minute and 8 at 5 minutes. The newborn examination was done in the delivery room with special attention directed toward the clavicles because of the difficult shoulder delivery. The clavicles were found to be intact, and the remainder of the physical examination did not detect any abnormality.

Because of the mother's diabetes, the infant was sent directly to the newborn nursery, where blood glucose levels were monitored. Approximately 4 hours after delivery, the infant was sent to the mother's room, remained with her for 45 minutes, and then was returned to the newborn nursery. Two hours later, a total of 9 hours after delivery, the child was noted by the nurse to have rapid respirations. Examination by a resident physician revealed mild respiratory distress with tachypnea and tachycardia. Crepitus was palpable over the left posterolateral chest. No skin changes suggestive of trauma were found. Chest x-ray examination revealed 5 fractured ribs over the left posterolateral chest area (Figure 1). There was no evidence of pneumothorax or other skeletal trauma. Over the next 36 hours the child experienced progressively less tachypnea and gradual disappearance of the crepitus. Full skeletal survey failed to show evidence of osteogenesis imperfecta or any other abnormality of bone mineralization. Since the fractured ribs were not noted at the time of delivery, the possibility was considered that injury occurred sometime in the 9-hour period immediately following delivery. A review of the nursery nursing notes and an interview of the nursing staff failed to reveal any evidence that injury occurred as the result of an accident by the nursery staff.

The possibility of child abuse by the mother also had to be considered. Social service personnel were consulted, and

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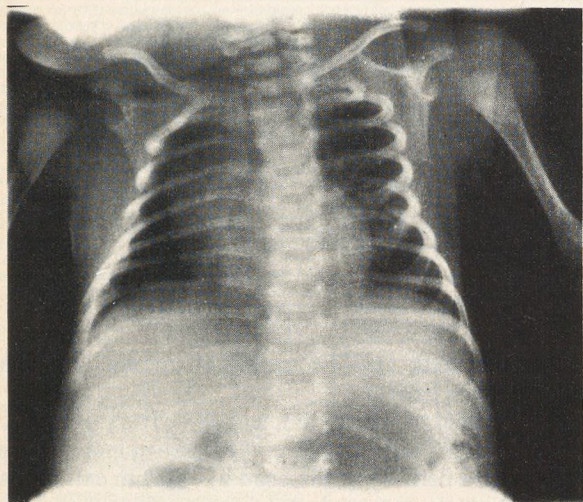


Figure 1. Nine hours after vaginal delivery, mild respiratory distress and crepitus over the posterolateral chest were noted. Chest roentgenogram revealed fractures of the left third, fourth, fifth, sixth and seventh ribs.

they met with the mother reviewing the circumstances of the pregnancy, her prenatal course, social supports, and attitudes toward the pregnancy and new baby. The pregnancy had been unexpected and unwanted and the product of a mixed racial relationship. The couple had separated 3 weeks before the baby's birth. Although there were multiple risk factors for child abuse, the mother denied having hurt the baby, and it was the opinion of the medical staff and the social service personnel that she be allowed to take the child home. Over the next 12 months the baby had normal physical and developmental growth with no evidence of child abuse. The baby has been followed by both her primary physician and the department of social services. Follow-up x-ray films of the ribs at 3 weeks postpartum showed callus formation and no other evidence of trauma.

DISCUSSION

A review of the literature reveals copious reference to birth injuries of the skull, clavicles, cervical spine, brachial plexus, and extremities, but little could be found describing rib fracture in full-term infants.^{1,2}

Rubin³ prospectively studied 15,435 births over a 6-year period. He found 108 injuries other than cephalhematoma, an incidence of one birth injury for every 143 deliveries.

TABLE 1. RISK-ASSESSMENT PROFILE

Injury	Score
Fractured clavicle	
Infant weight > 4000 g	4
Shoulder dystocia present	3
Infant weight between 3500 g and 4000 g	3
Midforceps used for delivery	3
Low forceps used for delivery	1
Fetal distress during delivery	1

A score of ≥ 5 correctly predicted 50% of the injured group and a score of < 5 predicted no injury in 94% of the comparison group. Reproduced with permission from Michael G. Levine⁴

Included were 43 fractured clavicles, 7 fractured humeri, and 1 skull fracture. There were no reported episodes of fractured ribs in his series.

Levine et al⁴ retrospectively studied 13,870 singleton consecutive live births and assessed risk factors associated with fractures and other injuries. That fractured ribs were not reported in this large series would suggest either that a rib fracture is an infrequent occurrence or that it is often missed. Thomas⁵ reviewed rib fractures in infants under 1 year of age during the period 1969 to 1975. Of over 10,000 chest roentgenograms reviewed, he identified 25 infants with evidence of one or more rib fractures. These included one newborn and one infant at 3 weeks of age. The infant with fracture at birth had osteogenesis imperfecta congenita and died at 3 days. The infant with rib fracture at 3 weeks was a full-term baby weighing 5686 g and was delivered by mid-forceps.

Levine et al identified risk factors associated with fractured clavicle. One might also speculate those same factors being predictive of potential rib fracture. Table 1 shows the risk factors identified in the infants with fractured clavicles. A score of 5 or greater predicted a fracture in greater than 50% of the injured group. The delivery described in this paper would have a total score of 7, resulting in a greater than 50% chance of a fracture if the risk factor scale of Levine et al were applied.

There are numerous reports of fractured ribs as a result of child abuse. Leonidas⁶ writes that fractured ribs are the third most frequent skeletal injury in battered children. The authors could find no reports that described abuse in the first week of life. In addition, almost all children with bone injuries from child abuse have other associated injuries.

CONCLUSIONS

A newborn infant was discovered to have five fractured ribs 9 hours after a vacuum-assisted delivery and moderate

shoulder dystocia. The diagnosis of child abuse was seriously considered, but little evidence was found to support this explanation of the injury despite the presence of several child-abuse risk factors.⁷⁻⁹ The mother's interactions with the child, as observed by nursing staff, medical staff, and social service personnel, were considered to be appropriate. That the child's subsequent development over the first year of life showed normal physical and psychological growth also argues against neonatal child abuse.

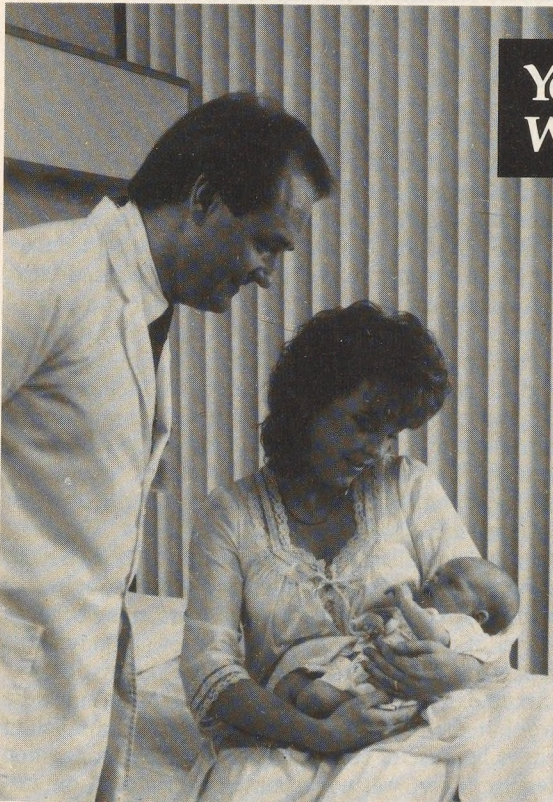
The injury is thought to have occurred during the delivery and was missed on the initial examination. The mechanical pressure exerted on the left side of the chest during the upward flexion of the body against the symphysis pubis is the probable mechanism of this trauma. In circumstances consistent with the risk profile as described by Levine et al (Table 1)—that is, infant weight greater than 4000 g, shoulder dystocia, and mid-forceps delivery—the authors suggest that a careful search for rib fracture may reveal that such an injury is not so rare as the literature would suggest.

In addition to the customary auscultation of the lungs, careful palpation of the ribs looking for evidence of crepita-

tion would probably represent an adequate initial screening measure to rule out rib fracture. Chest x-ray examination is not recommended unless there is respiratory distress or clinical evidence on the physical examination of possible rib fracture.

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