



Osteochondral junction lesions in stillborn fetuses and their relationship to autopsy diagnoses [☆]

Eumenia Costa da Cunha Castro ^{a,*}, Edwina Jane Popek ^{b,1}

^a General Pathology Discipline, Triângulo Mineiro Medical School, Rua Frei Paulino, n30, 38025-180, Uberaba - Minas Gerais, Brazil

^b Pathology and Pediatric Pathologist, Baylor College of Medicine and Texas Children's Hospital, 6621 Fannin MC 1-2261, 770302399, Houston, Texas, USA

Accepted 5 December 2006

KEYWORDS

Osteochondral junction;
Stillborn;
Autopsy

Abstract

Background: In the perinatal period, microscopic abnormalities of the costochondral junction in fetuses were described but little is known about the perinatal interurrences that were associated with them.

Aims: The aim of this study was to correlate the findings of the osteochondral junction (OCJ) of stillborn with the autopsy findings.

Study design: We studied 50 longitudinal sections of OCJ of the 5th and 6th ribs collected from stillborn fetuses, after decalcification and staining with Hematoxylin and Eosin (HE). The gestational age ranged between 22 and 41 weeks.

Results: The incidence of abnormal OCJ in the ribs was 62%. Intrauterine growth restriction was associated most often with banding. In 12% of our cases, we found one pattern of OCJ alteration that did not fit into the previous described categories. This pattern was the presence of a bone in the middle of the cartilage column associated with disorganization of the OCJ. The other pattern that has rarely been mentioned in the literature, we called "bizarre" and all the fetuses were less than 37 weeks of gestational age. The incidence of the "bizarre" or the "funny bone" patterns was less frequent than the other patterns of OCJ alteration, although they seem to be associated with the cases that had the most severe placental abnormalities (massive perivillous fibrinoid, decreased placenta blood flow) or congenital malformations (complex congenital heart defect, hydrocolpos).

Conclusion: In conclusion, OCJ alterations were more commonly associated with congenital malformation or placental abnormalities. Histologic examination of the OCJ is an easy and reproducible method of determining in utero growth disturbance even before there is a lag in fetal growth and is an important component of the perinatal autopsy.

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[☆] This work was performed at the Department of Pathology, Texas Children's Hospital, 6621 Fannin MC 1-2261, Houston, Texas 770302399. Grants from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) support this work.

* Corresponding author. Tel.: +55 34 33185428; fax: +55 34 3318 5462.

E-mail addresses: eumenia.pat@dcb.uftm.edu.br (E.C. da Cunha Castro), ejpopek@texaschildrenshospital.org (E.J. Popek).

¹ Tel.: +1 832 8242250; fax: +1 832 8251032.

1. Introduction

The rib is an ideal bone for studying linear growth, being probably the most rapidly growing bone in a linear fashion throughout the entire intrauterine period [4,5,12] and is easily accessible during routine autopsy. Longitudinal growth of the ribs is known to be the result of interstitial growth of the costal cartilage. More precisely, the rate of growth depends classically on the number of cells and the rate of mitosis in the growth plate, the amount of extracellular matrix produced and the rate of hypertrophy of the cells [4,8,12].

The rib is a trabecular bone type and is formed by endochondral ossification, which means that an initial cartilage template is converted into bone with proliferation and differentiation of osteoblasts in the fetus [8]. The costochondral junction appears as a column of cartilage cells lying between regular strands of chondroid matrix and abutting on bony trabeculae [4]. The linear growth is around 220 μ per day [11]. Growth plate chondrocytes are arranged in columns that sequentially and synchronously progress through proliferative, prehypertrophic and hypertrophic stages [9]. The hypertrophic chondrocytes die and are replaced by trabecular bone and bone marrow through a process that includes apoptosis of hypertrophic chondrocytes, vascular invasion of the growth plate, resorption of the cartilaginous matrix and recruitment of osteoblasts that are deposited in the trabecular bone matrix [13]. All the process seems to be regulated by the interaction of cells with the extracellular matrix (ECM) which provides the cells with cues critical for the determination of cell fate: proliferation, differentiation, and apoptosis [10,13].

It was proposed in the literature that sudden infant syndrome fetuses could have a disorganized osteochondral junction that could be used as an assessment of the presence and duration of illness in these children [2,6]. In the perinatal period, abnormalities of the costochondral junction in fetuses from 19 weeks of gestational age to 4 weeks old, were more frequent in those fetuses dying around term [5,6]. In addition, alterations of the costochondral junction have been associated with pulmonary problems such as hyaline membrane disease [14].

The literature has shown that the changes found in the ribs of stillborn babies, or babies dying within 48 h of birth are compatible with an upset in growth antedating labor, diagnosed by the gestation clinical data and by the autopsy measurements [5]. The lesions in the osteochondral junction were microscopically classified in changes compatible with growth arrest and "bizarre" pattern [5]. The growth arrest pattern was described by the authors as an irregularity of the cartilage line with an increased matrix deposition, diminution in cellularity of the connective tissue between the capillaries in the trabeculae and the osteoid or bone spicules. The "bizarre" pattern had irregular masses of matrix lying among the disorganized mixture of cartilage cells and trabeculae. Sixty percent of the fetuses born at ≤ 32 weeks of gestational age and nearly 75% of term fetuses showed evidence of in utero stress before birth [4,5]. But, although, authors considered the histologic study of the costochondral junction an extremely valuable part of the autopsy of any perinatal death, the cause of the utero stress associated with the OCJ lesions was not the scope of those studies [5].

The aim of this study was to correlate the findings of the costochondral junction of stillborn with the major findings at autopsy.

2. Methods

We study 50 sequential osteochondral junctions of the rib, which met criteria for quality (see below), collected from stillborn fetuses, or fetuses dying in the immediate peripartum period, from 1995 to 2001.

The intrauterine growth restricted fetuses were classified according to the birthweight below 10th percentile. When the birthweight was impossible to assess as in the hydropic or severe autolyzed fetus, we have used two or more other

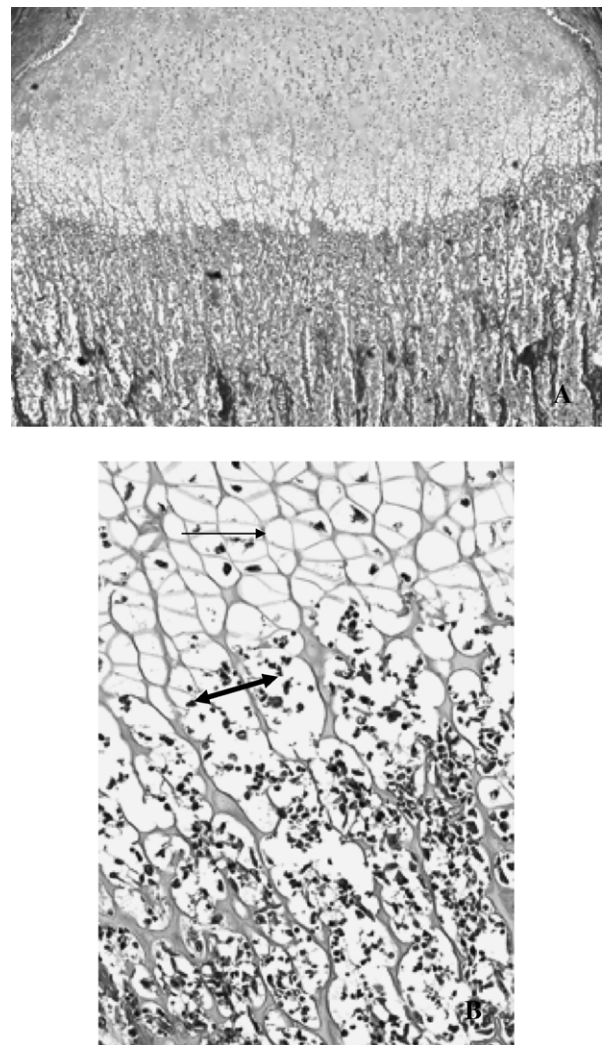


Figure 1 A. Showing the normal appearance of the costochondral junction. Intrauterine fetal demise at twenty-two weeks of gestational age, female, with history of hydrops and thoracic mass (case n 48; HEX4). B. Normal appearance of the osteochondral junction showing the cartilage cells in double or single rows oriented towards the bone. The hypertrophic zone, where the cells have a large perinuclear clear area (arrow) until the final cells (double arrow) appear to be bursting into the bone trabeculae. (HEX40).

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