

Radiographic Appearance of the Ossification Center of the Femoral Head in Erbil City; a case series of pediatric cases of delayed ossification of the femur head

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ABSTRACT

Bone development is one of the most important parts of the growth. Delay in the onset of ossification in the femoral head is one of the important complications in growth, showing the possibility of various medical conditions in infants, as well as skeletal dysplasia or endocrine diseases. Normal femoral head ossification appears in radiographs of most 7-8 months age infants; while physiologically ossification of femur nucleus gets started at 4 months age, making the radiological studies useful after 7-8-month ages. While timely diagnosis of hip conditions in infants stand in a high priority to prevent growth retardations and developmental dysplasia of the hip (DDH); we used ultrasonographic studies to assess ossification center of the femoral head. delayed ossification of the femur head was diagnosed by ultrasonography in 162 infants, aged between 6 to 10 months in 2020 at Hawler teaching hospital and Helina center in Erbil. The diagnoses were confirmed by radiological study. Infants with confirmed DDH diagnosis were excluded. Our primarily result showed the possibility of ultrasonographic examination for detection of delayed ossification of the femur head and the ultrasonographic characteristics of these cases were discussed. So, in further studies it can be used to assess the hips of infants in lower ages. Ultrasonographic seems to be an efficient diagnostic method in examining bone at an early age and could be used as a powerful screening tools of hip in lower ages that radiography is not so useful like ultrasound.

Keywords: Femoral head, ossification center, Ultrasound and X-ray.

INTRODUCTION

Bone growth is an important indicator of maturation of body. Radiographic findings of bone studies have long been used in the field of growth (1). The femoral head ossification starts at 2 to 3 weeks after birth and rarely appear in radiographs of some infants. At higher ages (7-8 months) when ossification is developed and is in final steps, its radiological appearance is used as an important indication of bone growth in infant. The delayed appearance of the femoral ossification center in infants is associated with medical and congenital conditions as well as skeletal dysplasia, endocrine diseases such as cretinism, and femoral growth dysplasia (DDH) (2). The formation and development of the femoral ossification center is used as a diagnostic and management sign in neonates with hip growth dysplasia (DDH) (3). In most normal children, the bone marrow appears radiographically by 6 months of age. In recent years, ultrasound examination of the hip joint has been the method of choice for early detection of the femoral ossification center and diagnosis of DDH (4). Although radiological findings may not be obvious in the first months of life, radiology is still used as a conventional diagnostic tool (5). Numerous radiological findings such as Barlow line, Shenton line, Perkin line, Hilgenreiner line and determination of acetabular index are used as indicators of various hip conditions in DDH (6). In order to prevent cases of clinical and radiological diagnostic failure, ultrasound method for screening and diagnosis in newborns has been developed and introduced. The most comprehensive initial survey was performed by graphs, measuring alpha and beta angles and evaluating detailed dynamics (7). Given that access to

ultrasound is almost significantly restricted to primary assessment and screening in our community, this study was performed to evaluate the ultrasonographic and radiographic findings of 162 infants with delayed ossification at Hawler teaching hospital and Helina center in Erbil city was performed.

METHODS

This case series study was conducted to report the ultrasound and radiographic findings of 162 infants diagnosed with delayed ossification of the femur head, aged 6 to 10 months. Ultrasound examination of hip joint was performed by graph method (8,9) A total of 162 infants were successfully diagnosed with confirmation of radiology findings in one-year study in 2020 at Hawler Teaching Hospital and Helina center in Erbil. All examinations were performed by a single physician with an ultrasound machine (Sonoline, Siemens, Germany). This device is equipped with a 5 MHz converter. For each infant, we recorded gender, date of birth, gestational age at birth (months), date of ultrasound examination, age of examination (weeks), and the presence or absence of a femoral head ossification center on ultrasound examination. All data were collected in a Microsoft Excel file and analyzed using SPSS software version 20.

RESULTS

The results of our study on the demographic information of infants can be seen in Table 1. There were 70 (43.2%) male and 92 (56.8%) female infants. In our study, infants were divided into four age groups. 72 infants (44.44%) were

in 6-7 months age group. 54 infants (33.33) were in the 7-8 months age group and 26 of infants (16.04%) were 8-9 months old. Finally, 10 infants (6.17%) were 9-10 months old. In our study, 104 infants (64.20) lived in rural areas and, 58 infants (35.80%) lived in urban areas (Table 1).

The results of our study on the incidence of changes in bone growth retardation by age can be seen in Table 2. Our results showed that 28 infants with 6-8 months age had unilateral ossification center of head of the femur. 44 infants with 6-8 months age had bilateral ossification center in head of the femur. 20 infants at age of 7-8 months had unilateral ossification center in head of the femur. 34 infants at age of 7-8 months had bilateral ossification center of head of the femur. At the age of 8-9 months, 10 infants had unilateral and 16 infants had bilateral ossification center of head of the femur. Finally, at the age of 9-10, 6 infants had unilateral and 4 infants had bilateral delayed in ossification center of head of the femur. There was not any significant difference between infants who had bilateral delayed in ossification center of head of the femur and infants with unilateral delayed in ossification center of head of the femur ($p>0.05$) (Table 2).

Table 1: Demographics information of patients

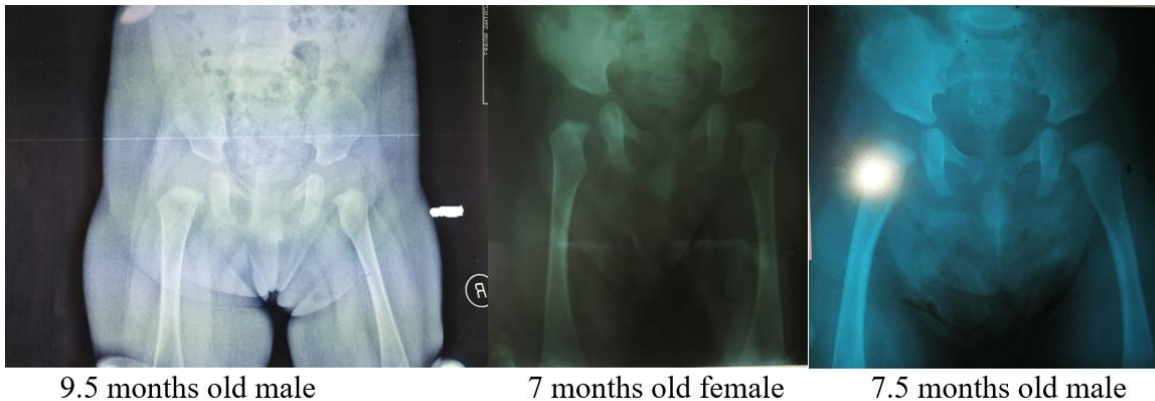
Male	70(43.2%)
Female	92(56.8%)
Age	
6-7	72(44.44%)
7-8	54(33.33%)
8-9	26(16.04%)
9-10	10(6.17%)
Area	
Rural	104(64.20%)
Urban	58(35.80%)

Table 2: Evaluation of delay in femur ossification at different ages

Age (months)	Unilateral	Bilateral
6-7	28(28.44%)	44(43.56%)
7-8	20(21.33%)	34(32.67%)
8-9	10(10.27%)	15(15.73%)
9-10	6(3.95%)	4(6.05%)

P value 0.589

Figure 1: Examples of Bilateral delayed ossification cases



DISCUSSION

Of all the long bones, the femur is the second bone starting ossification process right after the clavicle. The ossification of the femur begins in the middle of the shaft and progresses to both ends at the same time. Thigh ossification and femoral epiphysis are pursued differently¹⁰. The primary ossification center appears in the middle of the shaft in the seventh week of pregnancy, while the secondary ossification centers in the proximal and distal epiphyses appear in later stages, mainly in infancy. There are three ossification centers at the proximal end of the femur at the head, the larger and smaller trochanters, while there is only one ossification center at the end of the femur. The process of ossification of the femoral head begins between 6 and 12 months after birth, in the large trochanter in year 4 and in the smaller trochanter in year 14. Thigh head occurs in 16, 17 and 18 year olds, respectively. The bony neck of the bone shaft due to the expansion of the primary ossification center¹¹. Recent studies show that the ossification center is operational in 90% of infants at 7 to 8 months of age and in some cases at 4 months of age¹².

However, the results of our study showed that in 44.44% of the people in the study, the femoral head ossification center can be seen on ultrasound. In our study, 33.33% of the neonates at the ossification center were observed by ultrasound at the age of 7 to 8 months. Considering that the number of diagnoses at the age of less than 7 months is more than the number of diagnoses at the ages of 7 to 8 months, it can be said that the power of ultrasound diagnosis in identifying the ossification center in the femur is very high and reliable. The results of Pettersson et al study showed that the highest number of diagnoses of bone formation based on ultrasound was at the age of less than 5 months^{12,13}. For early diagnosis of the disease, clinical skills in physical examination are required, and radiography is a tool in confirming abnormalities in suspected cases, but since clinical signs are not always clearly seen, cases where the disease is diagnosed too late and have serious and compensatory complications. There is an inadmissibility¹⁴. At less than one year of age, the bones are not fully formed. Radiological examinations have high diagnostic power in areas where there is high bone density. Therefore, radiological diagnoses at a young age

are not very reliable. In contrast, ultrasound has a high diagnostic power, even in areas where there is no bone.

CONCLUSION

The results of our study showed and we noticed that there are increasing cases of delaying in ossification center of head of femur compared to normal range of ossification center which written in the text books some cases we were reported till 10 months of age ossification not occur. Also showed that Ultrasound is a suitable diagnostic method and more sensitive than x- ray to examine bone growth and diagnose the formation of a bone formation center in the femoral head.

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