

DEVELOPMENT OF THE GROWTH AREAS OF THE LONG TUBULAR BONES OF THE HAND IN PUPILS

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Introduction: In tubular bones, the epiphyseal growth zone, also called the «meta epiphyseal gland» is a thin layer of hyaline tissue located between the epiphysis and metaphysis of long tubular bones. Longitudinal growth of tubular bones takes place due to the processes of endochondral ossification in the growth zone, which involve the gradual replacement of cartilage tissue with bone.

The aim of the research: to study the condition of the growth areas of the shoulder, wrist, and elbow bones of schoolchildren at different ages and the specifics of the ossification process.

Research method and material: Practically healthy children from 7 to 16 years of age were involved in the study, and the study was conducted using a retrospective radiological method. Ossification sites were measured and evaluated using G.G. Avtandilov's grid.

Research results and discussion: Analysis of the dynamics of changes in the epiphyseal parts of the humerus showed that the surface area of the ossified part undergoes uncertain changes with age. At the age of 7, the ossified area of the proximal epiphysis is much larger than the distal part. Under the age of 16, the area of ossification of the proximal epiphysis increases to 83,5%, while the same indicators of the distal epiphysis are 68,8%. The most intensive growth of the proximal epiphysis is observed until the age of 12. In the following years, the annual growth decreases, and the second increase in the growth of the ossified area in 16 years is detected. Annual intensive growth of the distal epiphysis was observed until the age of 10 years, while at other age periods the growth became dynamic. The statistical analysis of the data showed that by the age of 16, the width of the ossified part of the proximal epiphysis of the shoulder increases by 68,65%, and the length index is 67,27%. At the ages of 9 (11,5%) and 15 (9,66%), an intensive increase in the width of the ossified part of the proximal epiphysis of the humerus is noted,

while the increase in length corresponds to the ages of 12 (9,77%) and 15 (11,39%). The analysis of radiographs shows that at the age of 7, osteogenesis of the proximal epiphysis is in 4 stages, while at this age, the distal epiphysis undergoes only 2–3 stages of osteogenesis. By the age of 9–10, boys and girls were at the same stage of osteogenesis, while at other age periods, girls were 1 year ahead of boys. At the age of 16, the epiphyses of the tibia are at the 9th stage in girls, while the 8th stage of osteogenesis is still observed in boys at this age.

The meta epiphyseal zone of the humerus under the age of 10 years is fully opened, and at the age of 14, the synostosis covers half to two-thirds of the growth zone, with areas free of bone tissue remaining along its edges. By the age of 16, radiographs show a white line in the meta epiphyseal zone, which indicates the possibility of further growth. By the age of 9, the ossified part of the lateral condyle of the distal part and the head of the distal epiphyseal condyle of the humerus are fully manifested in the form of two hemispheres of unequal size. By the age of 10, almost the entire medial curvature of the distal part is already visible, except for the marginal parts. At the age of 12–14 years, the shape of the humeral head and the lateral humerus of the distal epiphysis of the humerus correspond to anatomical indicators. At this age, the medial curvature of the distal part is closer to the shape of the anatomical norm of age, but it is manifested by a clear heterogeneity of the bone structure. At the age of 15, the light falling on the vertical gap between the circles of the blocks disappears.

By the age of 15–16, the lateral and medial axes of the distal part merge and are described as a whole. At the age of 16, the ossified part of the distal epiphysis of the humerus increases by 185,1% in width and 239,0% in length. The greatest annual increase in the width of the ossified part of the distal epiphysis of the humerus corresponds to the ages of 8 (12,7%) and 12 (9,84%), and the increase in length is observed until the age of 10. In the following years, the annual growth decreases, and a second increase in the length of the ossified part is observed during the 15th year. At 7 years of age, the surface area of the ossified part of the distal epiphysis of the carpal bone is much higher than that of the proximal epiphysis. By the age of 16, the ossification area of the distal epiphysis had increased by 98,48% and that of the proximal epiphysis by 279,4%. The most intensive annual growth of the proximal epiphysis is observed until the age of 11, and that of the distal epiphysis is observed until the age of 9.

Until the age of 11, the meta epiphyseal zone is completely open. Before the age of 13, the process of synostosis is noted, and less than half of the growth zone is

closed. At the age of 16, the sclerotic zone does not disappear at the site of the meta epiphyseal line, which indicates the possibility of further bone growth. At the age of 9, the width of the distal epiphysis increases intensively, and the increase is 20,4%; at the age of 14, it is 11,68%. It is in these young periods that the indicators of the distal part, the length (9,09%, 14,5%), and area (18,34%, 11,15%) of the distal epiphysis grow the most. By the age of 16, the area of the ossified part of the proximal epiphysis increases 14,64 times, and the area of the bone part of the distal epiphysis increases 4,96 times. The fastest annual growth is observed at the age of 12–14. Up to the age of 12, the meta epiphyseal zone of the proximal epiphysis is completely open, and the distal zone is up to the age of 10. By the age of 13, synostosis is observed, and less than half of the growth zone is closed. At the age of 15, synostosis covers half to two-thirds of the growth zone, and along its edges, areas cleared of bone tissue remain. By the age of 16, a white line-shaped area can be observed in place of the meta epiphyseal line.

Conclusion: The study of osteogenesis and the degree of ossification of the growth area of tubular bones on the radiograph made it possible to determine the sequence and formation of ossification of individual bones of the hands. Based on this, it is possible to assess the level of growth and development of the child in the process of increasing mineralization and bone density.

References:

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