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A REVIEW OF PAEDIATRICS DEVELOPMENTAL ANATOMY OF SKULL, VERTEBRAL COLUMN, AND LIMBS

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ABSTRACT

Paediatric developmental Anatomy covers the structural changes that cells, tissue, organs, and human body undergo from fertilization to adulthood. Advancement in neonatal medicine has enabled the successful management of the preterm infant born at as early as 24 weeks gestation. An understanding of the anatomical differences between adults, infants and neonates is essential for managing new-borns. This Article is focused on the normal Paediatric Developmental Anatomy of Skull, Vertebral column and long bones of Upper and Lower limbs.

KEYWORDS: Preterm, Gestation, Neonates, Adolescence, Paediatric Anatomy, Head Circumference.

INTRODUCTION

Child development involves the biological, physical, psychological and emotional changes that occur in human beings between birth and the conclusion of adolescence. Childhood is divided into three stages of life which include early childhood, middle childhood (preadolescence) and late childhood. Early childhood typically ranges from infancy to the age of 6 years old. During this period, development is significant. Middle childhood or age's 6-12 mark a distinctive period between major developmental transition points; Adolescence is the stage of life that typically starts around the major onset of puberty at 12-13 years of age. Paediatric developmental anatomy deals with anatomical changes that occur in human body from fertilization to adulthood.

MATERIALS AND METHOD

Material has been collected from modern text books, Research Journals, and electronic databases.

DEVELOPMENTAL ANATOMY

1. Skull

Embryological, the skull derives from ectodermal neural crest and mesoderm. The frontal, ethamoid and sphenoid bones derive from the neural crest, while the parietal and occipital bones originates from the mesoderm. Temporal derives from both the mesoderm and neural crest. At birth, the human skull is made up of 44 separate bony elements. During developments, many of these bony elements gradually fuse together into solid bone. The bones of roof of the skull are initially separated by regions of dense connective tissue called fontanels. There are six fontanels: one anterior (or frontal), one posterior (or occipital), two sphenoid (or anterolateral), and two mastoid (or posterolateral). At birth, these regions are fibrous and movable, necessary for birth and later growth.[1]

Ossification has not reached at the site of fontanels at birth. During parturition the bones of neurocranium are displaced and may even overlap at the suture lines to allow passage of the head through the birth canal. Two sphenoid (or anterolateral) and posterior (or occipital) fontanels are closed by 6 months and Two mastoid (or posterolateral) and anterior (or frontal) fontanels are closed by 2 years of age.[2]

Head circumference represents growth of the brain. At birth, the brain is 25% of adult size, and head circumference averages 35 cm. Head circumference increases an average by 2 cm/month in 0-3 months of age and 1cm/month in 3-6 months of age. During the last six months of infancy, head circumference increases by 0.5 cm/month. During the first year of life, there is a 12 cm average increase in head circumference. After one year of age, only 1 cm gain occurs per 6 months in head circumference until three years of age and only 1 cm every year between 3 to 5 years of age (average 5 cm total gain in head circumference occurs during 1 to 5 years of age).[3] Generally if brain does not develop normally head size deformities develop. Small head- in mental retardation. Large head- result of hydrocephalus, rickets, chondrodystrophy or syphilis.

2. Vertebral Column

At birth the spinal column is very flexible and lacks the fixed curvatures present in adulthood. The primary curves (Thoracic and Sacral curvatures) form during foetal development, being concave anteriorly.

The Cervical curvature develops at around 3 months when the child is able to support the weight of its head.

The Lumbar curvature develops when child is learning to walk at about 1 year.[4]

3. Upper and Lower limbs

The notochord is formed from mesoderm and overlying ectoderm becomes the neural plate. During the fourth week, the upper and lower limb buds begin to form. Muscle, bone, blood vessels and lymphatic's are all formed from the mesoderm, while peripheral nerves are differentiated neural crest cells. The upper and lower limbs begin development in the 4th week of gestation. Usually the upper limb begins development first, with the lower limb often lagging 2-3 days behind. The limbs are well differentiated by 8th week.[5]

Early in the development of human foetus, the skeletal is made entirely of cartilage. The relatively soft cartilage gradually turns into hard bone through ossification. This is a process in which mineral deposits replace cartilage. Ossification of long bones, which are found in upper and lower limb begins at the centre of the bones and continues towards the end. By birth several areas of cartilage remain in the skeleton, including growth plates at the ends of the long bones. This cartilage grows as the long bone grows so the bones can keep increasing in length during childhood. Long bone ossifies and get longer as they grow and develop. These bones grow from their ends, known as epiphysis. The presence of growth plate or epiphyseal line signifies that bone is still growing. In early twenties person reaches skeletal maturity. By then, all of the cartilage has been replaced by bone, so no further growth in bone length is possible.

Upper limbs are well developed and long compared to the neonatal lower limbs. The neonate has a relatively strong grasp reflex and is able to support its own weigh within first days of life. Lower limbs are under-developed and remain in a flexed and abducted position in the neonate.[6]

DISCUSSION

The present study provides a base line for the quantitative assessment of normal anatomical growth of the skull, vertebral column, and limbs at different ages. The fontanel of the skull ossifies and closes at 2 years of age which are open at birth. In the vertebral column of child, the cervical curvature develops at around 3 months of age and lumbar curvature at about 1year. The upper and lower limbs development begins in the 4th week of gestation and grows till early twenties when reaches skeletal maturity.

CONCLUSION

Infant and Children are not miniature adults, their anatomy differs from the adult in a number of ways specific to their age. The anatomical differences that distinguish babies and children from adults have implications for the management of new born and children. Some of the differences that persist into infancy and early childhood also affect the response to trauma and have implications for trauma management.

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