

**A MORPHOLOGICAL AND HISTOLOGICAL
STUDY OF DEVELOPING HUMAN FETAL
CEREBELLUM**

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SUMMARY

The current study is an effort to build a timeline for the different morphological and histological changes occurring in developing human fetal cerebellum. It would be helpful to the forensic experts to roughly estimate the gestational age in multivital cases, especially in cases where gestational age estimation is required, as only a few remains of the brain tissue. Moreover, any deviation from the normal timeline of events would indicate the development of any pathology.

This research was carried out in the Department of Anatomy, HIMS over a period of 12 months. A total of 10 human fetuses procured from the Department of Obstetrics and Gynecology, HIMS. The skulls were dissected and the cerebellum isolated and fixed in formalin. The study was done mainly using low power headings: morphological and histological. Details of macroscopic appearance, demarcation of vermis and cerebellar hemisphere were noted. Following this paraffin was made, cerebellar sections were prepared and stained with H&E, modified Luxol fast blue and G-ruby. Presence of various layers, the thickness and cell density in the lower layers of cell count per high power field in each layer at different gestational ages were noted.

SUMMARY

The current study is an effort to build a timeline for the different morphological and histological changes occurring in developing human fetal cerebellum. It would be helpful to the forensic experts to roughly estimate the gestational age in medicolegal cases, especially in cases where gestational age estimation is required from only a few remains of the brain tissue. Moreover, any deviation from the normal timeline of events would indicate the development of some pathology.

This research was carried out in the Department of Anatomy, HIMS over a period of one year. It was conducted on 60 human fetuses procured from the Department of Obstetrics and Gynaecology, HIMS. The skulls were dissected and the cerebellums obtained were fixed in formalin. The study was done mainly under two broad headings: morphological and histological. Details of morphological appearance, dimensions of vermis and cerebellar hemispheres were noted. Following this paravermal and mid cerebellar sections were prepared and stained with H&E, modified Luxol fast blue and Cresyl fast violet. Presence of various layers, the thickness and cell density in the form of means of cell count per high power field of each layer at different weeks gestation were noted.

Posterolateral fissure was the first to appear by 13 weeks of gestation. Folia and other fissures were seen 18 weeks onwards. Vermal parameters and transcerebellar diameter showed an increasing trend in each group. This linear relation of all the morphological parameters had a very good correlation with increasing gestational age. Multiple regression equations were derived that would help in a rough estimation of gestational age.

Histologically in order to reach an adult three layered structure of cerebellar cortex, fetal cerebellum undergoes a number of changes. From 13-17 weeks a three layered cortex with initial proliferative zones with migrating cells was observed. Between 18-22 weeks again a three-layered pattern was seen out of which two layers, molecular and internal granular layers continue in postnatal life. Dramatic change occurred between 23-27 weeks in the form of appearance of five layers including a transient layer, the lamina dissecans. Appreciable purkinje cells were seen in their initial phases of development. Finally, four layers were seen from 28-32 weeks, with disappearance of lamina dissecans. The four layers (EGL, ML, PCL, IGL) showed an increase in their thickness with gestational age except the external granular layer, which had a varying course. Cell count decreased in purkinje cell and molecular layer, as they advanced towards a pattern resembling the adult cortex. Thickness and cell counts

of both molecular and purkinje cell layer correlated well with increasing gestational age.

Purkinje cells organized themselves in a single row by 28 weeks with few resembling the classical appearance. The size of these cells also increased, mainly its transverse diameter. Intracerebellar nuclei an important part of cerebellar efferent pathways appeared by 32 weeks. The development of central white matter within each folia was appreciated from 28-32 weeks.

REFERENCES