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Histogenesis of Suprarenal Gland in Fetuses of Different Gestational Ages

Medical Science

KEYWORDS : Supra renal gland, foetal cortex, definitive cortex, medulla.

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ABSTRACT

Histogenesis of Suprarenal Gland in Fetuses of Different Gestational Ages. A total of sixty foetal suprarenal glands (right and left) from 9 to 36 weeks were studied to note the histological changes using routine histological staining procedures The study also includes the migration patterns of neuroblastic nodules through cortex to medulla of suprarenal gland at different gestational ages. Three distinct zones could be identified foetal transitional and definative zone. The arrangement of cells in definitive cortex changed from the discrete cells and clustures to well formed gomerulus like structure. Neuroblastic cells migrates from capsule towards central blood vessels. They differentiate into the chromaffin cells and sympathetic neurons, decreasing the number of neuroblastic nodules from 20 week onwards.

Introduction

The Anatomy of suprarenal gland was described almost 450 years ago in 1563 by Bartholomeo Eustacius and zonation of gland and its distinction from medulla were elucidated shortly thereafter. Brown-sequard demonstrated that adrenal gland were "Organs Essential for Life.

The Suprarenal glands are paired organs situated extraperitoneally near the posterior abdominal wall at the level of the eleventh–twelfth thoracic vertebrae. Each gland consists of an outer cortex and an inner medulla. Medulla forms 1/10th of gland and surrounded by the cortex except at hilum1.

Suprarenal gland plays a vital role in survival and maintenance of the internal milieu. The slightest disturbance in their function may lead to an exponential alteration in function, which can cost the life of the patient. 'Steroid hormones produced by the fetal adrenal cortex regulate intrauterine homeostasis and maturation of fetal organ system necessary for extra uterine life. Appropriatiate development and function of foetal adrenal cortex therefore are critical for fetal maturation and perinatal survival.

Moreover, the fetal cortex must itself undergo maturation in preparation for its essential role postnatally i.e. production of glucocorticoids, for foetal intrauterine homeostasis and to ensure adrenal cortical autonomy once the placenta has been separated[2.]

Therefore this study not only advances our knowledge of development of the human foetal adrenal but should also paves the way for new improvements in treatment of such disorders as premature labor, abnormalities of fetal and newborn adrenal function and gives more comprehensive view of this organ.

Material & Methods

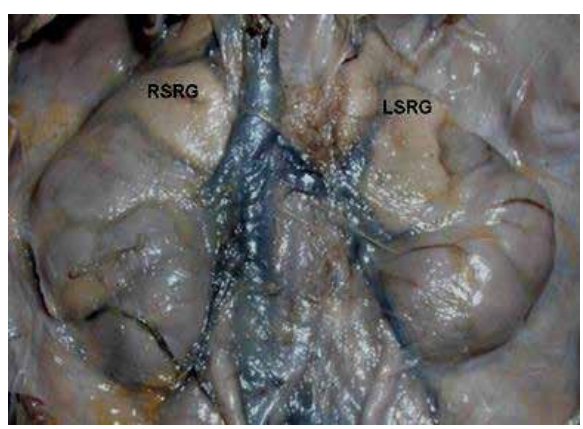
Collection of specimen

The material studied consisted of 100 suprarenals (Right & Left) from 50 foetuses of different gestational ages obtained from Sion Medical College, Mumbai and M.G.M. Medical College, Aurangabad after prior permission and ethical approval.

Classification into groups

Divided into 7 groups between ages from 9-12, 13-16, 17-20, 21-27 25-28, 29-32, 32-36 weeks of gestation according to Crown rump length.

Groups	Gestational Age (weeks)	Number of Fetuses
A	9-12	10
B	13-16	13
C	17-20	7
D	21-27	5
E	25-28	5
F	29-32	4
G	33-36	6



15 weeks Supra renal gland in situ

Dissection of foetuses

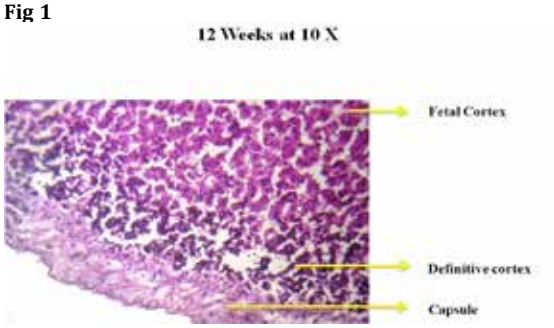
Foetuses were dissected abdominally taking a midline incision on anterior abdominal wall and the suprarenals were removed, weighed and fixed in Bouins medium for 24 hrs 70% alcohol 6-8 hrs, 90% alcohol overnight three changes of Absolute alcoholfor1h each The paraffin block of these tissues prepared and stained with haematoxylin and eosin for demonstration of normal histological features.

RESULTS

The microscopic findings at different gestational ages from 9-36 weeks a. 9-12 weeks : -

A thin capsule with blood vessels was seen. A superficial strip of dark zone occupying 1/6th of cortex and light zone occupy the rest of cortex.

Fig 1



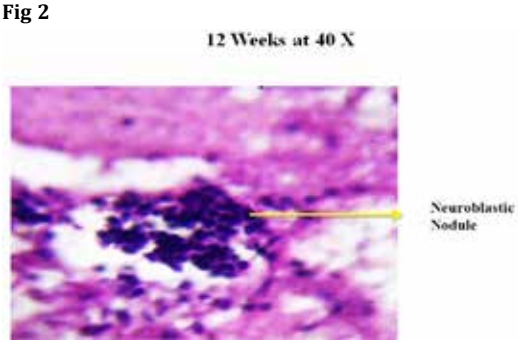
a. 12th Week

Capsule thin made of collagen fibres, capsule thicken at periphery than at hilum.

2 zones can be appreciated.

a. Superficial strip of dark zone (permanent cortex) referred as definitive or the adult cortex.
b. Deep zone of larger cells with eosinophilic cytoplasm and round nuclei. These cells form the fetal cortex of the gland. Neuroblastic Modules are seen in cortex

Fig 2

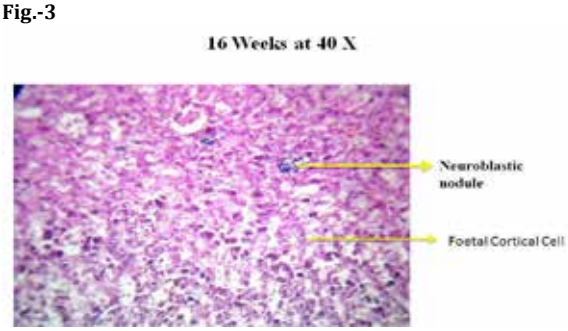


b. 13-16 weeks

Capsule well identified and thicker than the previous gestational age.

Deep to the dark zone i.e. permanent cortex there is a light zone (foetal cortex) fascicular reticular zone 6-7 layer thick. Cells polyhedral in shape, nucleus smaller. At the junction of permanent cortex and foetal cortex at some places coids of cells seen extending from permanent cortex into foetal cortex.This zone is referred as transition zone cells are polygonal with eosinophilic cytoplasm & oval nuclei. Single Neuroblastic nodules are seen throughout the gland.

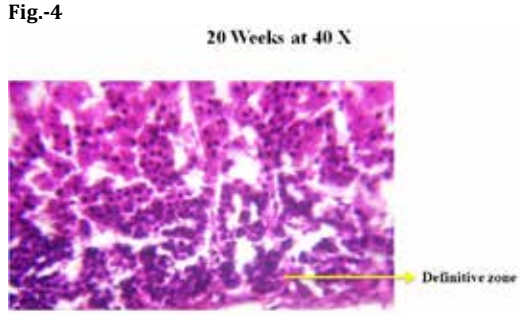
Fig.-3



c. 17-20 weeks

The capsule well identifiable and thick. The cells are widely placed towards the medulla whereas the cells were arranged in tightly packed columns towards the outer region of foetal zone. Vascularity of the gland is seen to be increasing.

Fig.-4



d. 21-24 Weeks

Capsule surrounds the entire gland. Blood vessel were seen in the capsule as previous gestational age groups.

Fig.-5

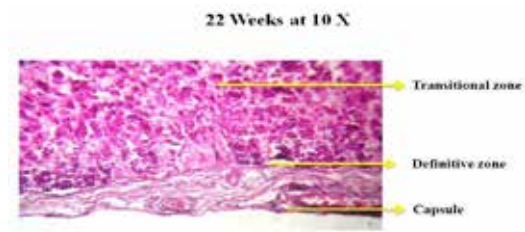
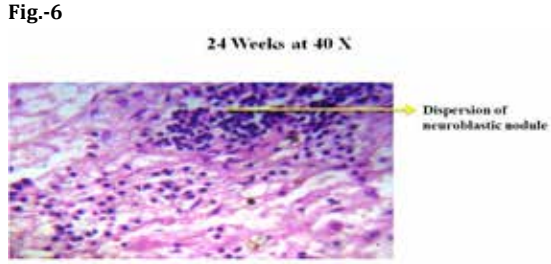


Fig.-6



e. 25-28 weeks

Capsule is seen clearly definitive cortex increases gradually from 25 weeks. Foetal zone starts showing degenerative changes (cell boundaries distorted and nuclei not stained).

Neuroblastic nodule decrease in number and chormaffin cells are seen more in numbers with few ganglionic cells.

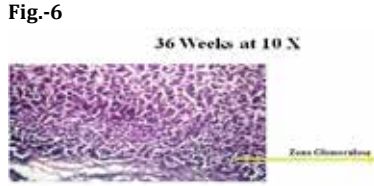
f. 29-32 week

Foetal cortex further reduces in thickness cells are few scattered neuroblastic nodules are seen:

g. 33-36 weeks

Cells in definitive cortex arrange in an arcuate shape which will form the future zona glomerulosa.The foetal cortex becomes thin replaced by the invading polygonal cells of definitive cortex. In 36 week gestation well differentiated glomerular cells are seen. In Medulla more number of chromaffin cells are seen

Fig.-6



Discussion

The histogenesis of suprarenal gland has been a subject of great interest by number of researches. 3, 4, 5, 6.The supra-

renal glands are derived from two sources and combined in a single capsule. The outer cortical layer from mesodermal cells and inner medullary portion from ectodermal cells that migrate from the neural crest.

In present study the capsule starts appearing in 12th week of gestation as a thin strip and as age advances it increases in thickness. However the cortex are not capsulated entirely until later in foetal life.

Foetal cortex of suprarenal gland.

The foetal suprarenal cortex is of mesodermal origin. In the present study under light microscope it was noted that a larger part of cortex is contributed by foetal cortex and this was similar to study done by Starkel et al and Mc.Intosh, who attributed that the large size of the suprarenal in fetal period was due to presence of a zone present only during fetal period. This zone occupied about 80% of the entire cortex. They called it as foetal zone.

The cells of foetal cortex were large polyhedral with eosinophilic cytoplasm and sound vesicular nuclei whereas cells of definitive cortex were small basophilic with darkely stained nuclei and these findings were similar with findings of Benirschke, Bluch and Herting; Mesiano and Jaffe, Turkel and Isabasli and Khayati Sant Ram.

In our study it was observed that the cells in outer part of cortex were arranged inform of longitudinal columns whereas the cells in inner part were arranged in the form of a network. Utiola (1940) described the foetal cortex as fasciculoreticular layer due to this type of arrangement.In the present study an intermediate zone between the definitive and foetal zone was seen from 12 week till 36th week of gestation.

Mesiano and Jaffe described the transitional zone as a zone of finger like columns of cells extending from definitive cortex to foetal cortex.

Foetal Medulla of suprarenal gland

The foetal suprarenal medulla is of neural crest origin. These neural crest derived cells invade the gland and migrate towards the centre of the gland. According to utiola (1940). The sympathetic cells invade the capsule and parenchyma of suprarenal as early as 7th week of gestation.In the present study these cells were small with round densely staining nuclei with basophilic cytoplasm and the cells were lying single or in groups and were migrating via different layers of gland.

According to Turkel and Itabashi (1974) called these cells as neuroblasts, and pheochromoblast by RE coupland 1952. A group of these neuroblastic cells was called as neuroblastic nodules by Turkul and Itablashi.

Conclusion

The size of suprarenal gland increases with gestational age. Three distinct zones could be identified foetal transitional and definative zone.The arrangement of cells in definitive cortex changed from the discrete cells and clustures to well formed gomerulus like structure. Neuroblastic cells migrates from capsule towards central blood vessels. They differentiate into the chromaffin cells and sympathetic neurons.There is a decrease in the number of neuroblastic nodules from 20 week onwards.Few cells had granules in cytoplasm, suggesting presence of epinephrine

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