

Histogenesis of Human Foetal Liver with Reference to Gestational Age: A study

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Abstract

Liver is the largest gland in the human body and foetal liver plays a vital role in the early period of development of human foetus. The objective of this study is to understand the age related histogenesis in the human foetal liver. This is achieved by dissecting the foetal liver and studying formalin fixed sections by normal histological staining.

Keywords: Kupffer cells; Hepatocytes; Sinusoids; Portal Triad.

Introduction

The liver is the largest of abdominal viscera. As the body grows from infancy to adult hood the liver rapidly increases in size. The liver weight is about 4-5% of body weight in infancy. It is an important site of haemopoiesis in foetus [1].

The liver gall bladder and biliary duct system arise as a ventral outgrowth from the caudal part of the fore gut in the fourth week of intrauterine life. The hepatic diverticulum (Liver bud) extends into the septum transversum as a mass of splanchnic mesoderm between the developing heart and midgut. The proliferating endodermal cells give rise to interlacing cords of hepatic cells and to the epithelial lining of the intrahepatic portion of the biliary apparatus. The hepatic cords anastomose around endothelium lined spaces the primordial of the hepatic sinusoids. The fibrous and haemopoietic tissue and kupffer cells of the liver are derived from mesenchyme in the septum transversum [2].

The endodermal cells of hepatic bud give rise to the parenchyma of the liver and capillaries. The mesoderm of the septum transversum forms the

capsule and fibrous tissue basis of the liver. The foetal liver is an important centre of blood formation (haemopoiesis). Large aggregations of blood forming cells are present between hepatic cells and blood vessels [3].

Aim of Study

- To study the Histogenesis of Human Fetal Liver in relation to gestational age of Foetus.

Material and Method

- The present work is conducted in the Department of Anatomy, S.V. Medical College, Tirupati with the fetuses provided by the Department of Obstetrics and Gynaecology, Government Maternity Hospital, Tirupati.

Collection of Specimens

- In the present study 51 human dead fetuses of 12 to 38 weeks gestational age of both sexes were studied. However, fetuses of more than 12 weeks of gestational age were only dissected for obtaining liver specimens (41). Abdominal cavity is opened (mid-line incision) and the ligamentum teres is separated from the anterior abdominal wall (umbilicus), the inferior vena cava, right and left triangular ligaments were separated and the liver is removed from the abdominal cavity. The livers thus removed were preserved by keeping in 10% formalin solution.

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Grouping of Specimens

- 0 to 12 weeks, 12 to 20 weeks, 20 to 24 weeks, 24 to 28 weeks, 28 to 30 weeks, 30 to 34 weeks and 34 to 36 weeks.
- However livers of foetuses above 20 weeks are only dissected.

Procedure for Histological Studies

- Liver slides are prepared and grouped according to the gestational ages. All the slides are

prepared by using Haemotoxyline and Eosin stains. Sections were observed under the microscope and are micro photographed.

Observations and Results

- The histological observations are categorized into 4 groups

Group I: - 20 – 24 weeks :- (Figure 1, 2 & 3)

Table 1: Gestational age (in weeks) of the foetuses

Gestational age (weeks)	No. of Subjects	Percentage
Less than 20	10	19.6
20 – 24	12	23.5
24 – 28	9	17.6
28 – 32	11	21.6
32 – 36	2	3.9
36 – 40	7	13.7
Total	51	100.0

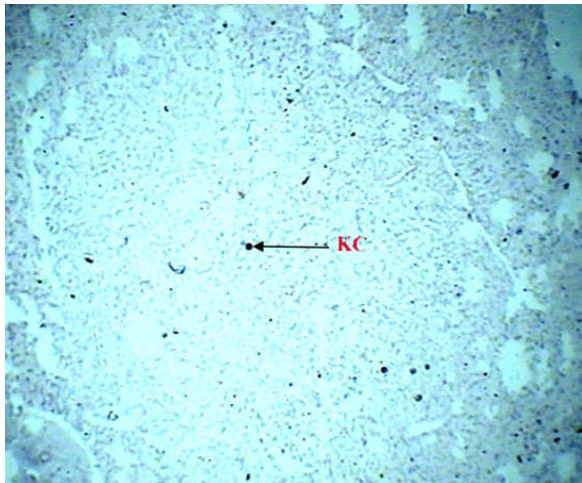


Fig. 1: 20 wks (4x) H & E stain, KC-Kupffer cell

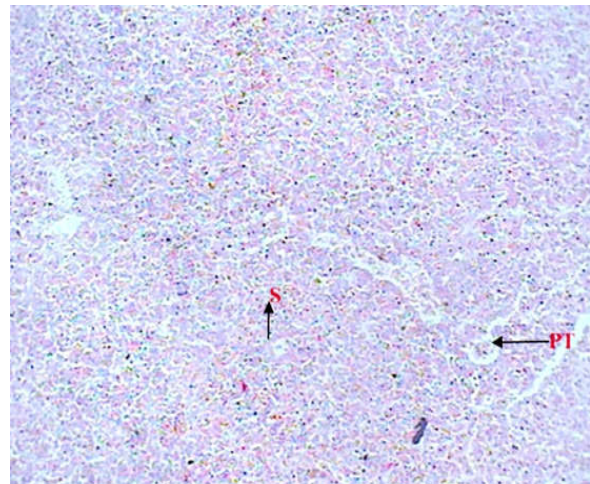


Fig. 2: 22 wks (10x) H & E stain, S-sinusoid, PT-Portal triad

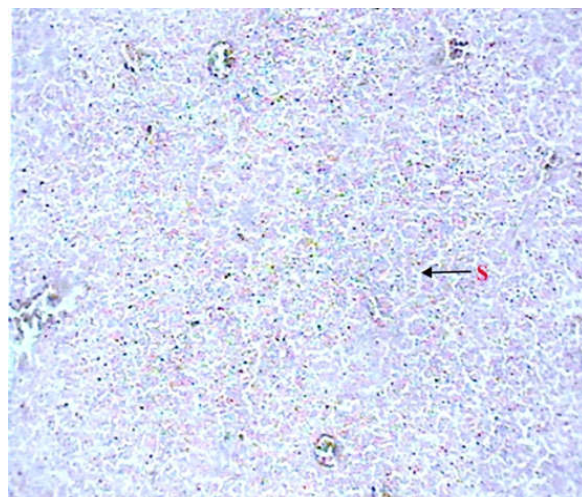


Fig. 3: 24 wks (10x) H & E Stain, S-sinusoids

- This category shows the presence of reticular fibers and kupffer cells (20 weeks), commencement of formation of sinusoids with areas of formation of portal triads (22 weeks), and portal triads at 24 weeks.

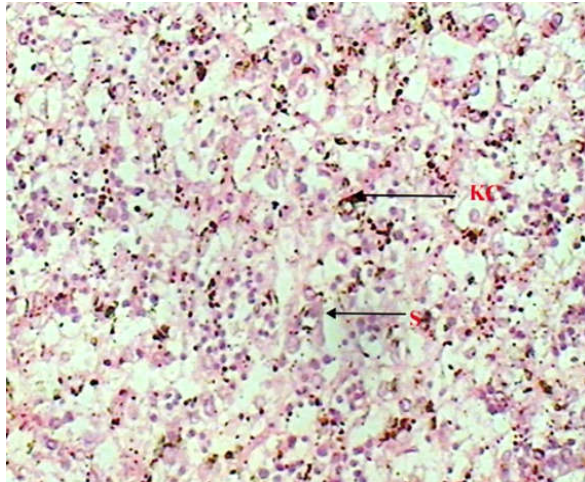


Fig. 4: 26 wks (40x) H & E Stain, S-Sinusoid, KC-Kupffer cells

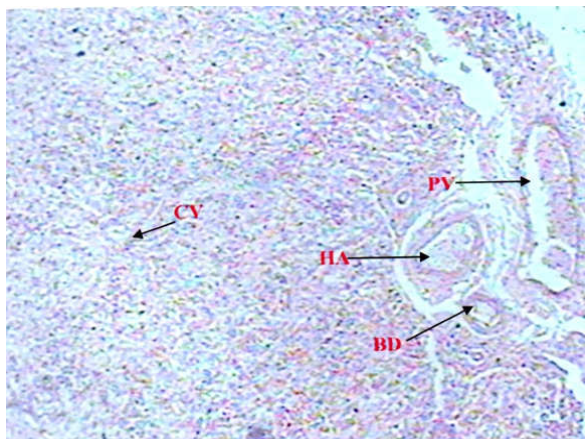


Fig. 5: 28 wks (4x) H & E stain PT-Portal triad, CV-Central vein

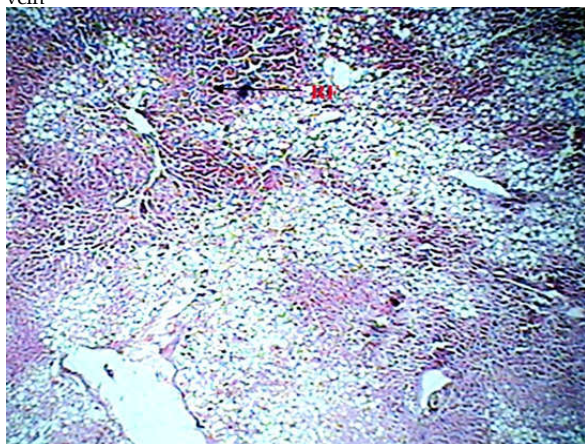


Fig. 6: 32 wks (4x) H & E stain RF-Reticular fibers

Group II: - 24 - 28 weeks :- (Figure 4 & 5)

- This category shows the presence of reticular cells, kupffer cells portal triads and sinusoids (26 weeks), increase pattern of lobulation with central vein (28 weeks).

Group III: - 28 - 34 weeks :- (Figure 6 & 7)

- The findings in this group are clear pattern of hepatic lobulation, portal triads, central vein, kupffer cells and sinusoids.

Group IV: - 34 - 38 weeks :- (Figure 8 & 9)

- The findings in this group are radiating cords of hepatocytes separated by sinusoids lined by kupffer cells with central vein and well organized portal triad.

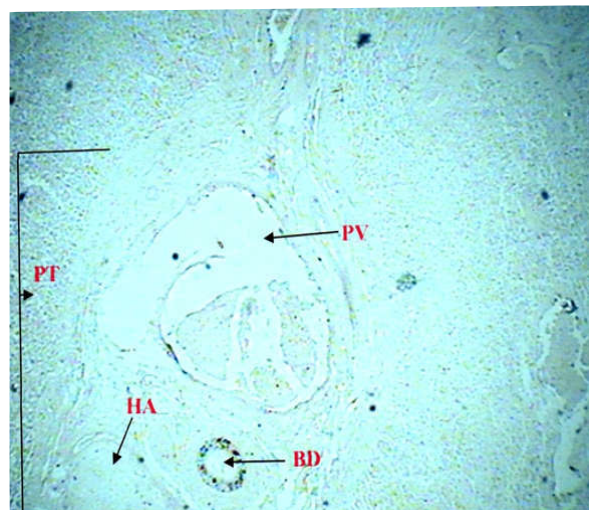


Fig. 6: 34 wks (4x) H & E stain PV- Portal Vein, BD-Bile duct, HA-Hepatic arteriole, PT-Portal triad

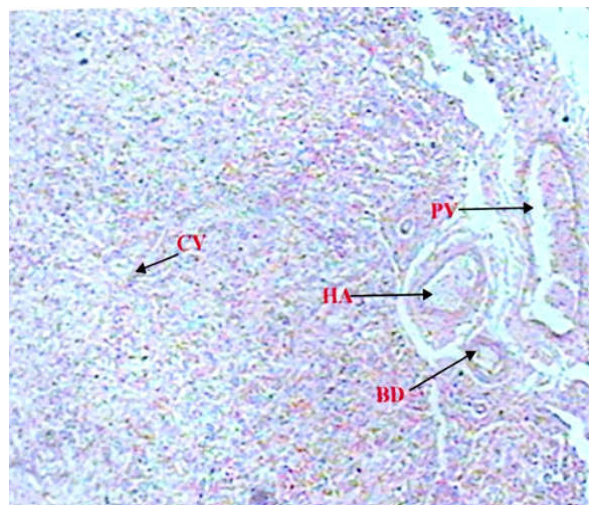


Fig. 8: 36 wks (10x) H & E stain Pv-Portal vein, BD-Bile duct, HA-Hepatic arteriole

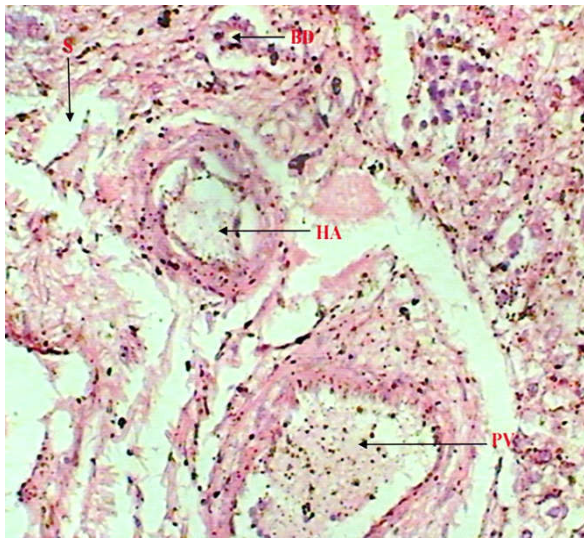


Fig. 9: 38 wks (40x) H & E stain PV-Portal vein, HA-Hepatic arteriole, BD-Bile duct, S-Sinusoid

Discussion

In the early weeks of gestation (20 - 24 weeks) there is abundance of Reticular fibres and Kupffer cells. As the gestational age progresses (24 - 32 weeks) there is appearance of portal triads and sinusoids with kupffer cells and reticular fibers. There are radiating cords of hepatocytes separated by sinusoids lined by kupffer cells with central vein and well organised portal triads (34 - 38 weeks).

In the study conducted by Sanjukta Sahoo, Arpan Haldar, Sanjay Kumar Giri specimen with 20 weeks of gestational age shows early stage of reticular fibres along with Kupffer cells. At 28 weeks of gestational age specimen shows increased reticular fibres with Kupffer cells. Portal triad, binucleated hepatocytes, Kupffer cells, portal canal, central vein and sinusoids were observed at 36 weeks of gestational age. The haematopoietic function decreased abruptly in 35-week-old foetus. Radiating cords of hepatocytes, Kupffer cells along with central vein were observed in a specimen at >36 weeks of gestational age [4].

According to Mohammed Mujahid Ansari, Anjalee G. Ovhal, Shyam Sunder Rao, central vein appears at around 16th to 17th weeks of gestation. Thereafter it shows increase in size. Portal tracts consist of the branches of portal vein, hepatic artery and bile ductule appear later during development at about 18th week of gestation. Kupffer cells around 22nd week of gestation. Kupffer cells appear in foetal liver and are seen to increase up to 34th week of gestation [5].

Hashmi IC, Wankhede HA observed that by 16th to 17th week central veins appears. Sinusoidal walls lined by endothelial cells are also identified at this stage. Portal tract can be identified at 18th week liver, but the clear-cut architectural pattern becomes evident only at 20th to 21st week of gestation. All the structures of classical liver can be identified clearly at 22nd week. The size of lobule increases thereafter [6].

In the study conducted by K. Sathesh Naik, S. Lokanadham, V. Subhadra Devi findings similar to this study were noted [7].

However, Bradley & Neil [8,9] stated that development of Kupffer cells and connective tissue cells begin at about 3rd month of gestational age. Gestational age of 24 weeks specimen shows portal triad with central vein and sinusoids surrounded by periportal connective tissue were observed. Blouin & Suyan [10,11] stated that periportal connective tissue surrounding the bile duct system observed during 8-12 weeks of gestational age. There was delay in the formation of bile duct system.

Conclusions

The findings are correlating with Indian studies, however there is a delay in the formation of sinusoids and kupffer cells in relation to western studies.

A larger sample involving a larger area is recommended.

Conflicts of Interests: Nil.

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