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Morphology and Morphometric Analysis of Human Foetal Liver Related with Gestational age of the Foetus in South India Population.

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ABSTRACT

Liver is a vital organ concerned with metabolism and also with formation of red blood cells in early part of intra uterine life. It has a wide range of function. It sub services both exocrine and endocrine functions. Aim of this article to study the morphology and morphometeric analysis of Human Foetal Liver related with gestational age of the foetus . The work was conducted in the Department of Anatomy, S.V.Medical College, Tirupati with the co-ordination of the Department of Obstetrics and Gynaecology, Government Maternity Hospital, Tirupati.About 50 fetal liver were studied.This study is useful to detect congenital anomalies and appreciate anatomical variations in liver.Clinical significance is dicussed in detail.

Keywords: morphology, morphometric, foetus, gestation

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INTRODUCTION

Liver is derived from German word leber a verb meaning to live. Medical practitioners in antiquity identified the liver as one of the three principal organs of the body, along with the heart and the brain.[1]Galen, ca. 200 A.D.-Roman Anatomist suggested "The liver as the source of the veins and the principal instrument of sanguification," [1].

Leonardo's depiction of the liver, for instance, is a good example of the changes that observation gradually made in the accounts of the body [2]. Islamic medical philosopher Avicenna observed, "Physicians regard the liver as the seat of manufacture of the dense part of the humors." He further specified the livers uniquely heavy and most condition as a function of the fact that the organ itself was nothing more than a dense concentration of blood rather than being made of actual tissue [1].

The number of lobes of the liver was debatable in early days. Generally the ancient and medieval anatomists found five (the number in a dog). Renaissance anatomists were less sure about this number, because increased dissection of human cadavers have suggested alternatives. At the end of 15th century Jacopo Berengario da Carpi, stated that liver has five lobes, sometimes four and three, sometimes two [3].

The Liver grows rapidly from 5th to 10th weeks. It reaches its largest relative size, 10% of foetal weight around 9th week. In the healthy neonate 5% of body weight is liver [3]. The adult liver weight is about 1/36th of the body weight and the foetal liver is 1/18th of the body weight [4]. In a 4mm embryo the whole liver is a single, at 7.5m237m complete lobule, at 11mm it is bilobed [5]. The size of the foetal liver and weight depends on number of sinusoids and haemopoietic function, beginning in the sixth week and maximum at fifth month.

Liver develops during fourth week as a endodermal diverticulum from the terminal part of the foregut at the ventral border [6]. The liver of a 5mm embryo is a large cresentic mass with a wing extending upwards on either side of the gut [7]. In embryo with 17 somites (2.5mm), its shallow primordium lies between the pericardium cavity and the attaching yolk sac [8]. During the early stages of the formation of the duodenum, small hepatic bud arises from a thickened area of endoderm which has previously appeared, at fourteen somite stage, in the region of the junction of the foregut and yolksac Liver develops from endodermal evagination of the foregut and septum transeversum. The development of liver is intimately related to the development of heart [9].

The liver is a gland and plays a major role in metabolism with numerous functions in the human body, including regulation of glycogen storage, decomposition of red blood cells, plasma protein synthesis, hormone production, and detoxification. It is an accessory digestive gland and produces bile, an alkaline compound which aids in digestion via the emulsification of lipids [10].

The liver is a reddish brown triangular organ with four lobes of unequal size and shape. A human liver normally weighs 1.44–1.66 kg (3.2–3.7 lb). It is both the largest internal organ and the largest gland in the human body. Located in the right upper quadrant of the abdominal cavity, it rests just below the diaphragm, to the right of the stomach and overlying the gallbladder. It is connected to two large blood vessels, the hepatic artery and the portal vein.

Gross anatomy traditionally divided the liver into two – a right and a left lobe, as viewed from the front (diaphragmatic) surface; but the underside (the visceral surface) shows it to be divided into four lobes and includes the caudate and quadrate lobes.

Organogenesis, the development of the organs takes place from the third to the eighth week in human embryogenesis. The origins of the liver lie in both the ventral portion of the foregut endoderm (endoderm being one of the 3 embryonic germ layers) and the constituents of the adjacent septum transversum mesenchyme. In the human embryo, the hepatic diverticulum is the tube of endoderm that extends out from the foregut into the surrounding mesenchyme [4]. The mesenchyme of septum transversum induces this endoderm to proliferate, to branch, and to form the glandular epithelium of the liver. Besides signals from the septum transversum mesenchyme, fibroblast growth factor from the developing heart also contributes to hepatic competence, along with retinoic acid emanating from

the lateral plate mesoderm. The hepatic endodermal cells undergo a morphological transition from columnar to pseudostratified resulting in thickening into the early liver bud.

After migration of hepatoblasts into the septum transversum mesenchyme, the hepatic architecture begins to be established, with liver sinusoids and bile canaliculi appearing. The liver bud separates into the lobes. . The biliary epithelial cells differentiate from hepatoblasts around portal veins, first producing a monolayer, and then a bilayer of cuboidal cells [15]. In ductal plate, focal dilations emerge at points in the bilayer, become surrounded by portal mesenchyme, and undergo tubule genesis into intra hepatic bile ducts [6].

MATERIALS AND METHODS

The present work was conducted in the Department of Anatomy, S.V.Medical College, Tirupati with the co-ordination of the Department of Obstetrics and Gynaecology, Government Maternity Hospital, Tirupati In the present study 50 livers of human dead foetuses of 12 to 38 weeks gestation of both sexes were dissected for observing morphology, morphometry more than 12 weeks gestational age were dissected for obtaining liver specimens. Abdominal cavity was opened by a mid-line incision. Apart from position or situation, colour, shape and size of the liver were noted. The ligamentum teres was separated from the anterior abdominal wall, the inferior vena cava, right and left triangular ligaments were separated and finally the liver was removed from the abdominal cavity. Specimen were preserved in 10% formalin in plastic containers.The specimen collected were weighed in grams by simple balance. With the help of measuring scale the lengths and widths were observed for right lobe, left lobe, caudate, quadrate and porta hepatis. The data collected were tabulated and studied.The specimen were grouped as under, 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.

RESULTS AND DISCUSSION

Total number of 50 liver specimens collected from foetuses of different age groups having both sexes out of which 20 male and 30 female foetuses.

Morphological observations

Situation of Liver

Right upper part of the abdomen and left hypochondrium .These findings on situation are in agreement with the findings reported by several authors in the articles.

Shape of liver

In the majority of the cases, the liver is square shape (62.7%) followed by wedge shape (35.3%). Further, Caudate lobe was normal in almost all fetuses (98.0%) while small in 1 fetus (2.0%). It was also found that the gall bladder was within the gall bladder fossa in all the cases (100.0%) shown in table 1

Table 1: Shape of the Liver in the Fetuses

Shape of the liver	No. of subjects	Percentage
Square	32	62.7
Wedge	17	35.3
Rt lobe flat, Lt lobe small	1	2.0
Total	**50**	**100.0**

Colour of Liver: Dark Brown in all the specimens.

Morphometric analysis

The fetuses studied are in the gestational age group of 20 -38 weeks . They are divided into 4 groups.

Group I: -20 – 24 weeks of gestational age
Group II: - 24-28 weeks of gestational age
Group III: - 28-34 weeks of gestational age
Group IV: - 34-38 weeks of gestational age

Thus majority of the fetuses had gestational age of 20 – 24 weeks (23.5%) and 28 – 32 weeks (21.6%) Majority of the fetuses were female (60.8%) compared to male (39.2%). Liver occupied right upper part of the abdomen and left hypochondrium. These findings on situation were in agreement with the findings reported by several authors in the past. In the majority of the cases, the liver is square shaped (62.7%) followed by wedge shaped (35.3%). Further, Caudate lobe was normal in almost all fetuses (98.0%) while small in 1 fetus (2.0%). It was also found that the gall bladder was within the gall bladder fossa in all the cases (100.0%) The colour of liver was dark brown in all the specimen [11,12].

The length and width of lobes are taken in centimeters. The length of the liver lobes is rapidly increasing with the gestational age from 22-28 wks, their afterwards there is slow increase of the same shown in table 2 and 3.

Table 2: Mean length of Left lobe of liver of by Gestational age wise

Gestational age (weeks)	Mean length of Left Lobe of Liver (Mean ± SD)
Less than 20	4.83 ± 1.72
20 – 24	4.02 ± 1.11
24 – 28	4.48 ± 1.11
28 – 32	4.70 ± 1.46
32 – 36	4.70 ± 0.98
36 – 40	5.78 ± 1.31

F = 1.55; P=0.19; NS

Thus the mean length of the Left lobe of the Liver increased steadily with the increase in the gestational age and the differences were however not statistically significant (P=0.19;NS).

Table 3: Mean length of Right Lobe of Liver of the fetuses by Gestational age

Gestational age (weeks)	Mean length of Right Lobe of Liver (Mean ± SD)
Less than 20	5.17 ± 1.90
20 – 24	4.12 ± 1.18
24 – 28	4.83 ± 1.66
28 – 32	4.70 ± 1.07
32 – 36	5.75 ± 1.76
36 – 40	6.14 ± 1.90

F = 1.99; P=0.09; NS

Thus the mean length of the Right lobe of the Liver increased steadily with the increase in the gestational age and the differences were however not statistically significant (P=0.09;NS).

Table 4: Mean width of Left Lobe of Liver of the fetuses by Gestational age

Gestational age (weeks)	Mean width of Left Lobe of Liver (Mean ± SD)
Less than 20	3.15 ± 1.02
20 – 24	3.05 ± 0.81
24 – 28	3.23 ± 0.48
28 – 32	4.09 ± 1.22
32 – 36	4.50 ± 0.70
36 – 40	5.00 ± 1.68

F = 4.33; P=0.0026; S

Thus the mean width of the Left lobe of the Liver increased steadily with the increase in the gestational age and the differences were also statistically significant (P=0.0026; S).

Table 5: Mean width of Right Lobe of Liver of the fetuses by Gestational age

Gestational age (weeks)	Mean width of Right Lobe of Liver (Mean ± SD)
Less than 20	5.30 ± 1.58
20 – 24	4.19 ± 0.59
24 – 28	4.55 ± 1.37
28 – 32	5.54 ± 1.63
32 – 36	6.25 ± 1.06
36 – 40	6.90 ± 0.89

F = 4.80; P=0.0013; S

Thus the mean width of the Right lobe of the Liver increased steadily with the increase in the gestational age and the differences were also statistically significant (P=0.0013; S).

CONCLUSIONS

Thus the analysis of morphology of liver in 50specimen was consistent with earlier studies. Morphologically the ratio of liver size to fetal weight gradually reduced. Congenital anomalies of liver like, Riedels lobe,[14] Accessory lobes, Fibrous appendix of liver, Lobar atrophy and Agenesis of the right lobe[13] are more important for surgeons,physicians and endocrinologists. This study will help future studies as a reference point.

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