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Morphological and Morphometric Study of Human Foetal Spleen at Different Gestational Age

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ABSTRACT

Introduction: The spleen, the largest of the lymphoid organs appears at about 6th weeks of gestation as localized thickening of the coelomic epithelium of the dorsal mesogastrium near its cranial end.

Aims and Objective: To study variations on morphology and morphometry of human foetal spleen at different gestational ages.

Materials and Methods: After permission from the Institutional Ethical Committee the foetal spleens were collected from MGM Medical College, Hospital, Navi Mumbai, India. The measurements length, width, thickness, and weight of fetal spleen and ratio between fetal weight and spleen weight were measured.

Result: All the spleen was observed in its normal location in the left hypochondric region of abdomen. Surfaces of all the collected spleens were smooth in appearance. Diaphragmatic surface presented impressions of 9th to 11th ribs. All the spleens were dark purple in colour.

Conclusions: The knowledge of measurement of human fetal spleen is helpful in medicine and surgical practice because of its clinical importance.

KEYWORDS :fetuses; gestational ages; lymphoid organs; spleen.

INTRODUCTION

The spleen, the largest of the lymphoid organs appears at about 6th weeks of gestation as localized thickening of the coelomic epithelium of the dorsal mesogastrium near its cranial end. The proliferating cells invade the underlying angiogenetic mesenchyme which becomes condensed & vascularised. The process occurs simultaneously in several adjoining areas which soon fuse to form a lobulated spleen of dual origin[1]. In surgical and medical history spleen has been described as mysterious organ. Clear understanding and appreciation of its function emerged only in the latter half of 20th century[2].

Spleen is flaccid bag that serves as a storage site of blood and processing station for scavenging of aged erythrocytes. Spleen is one of the dispensable organs, because mammal gets along quite nicely without a spleen[3]. The spleen has the third highest specific blood perfusion rate in human body typically 48mm^3/sec-gm (450m^3/min) [4].

Spleen is situated in the upper and left part of abdomen between the Fundus of stomach and the diaphragm. It lies mainly in the left hypochondria and partly in epigastric regions[5]. Spleen has diaphragmatic and visceral surfaces, superior and anterior borders and inferior and posterior extremities[6].Diaphragmatic surface is smooth and convex, directed upwards, backwards and to the left. Visceral surface presents gastric, renal colic and pancreatic impressions. Superior border separating the gastric impression from the diaphragmatic surface is thin, convex and presents one or two notches close to the lateral end. Inferior border separates the renal impression from diaphragmatic surface and extends obliquely coinciding with the lower border of the left 11 rib[7].

Size of spleen varies with age, with the individual and in the same individual under different conditions. In the adult it is usually about 12cm long, 7 to 8 cm broad and 3 to 4 cm wide[8]. According to Hareldellis the odd numbers 1,3,5,7,9,11 summarize some splenic statistic. Spleen measures 1x3x5 inches, weight 7 oz and lies deep to the left 9th to 11th ribs, same study mentioned that spleen is about size of cupped hand[9].

There is limited research about the sizes of foetal spleen and infant spleen[10]. Henry Gray in his book on the structure and uses of spleen reported a table of experiments to determine the weight of spleen before birth. He concluded that the spleen attains its greatest size during adult life. He stated that size of the spleen increases very rapidly in the embryo from about 6th month and at birth its weight in proportion to entire body is almost equal to that in the adult. In old age the organ proportion to the entire body weighed is 1 to 700[11]. Normal weight of spleen in adults is about 150g or 70 oz and normal range is 80 to 300 gm[12]. According to Bannister at birth spleen weighs 13gm and it doubles in the first postnatal year and triples by the end of the third year[13]. Hence, the aim of the present study is to find out the morphometric data and morphological features of human foetal spleen at different gestational ages.

MATERIALS AND METHODS

A total of 15 aborted human foetuses without any gross abnormality ranging from 16th to 30th gestational weeks (GWs) were collected from the MGM Medical College & Hospital Kalomboli, Navi Mumbai after seeking due permission from the concerned authority. After permission from the Institutional Ethical Committee, MGMIHS the foetuses were collected in 10% formalin for carrying the present study. The age of foetuses was calculated from the obstetrical history, gross features and crown-rump lengths (CRL). The specimens was categorized into three age groups for easier study as

Group I – 16th to 20th GW
Group II – 21st to 25th GW
Group III – 26th to 30th GW
Each group consist of 5 spleens.

OBSERVATIONS AND RESULTS

The average length, width and thickness of foetal spleen of gestational age between 16 to 20 weeks were 1.4cm, 0.8 and 0.6cm respectively, gestational age between 21 to 25 weeks were 1.7cm, 1.08 and 0.8cm respectively and gestational age between 26 to 30 weeks were 2.4cm, 1.6 and 1.0cm respectively (Table 1). The average foetal weight and spleen weight of gestational age between 16 to 20 weeks were 400gm and 1.80gm respectively and ratio between two was 0.45%, gestational age between 21 to 25 weeks were 800gm and 2.60gm respectively and ratio between two was 0.32% and gestational age between 26 to 30 weeks were 1200gm and 3.80gm respectively and ratio between two was 0.31% (Table 2).

DISCUSSION

In the foetuses of more than 15 weeks of gestational age the spleen was observed in its normal location in the left hypochondric region

of abdomen. These findings on location are in agreement with the findings reported by several authors in the literature[2, 14]. Surfaces of all the collected spleens were smooth in appearance. Diaphragmatic surface presented impressions of 9th, 10th and 11th ribs in almost all the spleens. All the spleens were dark purple in colour. These findings on colour are in agreement with the Robert and Adman et al [4, 15].

The data on various morphometric characters viz. length, width, thickness and weight of spleens were measured in present study (Table1). Length of spleen in our study varied from 1.4 cm at 16-20 weeks to 2.4cm at 26-30 weeks of gestation. Breadth of spleen ranged from 0.8cm at 16-20 weeks to 1.6cm at 26-30weeks. Thickness of spleen ranged from 0.6cm at 16-20 weeks to 1cm at 26-30 weeks. Average length, width and thickness of spleen at different gestational ages were gradually increased. There is limited literature available on sizes of foetal spleen and infant spleen. According to Jepta and JIskoot studies the length of spleen at 6th week of gestation is 10mm [10].

The weight of spleen varied from 1.80 grams at 16-20 weeks to 3.80 grams at 26-30 weeks gestational age. There is gradual increase in weight in the weight of spleen in the three gestational age groups of more than 15 weeks studied. Henry Gray compared the weight of spleen with that of body weight of foetus and found it to be 1 to 4000 at 5th month, 1 to 700 at 7th and 1 to 350 at 9th foetal month. In the present study during the 16-20 gestational ages the ratio between weight of foetuses and spleen was 0.45 % it was 0.32 % at 21-25 weeks and 0.31 % at 26-30 weeks of gestation. The present study shows there is gradual decrease in the ratio between weight of foetuses and spleen and it is in agreement with that reported by Henry Gray at full term but not before that. Henry Gray stated that size of the spleen increases very rapidly in the embryo from about 6th month[11]. There is gradual increase in the organ weight at different groups with the increase in foetal weight, but the ratio between foetal and splenic weight is more are less equal in the three categories studied (Table 2). This is in agreement with that reported by Potter et al. [16].

CONCLUSION

The knowledge of the measurements of human foetal spleen is very helpful to pediatric medicine and surgery practice because of it multifunction in children as erythropoietic and lymphatic organ.

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Tables

Table: 1- Average length, width and thickness of spleen specimens.

Gestational Age (weeks)	Average length (Cm)	Average width (Cm)	Average thickness (Cm)
16-20	1.4	0.8	0.6
21-25	1.7	1.1	0.8
26-30	2.4	1.6	1

Table: 2- Ratio between foetal weight and spleen weight in different groups.

Gestational Age (weeks)	Average foetal weight (Gms)	Average spleen weight (Gms)	Ratio between weight of foetuses and Spleen (%)
16-20	400	1.80	0.45
21-25	800	2.60	0.32
26-30	1200	3.80	0.31

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