

Morphological Assessment of Human Foetal Spleen

Dr. Ramanujam Singh* and Dr. Guria Kumari

M. B.B.S, MS(Anatomy) India.

Research Article

Article Info:

Received on: 15/12/2015
Accepted on: 10/01/2016
Published on: 23/01/2016



QR Code for mobile

Literati



ABSTRACT :

The spleen is an organ found in virtually all vertebrates. Similar in structure to a large lymph node, it acts primarily as a blood filter. The spleen plays important roles in regard to red blood cells (also referred to as erythrocytes) and the immune system. The study was done to study the morphology and other characteristics of the human foetal spleen at different gestational ages.

The Foetal spleens from the aborted foetus were collected for the study. The data on various characters like length, width, thickness and weight of spleens were measured in present study.

The data generated is helpful in the different medical as well as surgical conditions. As it is a haemolymph organ and belongs to the reticulo endothelial system.

Keywords: foetal spleen, morphological study

INTRODUCTION:

The spleen is an organ found in virtually all vertebrates. Similar in structure to a large lymph node, it acts primarily as a blood filter [1].

The spleen plays important roles in regard to red blood cells (also referred to as erythrocytes) and the immune system [2]. It removes old red blood cells and holds a reserve of blood, which can be valuable in case of hemorrhagic shock, and also recycles iron. As a part of the mononuclear phagocyte system, it metabolizes hemoglobin removed from senescent erythrocytes. The globin portion of hemoglobin is degraded to its constitutive amino acids, and the heme portion is metabolized to bilirubin, which is removed in the liver [3].

The spleen synthesizes antibodies in its white pulp and removes antibody-coated bacteria and antibody-coated blood cells by way of blood and lymph node circulation. A study published in 2009 using mice found that the spleen contains, in its reserve, half of the body's monocytes within the red pulp [4]. These monocytes, upon moving to injured tissue (such as the heart), turn into dendritic cells and macrophages while promoting tissue healing [4][5]

[6]. The spleen is a center of activity of the mononuclear phagocyte system and can be considered analogous to a large lymph node, as its absence causes a predisposition to certain infections [7].

In humans, the spleen is brownish in color and is located in the left upper quadrant of the abdomen.

In the fetus, the spleen acts as a hemopoietic center until late in gestation, and produces lymphocytes and monocytes throughout life. The spleen arises as an aggregation of reticular mesenchymal cells in the dorsal mesentery of the stomach during the sixth to seventh weeks, menstrual age. It acquires its characteristic crescent shape early in the fetal period. The spleen can be identified ultrasonographically after 20 weeks menstrual age [8,9].

According to Harald Ellis the spleen has cupped hand shape [10]. According to Sir Alfred Cuschier spleen varies in shape and three morphological types are desired [11]. According to studies of Prassopolous and Ranganathan spleen shapes are crecentic, rhomboid and triangular [12, 13]. Size of spleen varies with age, with the individual and in the same individual under different conditions. In the

doi: 10.15272/ajbps.v6i52.776

*Corresponding author:

Ramanujam Singh

M. B.B.S, MS(Anatomy) India.

Conflict of interest: Authors reported none

submit your manuscript | www.jbiopharm.com



adult it is usually about 12cm long, 7 to 8 cm broad and 3 to 4 cm wide [14]. According to Malawatkar [15] the sizes are 1.4x3.5x7 cm. 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 [10]. According to Sir Alfred Cushier the normal dimensions of the spleen are 13x9x3 cm [11]. There is limited research about the sizes of foetal spleen and infant spleen at 6th week the length of spleen is 10mm [16,17].

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. Henry gray 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. According to same study at birth it is 1 to 350, while in adult life it varies from 1 to 340 or 500. In old age the organ proportion to the entire body weighed is 1 to 700[18]. Normal weight of spleen in adults is about 150g or 70 oz and normal range is 80 to 300 gm [19]. Potter compared splenic weight to that of the body weight, according to his study weight of spleen at birth is 11gm [20]. 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 [21]. Spleen length was highly correlated with age, height, weight and BSA, but there is no statistical significant differences between the sexes [22]. According to Audrey et al the length of spleen ranges between 14 -16.3cm in normal adults. There is limited research about breadth and width [23]. Normally the breadth is 3 inches and width is 5 inches [24]. According to Ayers study spleen is supplied by the sympathetic from coeliac plexus. The fibres pass along with splenic artery and it branches, to enter the hilum and run with the segmental arteries and their branches. These fibres appear to be mainly noradrenergic vasomotor, concerned with the regulation of blood flow through the spleen. The spleen performs the functions of both immune and hematopoietic systems[25]. The present study undertaken for morphometric data and morphological features of human foetal spleen.

Study Methodology:

The study was done on the aborted foetus. The both sexes were selected in the study. The 150 spleens from the aborted foetus were collected from the North India region.

RESULTS & DISCUSSION:

The data on various morphometric characters viz. length, width, thickness and weight of spleens were measured in present study.

In the 12-24 weeks of the foetus length of spleen is observed is 1.4 ± 0.2 cm, width is observed is 1.1 ± 0.1 ; whereas thickness is seen as 0.8 ± 0.1 cm.

In the 25-36 weeks of foetus the length is observed as $2.4 \pm$

0.3 cm, width is observed as 1.5 ± 0.1 cm and thickness is seen as 1 ± 0.1 .

In the foetus of more than 36 weeks, length is seen as 2.5 ± 0.3 cm, width is observed as 1.7 ± 0.1 cm and thickness is seen as 1 ± 0.1 .

Table 1 : Values of the Length, Width & Thickness of the Gestational Foetus

Foetus	12 -24 weeks	25 - 36 weeks	More than 36 weeks
Gestational Age	12 -24 weeks	25 - 36 weeks	More than 36 weeks
Length (cm)	1.4 ± 0.2	2.4 ± 0.3	2.5 ± 0.3
Width (cm)	1.1 ± 0.1	1.5 ± 0.1	1.7 ± 0.1
Thickness (cm)	0.8 ± 0.1	1 ± 0.1	1 ± 0.1

The location of the spleen at different age is confirmed with the literature searched. In the embryos of 6-8weeks and 8-10 weeks gestational age spleen was identified at the lumbar level of serial sections of abdominal region. In the rest of the foetuses of more than 12 weeks gestational age the spleen was observed in its normal location in the left hypochondric region of abdomen. All the spleen showed the smooth surfaces. All the spleens were dark purple in color.

Table 2 : Foetal weight & Foetal Spleen

Gestational Age	12-24 weeks	25-36 weeks	More than 36 weeks
Foetal weight (gms)	700-800 gm	1200-1300 gm	2000-2200 gm
Spleen weight (gms)	2.6-2.8 gm	4.4-4.6 gm	7.0-7.2 gm

In the 12-24 week of gestation foetal weight is observed as 700-800 gm & spleen weight is observed as 2.6-2.8 gm.

In the 24-36 week of gestation foetal weight is observed as 1200-1300 gm & spleen weight is observed as 4.4-4.6 gm.

More than 36 week of gestation foetal weight is observed as 2000-2200 gm & spleen weight is observed as 7.0-7.2 gm.

There is gradual increase in the organ weight at different groups with the increase in foetal weight.

CONCLUSION:

Studies related to morphology analysis of spleen need to be carried out actively at various medical institutions/colleges for obtaining more concrete information. The implications of such projects are that it not only enhance the fundamental knowledge but also furnishes many insights on spleen's size clinical utility and significance.

REFERENCE:

1. Henry George Liddell, Robert Scott, A Greek-English Lexicon, on Perseus Digital Library
2. Spleen, Internet Encyclopedia of Science
3. Mebius, RE; Kraal, G (2005). "Structure and function of the spleen". Nature reviews. Immunology 5 (8): 606-16. doi:10.1038/nri1669. PMID 16056254.
4. Swirski, FK; Nahrendorf, M; Etzrodt, M; Wildgruber, M; Cortez-Retamozo, V; Panizzi, P; Figueiredo, JL; Kohler, RH; Chudnovskiy, A; Waterman, P; Aikawa, E; Mempel, TR;

- Libby, P; Weissleder, R; Pittet, MJ (2009). "Identification of splenic reservoir monocytes and their deployment to inflammatory sites". *Science* 325 (5940): 612-6. doi:10.1126/science.1175202. PMC 2803111. PMID 19644120.
5. Jia, T; Pamer, EG (2009). "Immunology. Dispensable but not irrelevant". *Science* 325 (5940): 549-50. doi:10.1126/science.1178329. PMC 2917045. PMID 19644100.
 6. Finally, the Spleen Gets Some Respect By NATALIE ANGIER, The New York Times, August 3, 2009.
 7. Brender, Erin (2005-11-23). Richard M. Glass, ed. Illustrated by Allison Burke. "Spleen Patient Page" (PDF). *Journal of the American Medical Association (American Medical Association)* 294 (20)
 8. Aoki S, Hata T, Kitao M. Ultrasonographic assessment of fetal and neonatal spleen. *Am J Perinatol* 1992;9:361-367.
 9. Burrig KF. Epithelial (true) splenic cysts. *Am J Surg Pathol* 1988;12:275-281.
 10. Herald Ellis. *Clinical Anatomy*. Blackwell publications. 2002;110-13p.
 11. Sir Alfred Cushieri, Robert JC, Steel. *Essentials of Surgical Practice*, Butterworth- einemann Limited, 4th edition. 2000;454-75p.
 12. Prassopoulos P, Daskalogiannaki M, Raissaki A, Hatjidakis, Gourtsoyiannis. Determination of normal splenic volume on computed tomography in relation to age, gender and habitus. *European Radiology*. 1997;7:246-48.
 13. Ranganathan T.S. *A text book of Human Anatomy*. S. Chand Group. ISBN:8121903955. 2006;281-82p.
 14. Hamilton W J. *Text book of Anatomy*. London etc.: Macmillan, 1976. 2nd edition. 1976;501-03.
 15. Malwatkar SG. *Integrated text book of Anatomy*. Oxford university press. ISBN 0195648722. 1999;100-10.
 16. Jephtha R. Hostetler, G. Adolph Ackerman, *Lymphopoiesis and lymph node histogenesis in the embryonic and neonatal rabbit*, *American Journal of Anatomy*, 1969;124(1);57-75.
 17. Jiskoot PMC. Unusual splenic sinusoidal in an overloaded sickle cell. *Journal of clinical pathology*. 2004;57:539-40.
 18. Henry Gary. *On the structure and uses of the spleen*. JW Parker and Sons. 1860;36p
 19. Chummy S Sinatamby. *Lats's Anatomy – Regional and applied anatomy*. Churchill Living stone. 1994;279-81p.
 20. Potter EL. *Pathology of foetal neonatal anatomy*. 1961;415-20.
 21. Bannister. *Gray's Anatomy* 38th edition. Churchill Living tone. 1995;1437-45pp
 22. Al-Iman O, Suleiman A, Khuleifat S. Ultra sound assessment of normal splenic Length and spleen to kidney ratio in children. *East Mediterr Health Journal*. 2000;(2):514-6.
 23. Audrey L, Spielmann, David M, DeLong, Mark A, Kliewer. *Sonographic Evaluation of Spleen size in tall healthy athletes Splenic*. *American Journal of Pathology*. 2001;159:501-12.
 24. Swischuk L E, Williams JB, John SD. Torsion of wandering spleen. The whored appearance of the spleen pedicle on CT. *Paediatric Radiology*. 1993;23:476-7.
 25. Ayers A B, Davies BN, Washington PG. Responses of the isolated perfused human spleen to sympathetic nerve stimulation, catecholamine and poly peptides. *British Journal of Pharmacology*. 2001;44:17-30.