



Sonographic Evaluation of Spleen Thickness and its Correlation with Age- Gender in Adult Population attending Tertiary Care Hospitalat Gwalior in Madhya Pradesh

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ABSTRACT:

Aims and objectives: To correlate the splenic thickness with age and to compare the splenic thickness of males and females of adults in Gwalior.

Material and methods: Present cross sectional study was done at Gajra Raja Medical College Gwalior M.P. with 160 adults of Gwalior- 80 males and 80 females. By Pearson's product moment correlation coefficients, the relation of spleen thickness to age was evaluated. One way ANOVA and Two way ANOVA technique were applied.

Results: Mean splenic thickness and mean age of the participant's were 4.40 ± 0.71 cm and 40.98 ± 12.53 years respectively. There was a significant negative correlation between the Splenic Thickness and Age ($p < 0.05$) among the males.

Conclusion: Males have statistically significant thicker spleen than females. The study noted that among the males the splenic thickness decreases with advancing age of an individual.

Key Words: Age; ANOVA; Correlation; Females; Males.

I. INTRODUCTION:

The spleen is a wedge shaped organ present in left hypochondrium and partly in epigastrum. It is soft, highly vascular and purple in colour. Its normal dimensions are 5*3*1 inches. Important functions of spleen are Phagocytosis, haemopoiesis, immune response and storage of RBCs.^[1]

It is a well-known fact that size of spleen varies in population. Enlargement of spleen is known as splenomegaly^[1], which can be detected clinically as well as by using USG. It must be two to three times enlarged before it is palpable. Ultrasonography is most commonly used technique for the detection of splenomegaly when it is not clinically palpable^[2]. While many imaging techniques can be used to determine spleen size;

ultrasonography is particularly useful because of ease of use and lack of radiation exposure^[3].

Splenomegaly is seen in conditions such as infectious mononucleosis, malaria, kala azar, TB, lymphomas and lymphatic leukemias, hemolytic anemia and many more. There are some studies which shows that normal spleen size has been found to vary significantly depending on age and sex^[4,5].

There is no extensive study on the measurement of thickness of spleen by ultrasonography in Gwalior city and therefore, the present study was planned to correlate the splenic thickness with age and to compare the splenic thickness of males and females of adults in Gwalior.

II. MATERIAL AND METHODS:

This cross sectional study was comprised of data collected from subjects under ultrasonographic evaluation for diseases not effecting the spleen conducted between December 2017 to December 2018 at Department of Anatomy, Gajra Raja Medical College Gwalior and Department of Radiodiagnosis, Gajra Raja Medical College Gwalior.

Total 160 participants with male females in equal proportion were included in the present study. The participants selected for the study were evaluated with Ultrasonography for abdominal and/or pelvic problem unrelated to the spleen, mostly because of UTI or abdominal pain. They have no history of disease related to the liver or spleen and no GIT, hematologic, oncologic or traumatic conditions. Dimensions of the spleen thickness were defined as: **Splenic Thickness (ST)** is defined as the distance between the inner and outer surface. It is measured at the level of the splenic hilum on a transverse section^[6].

Splenic thickness was measured in the supervision of experienced radiologist. After taking note of the splenic thickness, the complete information was recorded in the proforma. The



collected data were checked for completeness, accuracy and clarity before analysis. From these measurement Means, Standard deviation (SD) was calculated. Statistical test like independent t test, One Way ANOVA and Pearson's correlation coefficient was calculated. Two Way ANOVA technique were applied to descry any interaction effect between sex and different levels of Age for spleen thickness. When the study intrigues in the effects of two factors, a two-way design offers great advantages over two single-factor studies. The p value were calculated at 5 % level of significance. Data entry were done in Microsoft excel software and analysis were performed on the SPSS-16 software.

Ethical Clearance: Ethical clearance was obtained from institutional ethical committee. Informed consent was obtained from each participant at the time of data collection.

III. RESULTS:

A total of 160 participants (80 males and 80 females); were included in the study. Mean age of the participants was 40.98(±12.53) years. Mean age of the females and males were 40.67(±12.42) and 41.29(±12.71) years respectively. Overall mean splenic thickness was 4.40 (± 0.71) cm. While mean spleen thickness among females 4.29 (±0.73 cm) was significantly lower as compared with males 4.48 (±0.73 cm). (Table 1) Pearson's correlation coefficient for age and thickness were -

0.124 (p=0.118). Among the males; Pearson's correlation coefficient for age and thickness was significant (r= -0.327, p =0.003). (Table 2) In the age group <30, 30-45,>45 mean splenic thickness were 4.25(±0.60), 4.48(±0.88) and 4.37 (±0.64) respectively. One way ANOVA analysis shows there were no significant difference in splenic thickness among the age groups (F=1.11, P=0.332).

To discern howthe spleen thickness does varies among the males and females in different age groups, two ways ANOVA technique were applied. It is more efficient to study two factors simultaneously rather than separately. Main effects deal with each factor separately. The table 3 consider two factors, sex and age group. The main effect of sex is the difference between the mean thickness of spleen for males and females, studied in all three age groups. The main effect of Age Group is the difference in mean thickness for age group <30 years, 30-45 years and >45 years compared in the males and females of respective age groups. The interaction is the simultaneous changes in both the factors. If the changes in the average splenic thickness in males and females result in different changes in the value of the response variable for the different age group, we say that there is an interaction effect between the factors. In present study there was no significant result in Two Way ANOVA (p > 0.05) showing neither main effect nor interaction effect were significant.

Table 1: Comparison of age and thickness among males and females:

Descriptive for Variables	Male Mean± sd	Female Mean± sd	Independent t test	P value
Age	41.29±12.71	40.67±12.42	t=0.31	0.758
Thickness	4.48±0.73	4.29±0.73	t=2.57	0.011

Fig 1: Showing the age –sex distribution of the patients:

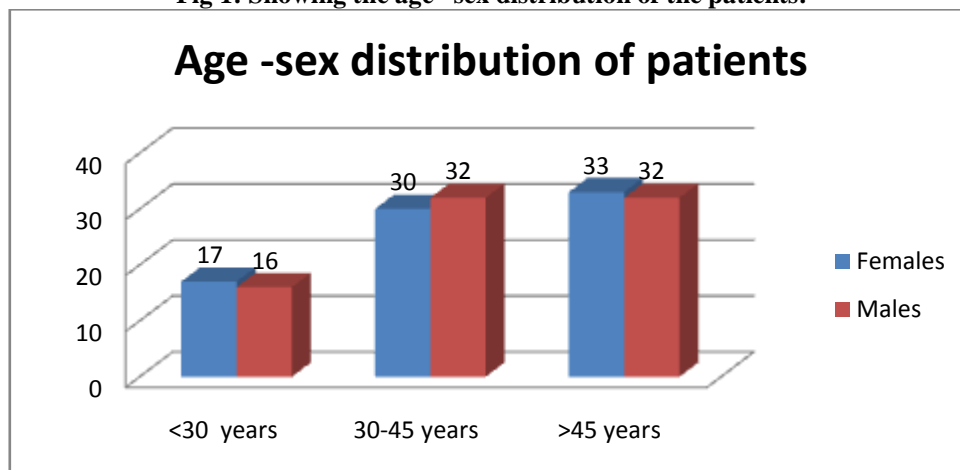




Table 2: Correlation

Correlation between Age and Thickness	Male		Female		Total	
	r	p	r	p	r	p
	-0.327	0.003	0.066	0.561	-0.124	0.118

Table 3: Two Way ANOVA:

Descriptive Statistics (Mean ± sd)				Two way Anova Table						
Age Group (in years)	SEX		Marginal Mean	Two way Anova Table	Source	DF	SS	MS	F	P
	Male	Female			Gender	1	1.87	1.87	3.54	0.06
<30	4.46±0.47	4.04±0.65	4.25±0.60		Age-Group	2	1.09	0.54	1.02	0.36
30-45	4.59±0.94	4.35±0.79	4.48±0.88		Interaction	2	0.97	0.48	0.91	0.40
>45	4.38±0.57	4.36±0.70	4.37±0.64		Error	155	82.19	0.53		
Marginal Mean	4.48±0.73	4.29±0.73	4.40±0.71		Corrected Total	160	85.74			

*DF: degree of freedom, SS: Sum of Square, MS: Mean sum of Square, P: p value

IV. DISCUSSION:

The spleen is an important lymphoid organ and plays an important role in the immune responses and helps in phagocytosis, is located in the abdomen, below the diaphragm and connected to the stomach^[7,8]. Size of spleen can be used as an indicator of disease activity in a variety of disorders of the reticuloendothelial system and many disorders alter splenic size including infective, infestation, infiltrative, immunologic and malignant conditions. In this study, we measured the splenic thickness in adults and compared our results to other populations.

In this study, mean age of the participants was 40.98 (±12.53) years and the mean age of the females and males were 40.67 (±12.42) years and 41.29 (±12.71) years respectively. Mean age of participants in the study is more when compared to similar studies done in Saudi Arabia^[6] and Ethiopia^[9] where mean age of participants were 35.4 (±12.2) years and 32.28 (±13.17) years respectively. In a similar study in Turkey^[10], mean age of male participants was 40.50(±12.77) years and that of female were 36.37(±10.83) years.

The Mean splenic thickness in the present study was 4.40 (± 0.71) cm. Some other studies found splenic thickness higher as compared with our study. Study conducted by Paul FN et al^[11] found splenic thickness as 4.59(±0.72)cm , Kanakaraj K et al^[12] found it as 8.2(±1.36) cm and Ehimwenma et al^[13] found it as 7.1 cm (±0.5)cm , study conducted in Nigeria by Yahuza et al^[14] found mean splenic thickness as 8.68±1.27 cm. Mean splenic thickness were observed lesser to present study in the some studies such as study

conducted in Ethiopia^[9] found it as 3.93 (± 1.05) cm ,study conducted in Jordan^[15] found splenic thickness as 4.40(±1.47 cm) and study conducted in Sudan^[16] found it as 3.78 (±0.81 cm) .

Badran et al^[15] found mean thickness as 4.93(±1.56) cm and 3.73(±1.0) cm among males and females i.e. higher in males as compared with females similar to our study. Finding of the present study were consistent with the findings of the studies conducted in Ethiopia^[9] where splenic thickness is lower in female 3.78 (± 0.98) as compared to male 4.05 (±1.09). In present study age and thickness were found to be negative correlated (r=-0.124). Demissie et al^[9] found that thickness was negatively correlated with the age (r=-0.107), Tekle et al^[6] found overall correlation between age and thickness as -0.183, among the females correlation coefficient were -0.185 and among the males correlation coefficient were - 0.223.

Conflict of Interest: Nil.

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REFERENCE:

- [1]. BD Chaurasia's .Human Anatomy: Regional and Applied Dissection and Clinical .2019; 8(2);344-348.
- [2]. Ioanitescu S, Iliescu L, Harza M, Ismail G. Student Edition.The spleen. In EFSUMB course book of Ultrasound. EFSUMB; 2012. 1-46 p.
- [3]. Hosey RG, Mattacola CG, Kriss V, Armsey T, Quarles JD, Jagger J. Ultrasound assessment of spleen size in collegiate



- athletes. *British journal of sports medicine*. 2006 Mar 1;40(3):251-4.
- [4]. Loftus WK, Metreweli C. Normal splenic size in a Chinese population. *Journal of ultrasound in medicine*. 1997 May;16(5):345-7.
- [5]. Danila M. The ultrasound examination of the spleen. *Medical ultrasonography*. 2010 Sep 1;12(3):253.
- [6]. Tekle Y, Hiware SD, Abreha M, Muche A, Ambaw M, Tegegne Z. Determination of Normal Dimension of the Spleen by Ultrasound and its Correlation with Age. *Asian Journal of Medical Research*! Volume. 2018 Oct;7(4):8.
- [7]. Chaware, PN, Belsare SM, Kulkarni Y R, Pandit S V, Ughade JM. Variational anatomy of the segmental branches of the splenic artery. *J. Clin. Diagn. Res.*,2012; 6(3):336-8.
- [8]. Mebius RE, Kraal G. Structure and function of the spleen. *Nature reviews immunology*. 2005 Aug;5(8):606-16.
- [9]. Demissie S, Mergu P, Fikadu T, Hailu T, Abebe G, Warsa M. Morphometric Assessment of Spleen Dimensions and Its Correlates Among Individual Living in Arba Minch Town, Southern Ethiopia.
- [10]. Çeliktas M, Özandaç S, Göker P, Bozkir MG. Sonographic determination of normal spleen size in Turkish adults. *Int. J. Morphol*. 2015 Jan 1;33(4):1401-5.
- [11]. Paul FN, Taher MA, Roy SK, Sarkar S, Sultana S. Splenic volume: Correlation between ultrasonogram and standard CT measurements. *Bangladesh Medical Research Council Bulletin*. 2017;43(2):58-62.
- [12]. Kanakaraj K, Kalaichezian M .Ultrasonographic Study of Splenic Dimensions. *Sch. J. App. Med. Sci.*, Oct, 2018; 6(10): 4100-4105
- [13]. Ehimwenma O, Tagbo MT. Determination of normal dimension of the spleen by ultrasound in an endemic tropical environment. *Nigerian medical journal: journal of the Nigeria Medical Association*. 2011 Jul;52(3):198.
- [14]. Yahuzama MA. Sonographic measurement of spleen dimensions in healthy adults in Kano, North Western Nigeria. *RADIOLOGY*. 2011.
- [15]. Badran DH, Kalbouneh HM, Al-Hadidi MT, Shatarat AT, Tarawneh ES, Hadidy AM, Mahafza WS. Ultrasonographic assessment of splenic volume and its correlation with body parameters in a Jordanian population. *Saudi medical journal*. 2015 Aug;36(8):967.
- [16]. Yousef M. Local Reference of splenic volume in Healthy Sudanese Subjects Sonographically. *Journal of Biomedical Engineering and Medical Imaging*. 2018 Aug 30;5(4):30.