



ORIGINAL RESEARCH PAPER

Anatomy

DETERMINATION OF NORMAL SPLEEN LENGTH BY ULTRASONOGRAPHY IN ADULT POPULATION OF GWALIOR REGION.

KEY WORDS: Splenic length, Ultrasonography

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ABSTRACT

Introduction: The human spleen is an important organ from the anatomical, immunological and clinical point of view. Variation in of spleen is of anatomical and clinical importance. **Objective:** The purpose of this study is to establish guidelines and reference values for normal splenic length and its variations by ultrasonographic method in healthy adults (males and females) of Gwalior region. **Method:** A sample of 160 patients (80 males and 80 females) in the age group of 20-60 years were drawn from G.R. Medical College and J.A. Group of Hospitals, Gwalior (M.P.). The patients selected for the study being evaluated sonographically for abdominal or pelvic problem unrelated to the spleen, most often because of urinary tract infection or abdominal pain. **Result:** The maximum splenic length was found to be 12.4 cm and minimum 6.5 cm in both gender. The mean splenic length (Mean±SE) in adult males was 9.74±1.44 cm which was significantly greater than females 9.4±1.31 cm. **Conclusion:** The basic knowledge of splenic dimensions by ultrasonography may be essential and helpful for providing the guideline and reference value to the radiologists, surgeons and clinicians for splenic diseases in Gwalior

INTRODUCTION

The spleen is the largest lymphoid organ with a parenchymal structure in the reticulo-endothelial system and it is situated in the left hypochondrium covered by the ribs.¹ The shape of the spleen is tetrahedral or wedge.²

Moreover, the spleen size shows variations according to people depending on the individual age and sex.³

Ultrasonographically, the spleen is crescent in shape with smooth outer convexity. The inner margin may be indented or nodulous, the echogenicity is homogenous which is slightly more echogenic than healthy liver tissue and markedly hyperechoic compared to kidney tissue.

Splenomegaly is a indicator of varieties of inflammatory, infectious (malaria and kala-azar), infiltrative, metabolic neoplastic, hematopoietic disease and the other diseases like portal hypertension, glycogen storage disorder, leukemia lymphoma, melanoma, celiac disease etc.^{4,5}

The spleen is affected by several groups of diseases. The splenic enlargement can be detected both ultrasonographically and clinically. But a small increase in spleen size cannot be detected accurately by clinical examination. It must be two to three times enlarged before it is palpable. The precise management of spleen by palpation is not reliable, as in cases a normal size spleen is palpable and non-palpable spleen may not be of a normal sized. So, the scanning of viscera is carried out to know the normal dimensions, echo pattern and deviations from normal leading to diagnosis of prediction of pathological conditions.

Ultrasonography is quick, safe and reliable method for calculation of spleen size and it is commonly used to diagnose splenomegaly.⁶

The aim of this study is to establish guidelines and reference values for normal splenic length and its variations by ultrasonographic method in healthy adults (males and females) of Gwalior region.

MATERIAL AND METHODS

Study was conducted on sample of 160 patients (80 males and 80 females) between the age group of 20-60 years were drawn from G.R. Medical College and J.A. Group of Hospitals, Gwalior (M.P.). Those patients, who were being evaluated sonographically for abdominal or pelvic problem unrelated

to the spleen; most often because of urinary tract infection or abdominal pain, and consented to be part of study was included in the study. While those patients who had a history of medical disorders affecting spleen and liver, Splenic, Hepatic or upper abdominal surgery, oncologic, Hematologic or abdominal traumatic condition or pregnant women and who did not consent were excluded from the study.

After obtaining detailed history and physical examination, selected patients were subjected to ultrasound examination of spleen. Firstly, the patients were placed in supine position and coupling gel were applied on abdominal wall in the left hypochondric region in order to assure optimal transmission of energy between the patient and the probe. Now the subject was asked to lie in the right lateral position with the left side elevated. Splenic measurement was taken during deep inspiration, to minimize masking by the lung. To estimate the dimension of the spleen ultrasonography was done with a model Aloka-prosound alpha-6 ultrasonographic machine with convex probe of 3.5-5MHz. **Splenic Length (SL)** was defined as the maximum distance between the dome of the spleen and tip of the spleen on a longitudinal section in the sagittal plane.

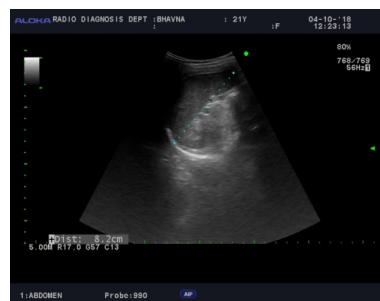


Figure 1: Sonographic Measurement of Splenic Length

After collection of data of the routine parameters ie. splenic length, the complete information was recorded in the Microsoft Excel worksheet 2010. The IBM SPSS statistical software version 26.0 was used for statistical analysis of the measurement results.

RESULTS

Out of 160 patients included in the study 80 (50%) were male and 80 (50%) were female. Twenty patients of either sex were included for the age groups of 21-30, 31-40, 41-50 and 51-60

years of age respectively.

Table 1: Splenic Length in different age groups in Male

Age (yrs)	Numbers	Mean±SD (cm)	F ratio/ p value
21-30	20	10.23±1.31	3.093/ 0.032 (p<0.05)
31-40	20	9.50±1.43	
41-50	20	10.15±1.67	
51-60	20	9.08±1.06	

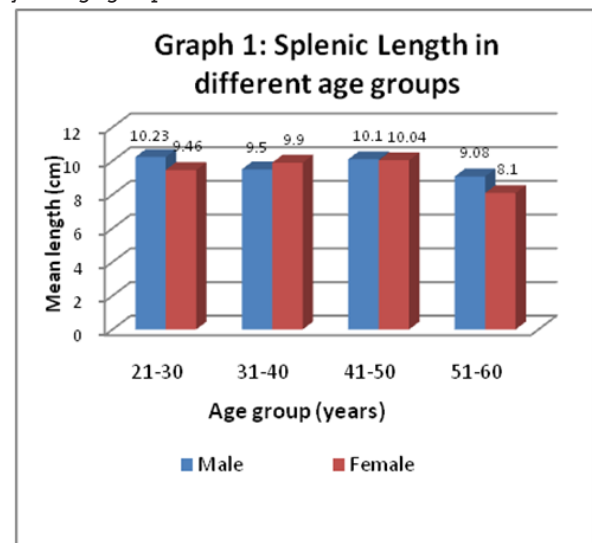
It was observed that the mean splenic length in male in the first age group i.e. 21-30 years was 10.23± 1.31 cm, in the second age group i.e. 31-40 years was 9.5±1.43 cm, in the third age group i.e. 41-50 years was 10.15±1.67 cm and in the fourth age group i.e. 51.60 years was observed to be 9.08±1.06 cm (Table 1).

With the advancing age of male group the mean splenic length first decreases then increases and finally decreased significantly.

Table 2: Splenic Length in different age groups in Female

Age (yrs)	Numbers	Mean±SD (cm)	F ratio/ p value
21-30	20	9.46±1.08	11.69/0.000 (p<0.05)
31-40	20	9.90±1.10	
41-50	20	10.04±1.35	
51-60	20	8.19±0.79	

In the female (Table 2 and Graph 1) the mean splenic length in the first age group i.e. 21-30 years was 9.46±1.08 cm, in the second age group i.e. 31-40 years was 9.90±1.10 cm, in the third age group i.e. 41-50 years was 10.04±1.35cm and in the fourth age group 51-60 years was observed to be 8.19±.79 cm. The splenic length in females first increases up to age 50 years then significantly decreases in advanced age ie. 51-60 years age group.



DISCUSSION

This study was conducted with the aim to measure the variations in spleen length according to age and sex by ultrasonography, to find out the reference values of spleen dimensions in adults of Gwalior region, and to find out possible correlations with the age and gender distribution.

In our study the mean Splenic Length in adults was 9.57cm. In males the length was 9.74cm and in females 9.4cm. The splenic length was found below 11 cm in our study and in other studies of India as compare to the results of other countries which were having splenic length of greater than 11cm in many foreign studies.

We compared our results with that of other studies done by

various authors from other countries as well as from our own country in different states. The findings of this study were supported by other similar studies conducted in different parts of world who demonstrated that the spleen dimensions was greater in males than in females. Perhaps this increased values in males than in females were due to general development of the organs in males or the differences in weight, height, body surface area and genetic factors.^{7,8}

In the study done by Chakraborti et al.⁹ in Tripura population, the mean spleen length in adults was 8.8cm; In males the splenic length was 8.85cm while in females 8.72cm. In the study done by Mittal & Chowdhary¹⁰ in Rajasthan the splenic length in males and females measure 9.4cm and 9.34cm respectively.

Similar findings of splenic length below 11 cm were observed by Frank et al.⁷ who demonstrated that in 95% of the cases splenic length was less than 11 cm and also in Udoaka et al.¹¹ study with splenic length of 9.82cm and 9.12cm in male and female respectively study. However, the splenic length was found below 8.7 cm in the study conducted by Niederau et al.¹² Spielmann et al.¹³ noted a splenic length of more than 12cm in 31.7% of men and 12.8% of the women. Racial differences in splenic length could result in inaccurate interpretation of the splenic size as noted by Loftus et al.¹⁴ and he suggested that a population specific splenic normogram would provide more accurate standards.

In a study in Nigeria Okoye et al.¹⁵ splenic length was found to be 11.1cm in males and 10.6cm in females which was higher than our study, while in Indian population (Kanakraj K et al.¹⁶) it was 9.6cm in males and 8.8cm in female which was comparable to our study. This difference in Indian and Nigerian populations corresponds to genetic morphometric difference between two regions.

Table 3: Comparative Study of Splenic Dimensions and Volume

Studies (Authors)	Study Area/ Country	Length (cm)	
		Male	Female
Okoye et al. ¹⁵	Nigeria	11.1	10.6
Spielman et al. ¹³	Canada	11.4	10.3
Hosey et al. ⁷	America	11.29	9.91
Mittal & Choudhary ¹⁰	India (Rajasthan)	9.4	9.34
Ehimwenma & Tagbo ²	Nigeria	11.1	10.1
Udoaka et al. ¹¹	Nigeria (Tripura)	9.82	9.12
Chakraborti et al. ⁹	India (Tripura)	8.85	8.72
Kanakraj K et al. ¹⁶	India	9.6	8.8
Our study	India (Gwalior, MP)	9.74	9.4

CONCLUSION

All the dimensions were greater in males than females. In males with different age group study, splenic length firstly slightly decreased than increased and finally decreased, while in the female age groups splenic length first slightly increased and finally decreased. In this study, the most important finding is that there was significant decrease in mean splenic length in all males and females after the age of 50 years which was statistically significant. The basic knowledge of splenic dimensions by ultrasonography may be essential and helpful for providing the guideline and reference value to the radiologists, surgeons and clinicians for splenic diseases in Gwalior region.

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