

Original Article

AGE-RELATED CHANGES IN ULTRASONOGRAPHIC SPLEEN LENGTH IN THE ADULT POPULATION OF KANPUR

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ABSTRACT

Introduction: The spleen is an intra-abdominal organ affected by a number of diseases. Estimates of spleen size in vivo are often important in the diagnosis, treatment, and prognosis of many disorders which is unreliable by palpation. Several previous studies have sought to develop standards for spleen size such as CT scan, scintigraphy, MRI, and ultrasound. Conventional ultrasound has been shown to be a good measure of spleen size without the need for ionizing radiation. In this study, an attempt was made to determine the normal range of the spleen and its correlation with age of male and female subjects.

Materials and Methods: 80 males and 80 females aged 20 to 60 years from the Department of Anatomy and Radiology, Rama Medical College & Research Centre, Kanpur were selected. Using ultrasound, the length of the spleen was measured.

Results: It was observed that in both men and women, the length of the spleen decreases with age. Spleen length decreases at a slower rate until age 50, after which it declines rapidly. Spleen length is greater in men than in women at all ages.

Conclusions: Spleen size varies greatly among individuals. Establishing normative spleen length data is crucial for assessing changes. Age significantly influences spleen size, especially in males over 50. Consider age before diagnosing spleen length changes.

Keywords : Spleen, Palpation, Hematopoietic system, Portal hypertension

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INTRODUCTION

The spleen is an intraperitoneal organ located posterolaterally in the left hypochondrium between the fundus of the stomach and the left hemidiaphragm. In the supine position, the long axis of the spleen is in line with the tenth rib, but in the upright position, it is more vertical. Its extreme or superior angle lies approximately 4 cm from the tenth thoracic spine, and its lateral border at the mid-axillary line in the ninth intercostal space. The shape of the spleen is characteristically tetrahedral but may be modified when enlarged. The splenic hilum is the only portion that is not covered by peritoneum, but here peritoneal reflections carry the main splenic vessels, the splenic arteries, and veins.

The spleen, though not firmly anchored in the body, is attached to the stomach by the gastrosplenic ligament and to the dorsal body wall by the lienorenal ligament. The phrenicocolic ligament, which is not directly attached to the spleen, supports its inferior end. These attachments allow the spleen to enlarge as much as ten times and to shift to ectopic locations. A connective tissue capsule covers the spleen and projects fibers (trabeculae) into its pulp. The peritoneum covers the capsule.

The spleen is an intra-abdominal organ affected by a number of diseases. In various clinical conditions, the spleen is enlarged, most commonly due to reactive proliferation

of lymphocytes or reticuloendothelial cells. The spleen also enlarges in malignancies of the hematopoietic system such as lymphoma, diseases associated with portal hypertension, disseminated tuberculosis, malaria, kala azar, cirrhosis, collagen storage diseases, etc.

The normal limits of spleen size must be known for pathological changes to be recognized. It is impractical to calculate the volume of the spleen. For this reason, especially splenic length determination is more meaningful and important [1–3]. Estimates of spleen size in vivo are often crucial in the diagnosis, treatment, and prognosis of many disorders. Accurate measurement of the spleen by palpation is unreliable because in some cases, the spleen may be palpable of normal size while a palpable spleen is not always of normal size. Imaging of the spleen can be obtained with simple radiography [4], but this exposes the patient to avoidable radiation exposure. In addition, if there is an upper lateral quadrant mass, it is very difficult to distinguish splenic tissue from that of nearby organs.

Radionuclide imaging is also used to estimate spleen size. Its accuracy depends on the vascular integrity of the organ and it exposes the patient to excessive gamma radiation [5]. Ultrasound has been shown to be both accurate and reliable for the measurement of splenic dimensions [6]. As a result of recent advances in ultrasonography, assessment of

splenic size (either palpable or unpalpable) has become feasible, reliable, and accurate. Ultrasonography is a simple, safe, and accurate method of assessing splenic size, and patients with persistent splenomegaly should be followed up closely for the development of complications, which may necessitate splenectomy [5].

Ultrasound scanning, apart from being non-ionizing, is painless, non-invasive, widely available, easy to use, and less expensive than most other imaging methods. However, its main limitation is being operator-dependent. It can demonstrate the existence and composition of splenic masses, changes in splenic echotexture and outline, progressive changes in masses, and the size of the spleen.

Measurement of splenic length by ultrasound is reliable within and between technicians. Measurement of splenic width, however, is less reliable, as evidenced by only moderate intra- and inter-rater reliability. This finding supports the historical assessment of splenomegaly based on spleen length.

Because the measurement of splenic width is less reliable, defining splenomegaly on the basis of splenic volume may be more uncertain [7]. In this study, an attempt was made to determine the normal range of the spleen and its correlation with the age of male and female subjects.

MATERIAL AND METHODS

A total of 160 patients, 80 men, and 80 women aged 20 to 60 years were selected for this study. Informed consent was obtained from all patients before inclusion. The study's purpose, potential effects, and examination stages were explained either individually or in groups.

Patients were psychologically reassured and instructed to relax before the examination. Then, they were asked to lie supine on the couch with arms away from the chest wall and to take shallow breaths.

All measurements were conducted on sections through the splenic hilum to ensure a consistent reference point for reproducibility, following the guidelines of the American Institute of Ultrasound in Medicine [8], as described by Lamb et al. [9]. Splenic length (the maximum distance between the dome of the spleen and the splenic tip) was measured on the longitudinal section.

Exclusion criteria: Patients with a history of splenectomy, age under 20, history of malignancy, hematologic disorders, or persistent fever were excluded from the study.

Ethics: Ethical clearance was obtained from the college ethics committee [RMCHRC/Ethics/2022/2035-A].

Age	No. of subject	Mean±SD (cm)	Range (cm)	F ratio
21-30 yrs.	20	10.61 ± 1.35	9.97-11.24	F=9.088 (P<0.001)
31-40 yrs.	20	10.38 ± 1.81	9.82-10.93	
41-50 yrs.	20	9.95 ± 1.33	9.32-10.57	
51-60 yrs.	20	8.64 ± 1.33	8.02-9.26	

Table 1. Comparison of splenic length in different age groups in males

Statistical analysis: All data were entered into a Microsoft Excel sheet and then statistically analyzed using SPSS software version 26 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics including frequency, percentage, mean, and standard deviation were utilized.

RESULTS

Spleen length was 10.61 ± 1.35 cm in the age group of 21-30 years and decreased to 8.64 ± 1.33 cm in the age group of 51-60 years in males [Table-I]. In females, spleen length decreased from 9.63 ± 1.32 cm to 8.41 ± 1.43 cm from the age group of 21-30 years to the age group of 51-60 years [Table-II]. This decrease in length was significant (F=9.088, P<0.001) in males as well as females (F=3.108, P<0.05).

In both males and females, splenic length decreased with age. The splenic length decreased at a slow rate up to the age of 50 years, after which it decreased rapidly. The splenic length was greater in males than females in each age group.

Correlation analysis showed that spleen length was negatively correlated with age in all adults [Table-III]. So, with increasing age, spleen length was found to be decreasing. This decrease in splenic length is significant (Pearson Correlation -0.259, P<0.05) in males and was not significant in females (Pearson Correlation -0.076, P>0.05).

DISCUSSION

The splenic size may provide insights into the diagnosis and prognosis of gastrointestinal and hematologic diseases [10]. Most individuals in this study had spleens less than 11 cm in length, consistent with Frank et al.'s findings [5].

According to Rosenberg et al. [11], girls aged 15 years or older have spleens with an upper normal limit of 12 cm, slightly differing from this study's results. In this study, splenic length gradually declined until age 50, then reduced rapidly, consistent with Loftus and Matrewali's findings [12]. They noted a significant increase in splenic length up to age 20, followed by a moderate decline in growth rate until age 50.

Age	No. of subject	Mean±SD (cm)	Range (cm)	F ratio
21-30 yrs.	20	9.63 ± 1.32	9.01-10.25	F=3.108 (P<0.05)
31-40 yrs.	20	9.41 ± 1.27	8.81-10.00	
41-50 yrs.	20	9.21 ± 1.34	8.57-9.84	
51-60 yrs.	20	8.41 ± 1.43	7.74-9.08	

Table 2. Comparison of splenic length in different age groups in females

Konus et al. [13] found the best correlation between splenic length and body height. Splenic dimensions (length, breadth, and thickness) decreased with age in both males and females. Age showed a statistically significant negative correlation with splenic measurements in males [14].

Similarly, research on Chinese individuals showed rapid splenic length increase up to age 20, followed by gradual decline until age 50, then rapid decrease. The average spleen measured 9.56 ± 1.37 cm, with a negative correlation between age and splenic length [15].

Studies in Tripura, West Nepal, East Nepal, and North India found an inverse relationship between adult subjects' age and splenic size, indicating a decrease with age [16]. Ezeofor et al. [17] studied children aged 5 to 17 years, noting a significant correlation between splenic length and age ($P < 0.001$), with males having statistically longer spleens than females.

CONCLUSION

Spleen size varies greatly among individuals, emphasizing the need for normative data to assess changes accurately. Patient age

Parameters	Splenic length(cm)			
	Male (80)		Female (80)	
	Pearson's Correlation	P value	Pearson's Correlation	P value
Age(years)	-0.259	<0.05	-0.076	>0.05

Table 3. Correlation of spleen length and age

significantly influences spleen size. Therefore, age consideration is crucial when evaluating spleen length changes due to disease. In males over 50, spleen size is typically reduced, warranting caution in reporting normal spleen size.

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