

Original Article

ULTRASONOGRAPHIC MEASUREMENT OF SPLENIC LENGTH IN RELATION WITH BODY SURFACE AREA IN ADULTS OF BIHAR

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ABSTRACT

The spleen, 'Haemo-Lymph organ' composed of lymphoid tissue is the largest 'Ductless gland' in the body. In a variety of Clinical conditions the spleen enlarges. The estimation of splenic size in vivo is often important in the diagnosis, treatment and prognosis of variety of disorders. The precise measurement of spleen by palpation is not reliable. Several prior studies have sought to develop standards for splenic size such as C.T. Scan, Scintigraphy, M.R.I. and Sonography.

The present study was done to determine the normal range of length of spleen in correlation with the body surface area of adult male and female subjects. 80 male and 80 female subjects aged between 20-60 yrs coming to the Dept. of Anatomy and Radiology of Darbhanga Medical College and Hospital, Darbhanga, Bihar were selected. Splenic length was determined by Ultrasonography and body surface area was calculated with the help of Mosteller formula.

It was observed that length of spleen increased with increase in body surface area in both males and females. The dimension was less in female than that of male with corresponding group of the body surface area.

Key words : Spleen, Ultrasonography, Splenic length, Body surface area.

INTRODUCTION : The spleen also known as "lien" is the largest ductless gland in the body, a haemo-lymph organ, composed of Lymphoid tissue. It is womb and tomb of R.B.Cs. which produces lymphocytes and a burial ground for RBCs and hence regarded as blood purifier.

Spleen is situated mainly in left hypochondrium, against 9th, 10th, 11th ribs. Upper medial end reaches epigastrium, lower lateral end upto mid axillary line, its long axis corresponds to 10th rib, oriented obliquely from above downwards and laterally.

The size & weight of spleen vary at different periods of life, in different individuals, in the same individual under different conditions. Usually dimensions are - Length 12cm, Breadth 7cm, Thickness 3 to 4cm, average Weight 150gms (range: 80 to 300gms).

Spleen is affected by several diseases. Its size may give information regarding diagnosis and course of various gastrointestinal and hematological diseases. So, the estimation of the splenic size in vivo

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is often important in the diagnosis, treatment and prognosis of a variety of disorders.

The precise measurement of the spleen by palpation or percussion is not reliable. In some cases a normal sized spleen is palpable whereas a nonpalpable spleen is not always normal sized, hence comes the importance of imaging techniques. Ultrasound has been found to be both accurate and reliable (Petzoldt et.al. 1976)[1] for these measurements. Advantages being lack of ionizing radiation, low cost, portability of instrument, non-invasive, lack of risk of allergic reactions, in comparison to other diagnostic tools, such as Simple X-Ray, Radionuclide imaging, Angiography, Sulfur colloid scintigraphy, C.T. and M.R.I.

MATERIAL AND METHODS

A total of 160 subjects (80 males and 80 females), coming to the Department of Anatomy and Radiology, Darbhanga Medical College, Darbhanga, Bihar, were selected. Inclusion criteria being - Volunteers aged between 20 – 60yrs, Resident of Bihar, Equal number of males and females, Informed consent of the subject, and Exclusion criteria being - Volunteers aged <20yrs and >60yrs, history of prolonged febrile illness, Malignancy, Hematological disorder etc.

Body Surface area was calculated with the help of MOSTELLER FORMULA :

$$BSA (m^2) = \{Height (cm) \text{ Weight (kg)}\} / 3600$$



Fig. 1. Showing length of spleen (Male)



Fig. II : Showing length of spleen (Female)

Height was recorded with Stadiometer in ‘cm’ (accuracy 0.1 cm)

Weight was recorded with the help of Weighing scale in Kilograms (accuracy 0.1 kg), Brand name of scale was Krups, with max. capacity 130 kg.

Splenic length was measured with Ultrasound machine (model LOGIQ TM 200 with curvilinear 3.5-MHz transducer) on longitudinal coronal plane from dome to tip through the hilum (Fig-I, II).

OBSERVATIONS

Table- I :

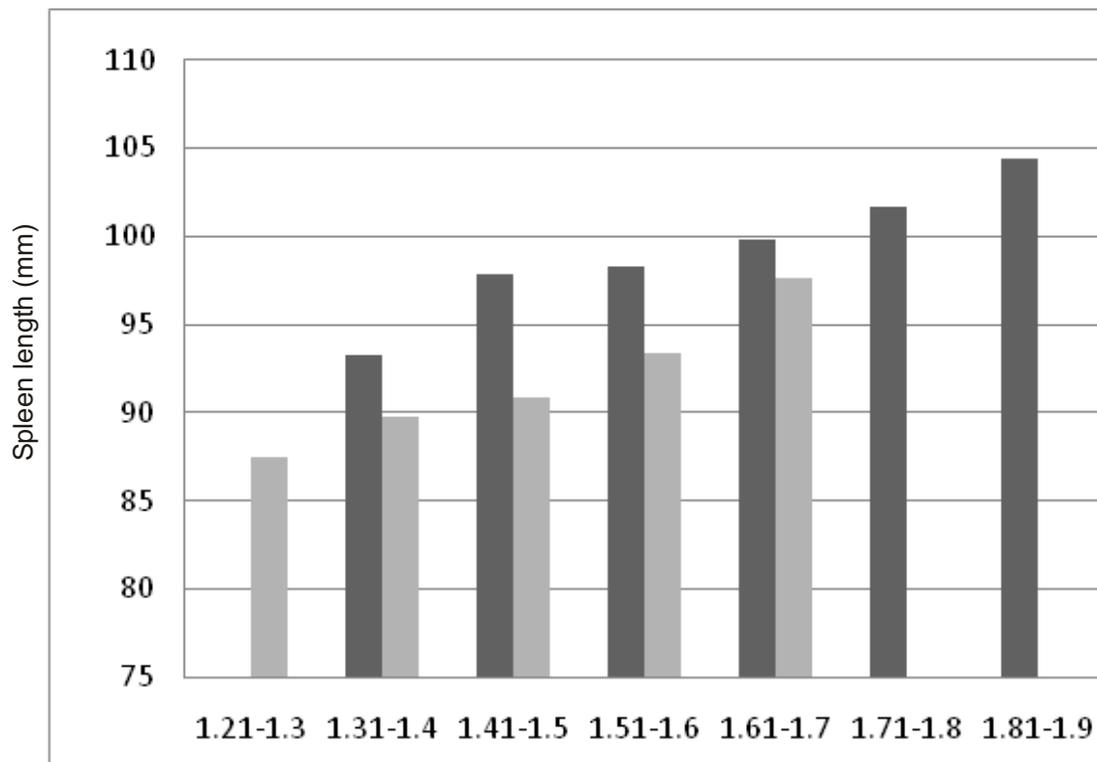
Comparison of splenic length with body surface area in male

Body Surface area (M ²)	N	Splenic length		
		Mean (mm)	S.D	Range (mm)
1.31–1.4	04	93.25	16.24	74.9 – 111
1.41–1.5	14	97.82	17.62	73.2 – 130
1.51–1.6	18	98.27	11.84	71.6 – 123
1.61–1.7	19	99.83	17.68	70 – 121
1.71–1.8	15	101.65	11.90	87 – 132
1.81–1.9	10	104.41	8.82	89.4–119.5

Table- II :
Comparison of splenic length with body surface area in female

Body Surface area (M ²)	N	Splenic length		
		Mean (mm)	S.D	Range (mm)
1.21-1.3	10	87.47	15.22	73.2 – 123.3
1.31-1.4	21	89.78	12.43	68.4 – 115
1.41-1.5	13	90.91	15.69	73.8 – 118
1.51-1.6	19	93.39	11.70	71.0 – 119
1.61-1.7	17	94.65	15.63	65.4 – 122

Fig- III
Comparison of the splenic length with the body surface area of the subjects (Table I & II)



■ Male		93.25	97.82	98.27	98.83	101.65	104.41
□ Female	87.47	89.78	90.91	93.39	97.65		

Surface area (m²)

Fig III Shows that the splenic length increased in both males and females with increase in body surface area. The splenic length was greater in males than females with each corresponding groups of the surface area.

Table - III :
Comparison of splenic length in males and females in different subgroups of body surface area

Body Surface area (M ²)	Splenic length				t	P
	Male		Female			
	N	Mean (mm) S.D	N	Mean (mm) ± S.D		
1.31-1.4	4	93.25 ± 16.24	21	89.78 ± 12.43	0.49	N.S.
1.41-1.5	14	97.82 ± 17.62	13	94.91 ± 15.69	1.07	N.S.
1.51-1.6	18	98.27 ± 11.84	19	93.39 ± 11.79	1.26	N.S.
1.61-1.7	19	99.83 ± 17.68	17	97.65 ± 15.63	0.39	N.S.

Table –III Shows that the splenic length is greater in the males then the females and the difference is statistically not significant.

Table-IV : Correlation table of splenic length with body surface area in males and females

	r	t	P
Males	0.18	1.64	N.S.
Females	0.23	2.13	P < 0.05

Table-IV Shows that in males a positive statistically non significant correlation of the splenic length was found with the body surface area were as in females a positive statistically significant correlation was found.

DISCUSSION

The splenic size may give information about the diagnosis and course of the gastrointestinal and hematologic disease.

Several prior studies have sought to develop the standards for the splenic size, such as C.T. scan, M.R.I., Sulfur colloid scintigraphy (Roberts et. al. 1976)[2], Simple X-Ray (Schindler et. al. 1976)[3], Radionuclide imaging (Frank H et. al. 1970)[4] and Sonography. The conventional Sonography was found to be a well established, widely used and relatively inexpensive means for assessing the splenic size without ionizing radiation.

In the present study it was observed that the splenic length increased in both males and females with increase in body surface area (Table I, II). In males statistically non significant correlation was

found (r=0.18, t=1.64, P=N.S.), whereas in females a positive statistically significant correlation was found (r=0.23, t=2.13, P=< 0.05) (Table-IV). The splenic length was greater in males than females with each corresponding groups of the body surface area (Fig-I), and the difference was statistically not significant (Table-III). These findings were in accordance with findings of various workers.

Niederlau et. al. (1983)[5] determined normal values and upper limits (95th percentile) of liver, spleen, pancreas and portal vein size prospectively with ultrasound in 915 healthy subjects. Sex, age, height, weight and body surface area were determined in each case. Measurement of transverse and longitudinal diameter and cross sectional area of the spleen along its longitudinal axis had been shown to be an accurate and reliable method of estimating its size. It was found that organ size increase with height and body surface area and decrease with age.

Konus et. al. (1998)[6] examined 307 subjects (138 male and 168 female) aged 20- 50 years with normal physical and sonographic findings, who were examined because of problems unrelated to the measured organs (liver, spleen, kidney). They found that the dimensions of the measured organs were not statistically different in males and females. Longitudinal dimensions of all the three organs showed the best correlation with age, body weight, height and body surface area. Out of all these height showed the strongest correlation.

Megremis et al. (2004)[7] examined 512 healthy subjects (274 males and 238 females) with age ranging from 18 to 45 years. None had a problem that could affect spleen size. Spleen length was highly correlated with age, height, weight and body surface area. There was no statistically significant difference between the sexes. The exact pattern of these relationships was nonlinear. Multiple regression analysis indicated that age, height and either weight or body surface area had significant positive association with spleen length.

Poddar et.al. (2010)[8] in their study on Pediatric subjects highlighted that unlike in adults, visceral organs grow with age and hence can not have fixed standard measurements of liver and spleen. Measurement needs to be correlated with age, height, weight and body surface area. In children there is no difference in organs size between males & females. Though liver and spleen size measurement correlate best with height, some studies have shown a good correlation with weight and body surface area.

Arora et.al. (2013)[9] did a similar study in North Indian Adult Population and found that length of the spleen increased with increase in body surface area in both males and females, in most of the subjects splenic length was <11cm and splenic size was more in males as compared to females. These finding were in accordance with the study done by us.

CONCLUSION

From the study conducted we came to the conclusion that:

- The length of spleen increased with increase in the body surface area in both male and female.
- The dimension of spleen was less in female than that of male in each corresponding groups of body surface area.
- In most of the subjects, splenic length was found to be less than 11cm.

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