

Original Article

MEASUREMENT OF THE SPLEEN WIDTH IN RELATION WITH THE HEIGHT IN THE ADULTS OF BIHAR – AN ULTRASONOGRAPHIC STUDY

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ABSTRACT

The spleen, also known as “lien” is the largest ductless gland in the body. It is a “Haemo-lymph organ”, composed of lymphoid tissue which shows variations in its size and weight at different periods of life, in different individuals, and in the same individual under different conditions.

The spleen size may give information regarding diagnosis and course of various gastrointestinal and hematological diseases, so, the estimation of the spleen size in vivo is often important in the diagnosis, treatment and prognosis of a variety of disorders.

The present study was done to determine the normal range of width of spleen in correlation with the height of adult male and female subjects. A total of 160 subjects (80 males and 80 females) were selected coming to the Department of Anatomy and Radiology, Darbhanga Medical College and Hospital, Darbhanga, Bihar. Height of each individual was measured with the help of Stadiometer and Spleen width was determined with the help of ultrasound machine. It was observed that the width of spleen increased with increase in height in both males and females. The dimensions of spleen width were less in females than that of males with corresponding group of body height.

KEY WORDS : Spleen, Ultrasonography, Spleen width, Height,

INTRODUCTION

The spleen, ‘A Haemo-lymph organ, composed of lymphoid tissue, situated in the left hypochondrium against 9th, 10th, 11th ribs, with long axis corresponding to the 10th rib, shows variations in its size and weight at different periods of life, in different individuals and in the same individual under different conditions. Its upper medial end reaches epigastrium and lower lateral end upto mid axillary line, as, it is oriented obliquely from above downwards and laterally. Usual dimensions are : Length - 12cm, Breath – 7cm, Thickness – 3 to 4cm, average Weight – 150gms [range : 80 to 300gms].

The spleen size may give information regarding diagnosis and course [by increase or decrease of spleen size] of various gastrointestinal and haematological diseases[1], so the estimation of the spleen size in vivo is often important in the diagnosis, treatment and prognosis of a variety of disorders.

The precise measurement of spleen by palpation is not reliable, since in some of the cases a normal sized spleen is palpable where as a non palpable spleen is not always normal sized.

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Measurement of the Spleen width in Relation

Ultrasound has been found to be both accurate and reliable[2] for these measurements with the advantages of lack of ionizing radiation, low cost, portability of instrument, non invasive, lack of risk of allergic reactions, as compared to other diagnostic tools, such as simple X-ray[3], Radionuclide imaging[4], Angiography, Sulfur Colloid and Scintigraphy[5], C.T. and M.R.I.

The present study was attempted to determine the normal range of width of spleen in adult male and female subjects of different height.

MATERIAL & METHODS

A total of 160 subjects, 80 males and 80 females aged between 20 to 60 yrs. coming to the department of Anatomy and Radiology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, were selected.

Subjects with age younger than 20 yrs or more than 60 yrs, with a history of splenectomy, malignancy, hematological disorders, prolong febrile illness were excluded.

Height of the subject was recorded with the help of STADIOMETER. The instrument measures the height in 'cm' with accuracy of 0.1 cm.

Width of spleen was measured with the help of ULTRASOUND MACHINE [Model LOGIQ TM 200 with curvilinear 3.5-MHz transducer] on transverse coronal plane at the hilum [Fig. I, II].

Data was analyzed by 'Independent two sample t-test' and p-value (Probability). Pearson's correlation coefficient (r) was used to measure the strength of the association between the two variables.

Formulae used –

- Independent two sample t – test (t) :

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s_{x_1x_2} \cdot \sqrt{\frac{1}{n}}}$$

where

$$s_{x_1x_2} = \sqrt{s_{x_1}^2 + s_{x_2}^2}$$

Here $s_{x_1x_2}$ is the grand standard deviation (or pooled standard deviation), 1 = group one, 2 = group two. $s_{x_1}^2$ and $s_{x_2}^2$ are the unbiased estimators of the

variances of the two samples. The denominator of t is the standard error of the difference between two means.

For significance testing, the degrees of freedom for this test is $2n - 2$ where n is the number of participants in each group.

\bar{x} sample mean.

Probability = p – value (P) :

was calculated with table using 'df' (degree of freedom) and t – statistics (t – test). Value < 0.01 = statistically significant; < 0.001 = statistically highly significant, ; > 0.05 statistically not significant (N.S.)

Pearson Correlation Coefficient (r) formula :

$$r = \frac{Nxy - (\sum x)(\sum y)}{\sqrt{[N\sum x^2 - (\sum x)^2][N\sum y^2 - (\sum y)^2]}}$$

Where :

N = number of pairs of scores

xy = number of pairs of scores

x = sum of the products of paired scores

y = sum of x scores

x^2 = sum of y scores

y^2 = sum of squared y scores

OBSERVATIONS

Table-I : Comparison of the spleen width with the height in the males

Height [cm]	No.	Mean (mm) ±S.D.	Range (mm)
151-155	12	43.72 ± 8.85	31.3-64.9
156-160	13	45.01 ± 9.93	33.0-72.4
161-165	18	48.41 ± 7.50	35.4-65.3
166-170	21	49.72 ± 10.66	33.8-74.8
171-175	16	52.74 ± 9.32	34.0-73.3

[S.D = Standard deviation ; No. = Number of people in the group.]



Fig. I. Showing width of the spleen (Male)

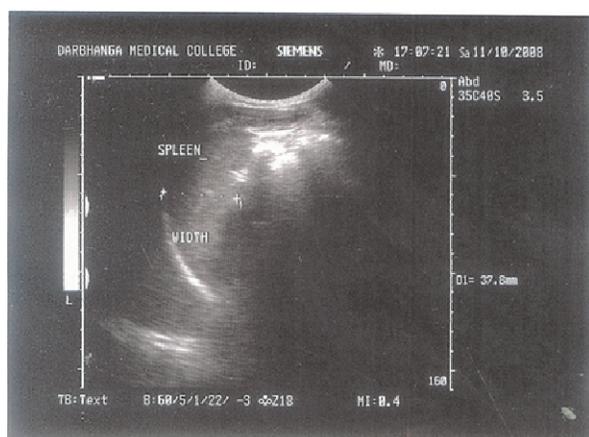


Fig. II. Showing width of the spleen (Female)

Table- II : Comparison of the spleen width with the height in the females

Height [cm]	No.	Mean (mm) ±S.D.	Range (mm)
146-150	14	41.41 ± 9.85	31.4-69.8
151-155	22	41.80 ± 9.13	31.0-66.3
156-160	16	42.58 ± 13.12	32.4-83.8
161-165	12	44.63 ± 8.41	33.6-61.0
166-170	16	47.08 ± 11.39	31.4-68.0

[S.D = Standard deviation; No. = Number of people in the group.]

Fig.- III: Comparison of the spleen width with the height of the subjects

(Table I&II)

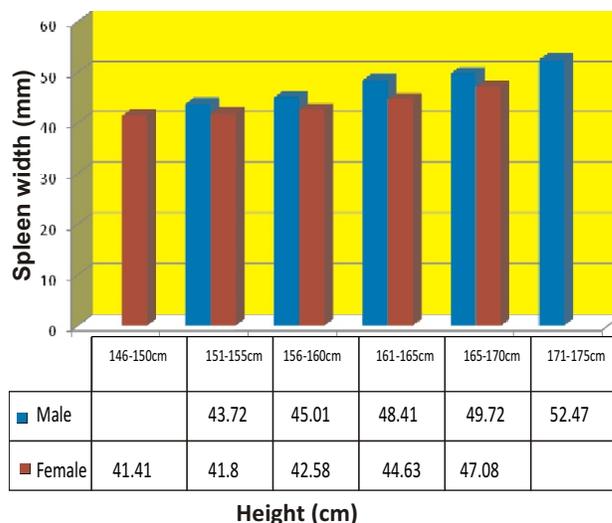


Fig.III : Shows that the spleen width increased with increase in the height in both the males and the females. In the females initially the spleen width remained relatively constant up to 160cm, after that the spleen width increased. The spleen width was greater in the males than in the females with the corresponding groups of the height.

Table-III: Comparison of the spleen width in the males and the females in different subgroups of the height

Height [cm]	Spleen width [mm]				t	P
	Male		Female			
	N	Mean ± S.D.	N	Mean ± S.D.		
151-155	12	43.72 ± 8.85	22	41.80 ± 9.13	0.59	N.S.
156-160	13	45.01 ± 9.93	16	42.58 ± 13.12	0.55	N.S.
161-165	18	48.41 ± 7.50	11	44.63 ± 8.41	1.35	N.S.
166-170	21	49.72 ± 10.66	17	47.08 ± 11.39	0.74	N.S.

[t = independent two sample t- test ; P = p-value (Probability); N.S. = not significant; S.D. = Standard deviation; No. = Number of people in the group.]

Table –III Shows that the difference of the spleen width in the males and the females is statistically not significant, but the spleen width of the males is greater than that of the females with each corresponding groups of the height.

Table-IV: Correlation table of the spleen width with the height in the males and the females

	r	t	P
Males	0.30	2.78	P<0.01
Females	0.23	2.13	P<0.05

[r = Pearson’s correlation coefficient; t = Independent two sample t- test ; P = p – value (Probability).]

Table-IV Shows that in the males as well as the females a positive statistically significant correlation of the spleen width is found with the height.

DISCUSSION

The spleen size may give information about the diagnosis and course [by increase or decrease of spleen size] of the various gastrointestinal and hematologic diseases (Niederau et al. 1983)[1]. The conventional sonography was found to be well established, widely used and relatively inexpensive means for assessing the spleen size without ionizing radiation.

In the present study it was observed that the spleen width increased with increase in the height in both the males and the females [Table-I, II]. The spleen width was greater in the males than in the females with the corresponding groups of the height [Fig-I], [Table-III]. In the males [r=0.30, t=2.78, P=<0.01] as well as the females [r=0.23, t=2.13, P<0.05] a positive statistically significant correlation of the spleen width was found with the height [Table-IV]. These findings were in accordance with findings of various workers.

Spielmann et. al (2005) [6] did Sonographic study of spleen size in tall healthy Athletes (82 men, 47 women) to establish the range of spleen size, and

found that spleen size (length, width, volume) correlates with height in tall healthy Athletes. In men height correlated with spleen width(r=0.5, P=0.0001) and in women also height correlated with spleen width(r=0.4, P=0.01).

Hosey et. al (2006) [7] determined normal spleen dimensions in 631 healthy collegiate athletic population and found Mean(SD) spleen length was 10.65(1.55)cm and width 5.16(1.21)cm. Men had larger spleens than women(P<0.001). White subjects had larger spleens than African American subjects (P<0.001).

McCorkle et. al (2009) [8] did Ultrasound measurements of spleen size in sixtysix tall athletes and compared with ‘normal sized’ controls from literature and they concluded that normal spleen size was significantly larger in tall athletes than the normal spleen size of an average individual.

Ehimwenma et. al (2011) [9] did a prospective study of normal spleen Ultrasound-based measurements in 200 Nigerian adults (91 males, 109 females), age ranging between 20 to 60yrs. Comparison between mean spleen dimension parameters for males and females (from unpaired t-test determination) showed a statistically significant difference (P<0.001) for spleen length, width, depth and volume. There was also statistically significant increasing value correlation between subjects weight and height (in favour of height) when compared to spleen length, width, depth and volume, height and width correlation was similar to our study.

In the present study the spleen width was observed to be less than 6 cm in most of the subjects. This was different from the findings of Frank et al. (1986)[10], who observed the spleen width below 7cm in most of the subjects. This difference may be due to the generic, nutritional or the environmental factors.

CONCLUSION

From the study conducted we came to the conclusion that:

1. The spleen width increases with increase in height in both the male and the female.

2. The spleen width was greater in the male than in the female with corresponding groups of height.
3. The spleen width was observed to be less than 6cm in most of the subjects.

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