

ORIGINAL RESEARCH

CORRELATION OF SPLENIC WEIGHT WITH THE WEIGHT AND SEX OF AN INDIVIDUAL – A CROSS SECTION STUDY

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ABSTRACT

Background:The normal weight of the spleen varies from 80 – 300 gm. Various textbooks describe the measurement of splenic weight but not its correlation with the weight of an individual. As per the data available, there are few studies done, correlating the splenic weight and weight of an individual. Clinically, the weight of the spleen is more significant. Hence, this study has been taken up with the criteria of ultrasonographic measurement of splenic weight and its correlation with the weight of an individual.
Objective: To estimate splenic weight in correlation with the weight and sex of an individual.

Materials and Methods: The study was conducted in the department of Radio diagnosis, Raichur Institute of Medical Sciences and Navodaya Medical College Hospital, Raichur. 500 individuals were selected for the study based on inclusion and exclusion criteria. Splenic dimensions were measured with the help of Ultrasound and splenic weight was calculated with the help of formula. Weight of the individual was measured in Kgs with the help of a weighing machine and statistical analysis was done using formulas.

Results: The weight of the spleen increases proportionately with increase in weight of individual. ($F = 5.835$, $P < 0.001$) in Males, ($F = 2.697$, $P = 0.02$) in Females.

Conclusion: The relation between splenic weight and weight of an individual is significantly positive.

Keywords: Weight, Splenic Weight, Ultrasound.

INTRODUCTION

The spleen is a large, encapsulated mass of vascular and lymphoid tissue, situated in the upper left quadrant of abdominal cavity between the fundus of stomach and diaphragm. Its shape varies from curved wedge to a domed tetrahedron. The relations of the neighboring structures determine the shape of spleen during the development.^[1]

The size and weight of the spleen vary with age and between the sexes. It also varies slightly in same individual under different conditions. It is comparatively large in the young child and although weight increases during the puberty, by the adulthood it is relatively smaller in comparison with neighboring organs. It tends to diminish in size and weight as age advances. Its average adult weight is about 150 gm, although the normal range is wide between 80 gm to 300 gm, Splenomegaly is an important clinical sign for diagnosis and evaluation of various conditions in the Indian subcontinent, be it malaria, Kala-azar, malignancies of hematopoietic system or conditions related to portal hypertension. However, determination of spleen size especially of unpalpable spleens, based on the percussion is not always reliable. Therefore splenomegaly, in reports of clinical studies, often represents only palpable spleens, and accuracy of such a diagnosis in each is often unknown.^[2]

In case where there is only mild splenomegaly or mild enlargement, making decision about size can be difficult. It is very important to have a set of standard normal sonographic values showing upper and lower limits.^[3] Gerspcher et al, who compared ultrasonographic and clinical palpation of spleen and evaluated size changes, concluded that abdominal palpation was a poor method for estimation of splenomegaly.^[4] Sonographic measurements, allow accurate determination of splenic weight. Estimating splenic weight with formula $0.43 \times \text{length} \times \text{width} \times \text{thickness}$, Downey provides the greatest overall accuracy.^[5]

A study conducted on Hong Kong based Chinese population, show a rapid growth in splenic length up to age 20 years, followed by a mild decrease. A statically significant difference is seen between male and female subjects from about 15 to 40 years with spleens of men being about 0.5 cm longer.^[6]

Assessment of splenic size by physical examination is subjective and known to be inaccurate. Therefore, evaluation with radiological imaging is common. Sonography is quick, simple and relatively inexpensive modality that carries no risk ionizing radiation.^[6]

Spleen length is correlated with age, height, weight and BSA. Multiple regression analysis indicates that age, height, and either weight or BSA have significant positive association with spleen length. Statically significant differences between splenic dimension and weight in both sexes have been established in Nigerian adult population by Okoye et al.^[7,8]

In pediatric populations, there is a significant correlation between spleen size and height, weight, and body surface area.^[8,9] The previous studies done by different people namely Rosenberg, Dittrich, Konus, Frank, Niderau, Loftus, Hosey on the Splenic dimensions and their correlation with the physical data of the individual have given the significant values.

Normal spleen size has been found to vary significantly depending on age and sex.^[9-15] Therefore Ultrasonographic measurement of Splenic weight and its correlation with weight of an individual has been taken up in this study.

MATERIALS & METHODS

Source of data:

During the period of the study, about 2500 apparently healthy subjects visited Raichur Institute Medical Sciences and Navodaya Medical College Hospital for health check-ups, among them 500 healthy subjects were selected for the study based on inclusion and exclusion criteria.

The men and women with no apparent diseases and who had no fever were included in the study. Individuals with the signs and symptoms of cirrhosis of Liver or portal hypertension, Hepatobiliary or pancreatic disorder, Congenital or acquired), haematological disorders, febrile illness or traumas, women with recent history of abortion and pregnant women were excluded from the study.

Ultrasound examination:

Each subject was scanned using a voluson 750 pro ultrasound machine with a sector probe of 3.5 MHZ frequency with an electronic calliper. The length is measured in longitudinal images, the maximum length measured as the greatest overall dimension, width and thickness were measured in transverse images

The weight of the individuals was measured in kgs with the help of weighing machine.

Descriptive statically analysis was used in the present study. Person correlation was used to find the relationship of splenic weight with weight of the individual. Student-t test was used to find the significance of correlation.

RESULTS

Among the 500 subjects with the age more than 18 years taken for the study, the total number of male subjects was 278 (57.6%) and the number of females was 222(44.4%). The weight of the 500 subjects taken for the study, ranged from 40 to 110 kgs. The splenic length,width and thickness of 500 individuals was obtained by using Ultrasound machine, splenic weight was calculated by formula. Statistical analysis was done with the parameters using student-t test to find correlation between splenic weight and weight of the individual.

Table 1: Mean splenic weight in male and female subjects according to weight

Weight (Kg)	Splenic Weight	
	Male	Female
40-49	69.67	80.99±15.07
50-59	93.17±29.08	92.26±31.09
60-69	112.32±39.37	100.07±31.11
70-79	131.88±40.78	106.52±32.68
80-89	126.82±36.32	121.79±44.97
90 and above	143.45±38.76	103.69±31.30
Total	121.83±40.77	99.44±32.31
Significance	F=5.835; P<0.001**	F=2.697; P=0.022*

The splenic weight increases with weight of the subjects studied.

In males from 69.67 grams to 143.45±38.76 grams

In females from 80.99±15.07 to 103.69±31.30 grams

This shows strong significance in males ($p < 0.001$) and in females shows moderate significance ($p = 0.022$)

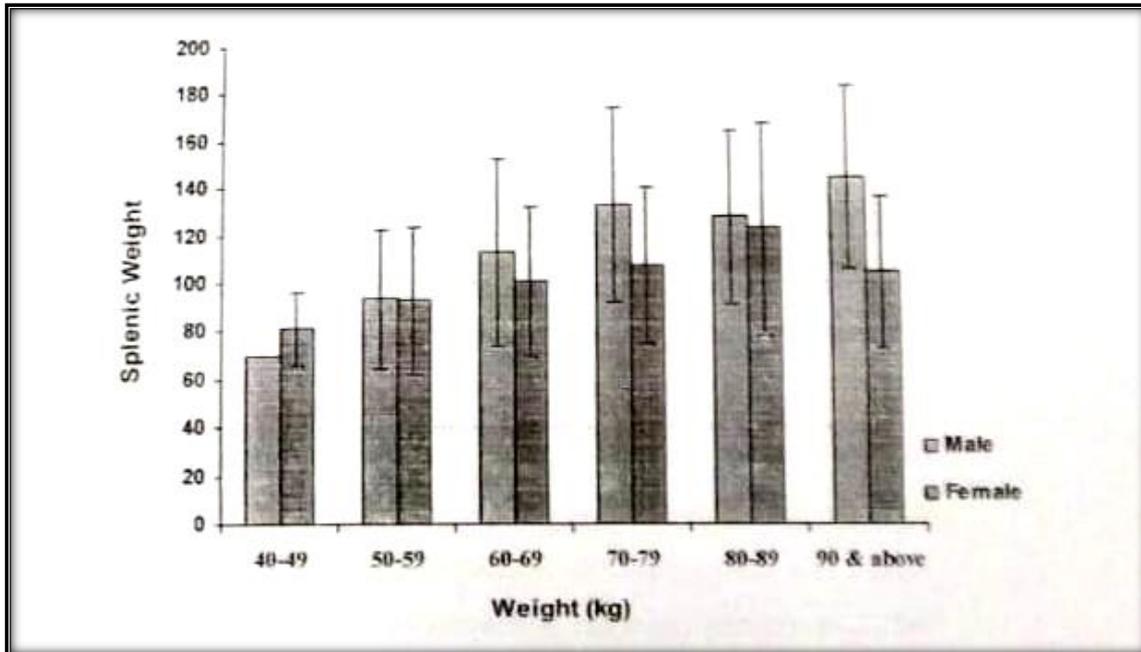


Figure 1: Mean splenic weight in male and females subjects according to weight.

The table shows relationship between bodyweight and splenic weight in an individual. A moderate correlation of $r = 0.386$ was noted between weight of the individual and splenic weight. The splenic weight increases.

DISCUSSION

Normally splenic weight varies from 80 gm – 300 gm. In case where there is mild splenomegaly making decision about size and weight can be difficult. It is very important to have asset of standard normal sonographic values showing upper and lower limits.

Photograph showing measurement of spleen in Longitudinal Scan.

(1 – Measuring the length of the spleen)



Conventional sonography is a well established, widely used, and relatively inexpensive means of assessing the spleen without ionizing radiation. A study by Rosenberg et al,^[9] found that a simple measurement of length was accurate as a guide to the spleen size. The authors proposed setting the upper limit of splenic length at 12 cm for girls 15 years or older and at 13 cm for boys 15 years and older. This study Rosenberg⁹ etc and another by Dittrich et al,^[10] found that there was an approximately linear increase in spleen size, as measured on sonography, in the course of development in paediatric population and that spleen size correlated best with body height. A third study of paediatric population by Konus et al,^[11] with 307 subjects also found that height correlated best with spleen length ($r=0.88$), although their tallest individual was only 68 inches (173 cm), which is shorter than that of our study population. In a study of adults, Frank et al,^[12] used conventional sonography to evaluate 793 healthy patients (17-82 years) and found that 95% of patients had splenic length of less than 11 cm, a width (transverse diameter) of less than 7 cm and a thickness of less than 5cm. Niederau et al,^[13] studied 915 healthy subjects using sonography and found the mean longitudinal and transverse diameters of the spleen to be 5.8 ± 1.8 and 5.5 ± 1.4 cm, respectively in male and female. In all these previous studies it was concluded that splenic length varies directly with height of an individual. Statistical analysis of the present study showed that, both in males and females, splenic weight varies directly with weight of the individual, and hence it was concluded that a significant correlation does exist between splenic weight and weight of the individual.^[14,15]

Splenic Weight in Gms = $32.56 + 1.15 \times$ Weight of subject in Kgs

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