



Sonographic Evaluation of Spleen Sizes in Relation to Age; a Prospective Study of Healthy Adult Nigerians.

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ABSTRACT

Racial differences in organ dimensions could result in incorrect interpretation of spleen measurements. The purpose of this study is to establish the range of spleen dimension in adult healthy Nigerians. A total of 1012 age 18-73 years were recruited from volunteers and referrals for abdominal or pelvic ultrasound scans to three hospitals, Ebonyi State University Teaching Hospital, Federal Medical Centre and Felix Memorial Hospital all in Ebonyi State south east Nigeria. The subjects were scanned in spine position. Longitudinal and transverse dimensions of the spleen were obtained along the left mid axillary line. Clinical disorders associated with splenomegaly were discarded. The entire population has the following mean values splenic length 108.62 ± 8.266 mm, and splenic width 50.89 ± 10.905 mm. The subjects had a slightly higher mean value of splenic length than most of the Caucasians and Asian population suggesting a racial difference and the splenic length decreased with increase age. Splenic length were greater in male than female.

Keywords: Sonography, measurement, spleen.

The variations in the anthropometric features of various population, races and regions are an established fact. The climate of the zone and the socio-economic status of Nigerians make the population of this region special.

The spleen is an intra abdominal organ that is affected by several diseases. In a variety of clinical conditions the spleen enlarges, most often due to the relative proliferation of the lymphocyte or reticuloendothelial cells. Splenomegaly is also present in the malignancies of haematopoietic system such as lymphoma, condition related to the portal hypertension, disseminated tuberculosis, malaria, cirrhosis, collagen storage diseases etc.

The estimation of the splenic size in vivo is often important in the diagnosis, treatment and prognosis of a variety of disorders. The precise measurements of the spleen by palpation is not reliable, since in some of the cases a normal size spleen is palpable whereas a non palpable spleen is not always normal sized. Images of spleen can be obtained by a simple X-ray (Schindler et al 1976) but exposes the patient to the radiation which could be avoided further if there is a left upper quadrant mass, then it is more often not helpful to differentiate the visible soft tissue arising from the spleen or the adjacent organs.

Radionuclide imaging is also used for estimating the spleen size but its occurrence depends upon the vascular integrity of the organ and it unduly exposes the patients to gamma radiations (Frank 1970). Angiography is another method but it exposes the patient to the radiation and allergic reactions of the dye and is also invasive.

Sulfur Colloid and Scintigraphy (Roberts et al 1976) can also be used for measuring the splenic size but these procedures are time consuming and have potential hazard of the radiation. C.T Scans and M.R.I can also be used but they are very costly. Ultrasound has been found to be both accurate and reliable (Petzoldt et al 1976).

MATERIALS AND METHODS

This is a prospective study involved in the establishment of normal values of spleen size by ultra sonography in healthy adult Nigerians.

Subjects were volunteers and referrals for abdominal and pelvic ultrasounds to the Radiology unit of Ebonyi State University, Federal Medical Centre FMC and a renowned private hospital (Felix Memorial Hospital).

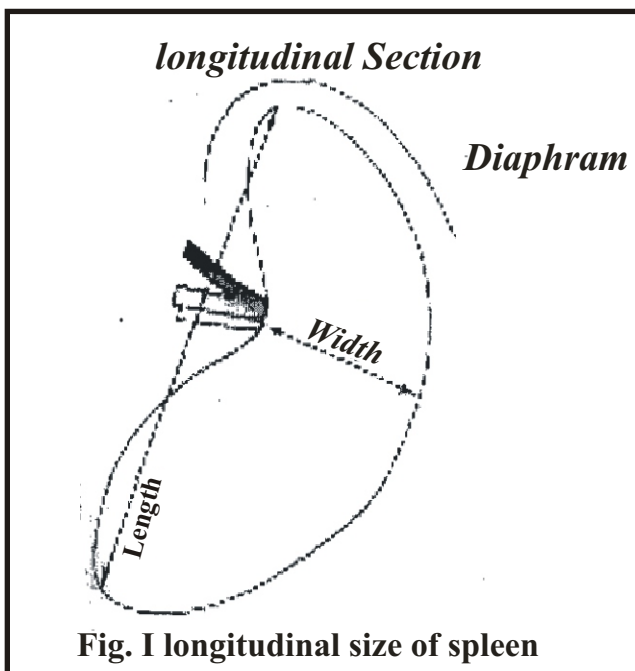
Before starting study, clearance from the Institution ethical committees were obtained one thousand and twelve subjects were measured for this study, they met the

inclusion criteria. All measured spleen had a normal position, shape and echotexture. With the help of ultrasound the length and width of the spleen were measured. The height and weight were measured without foot wears.

The subjects were scanned in supine position and measurement of spleen taken, in the same position longitudinal and transverse scans were carried out. For the longitudinal scan, probe use placed along the left axillary line at the level of xiphisternum between 9th and 10th thoracic vertebra.

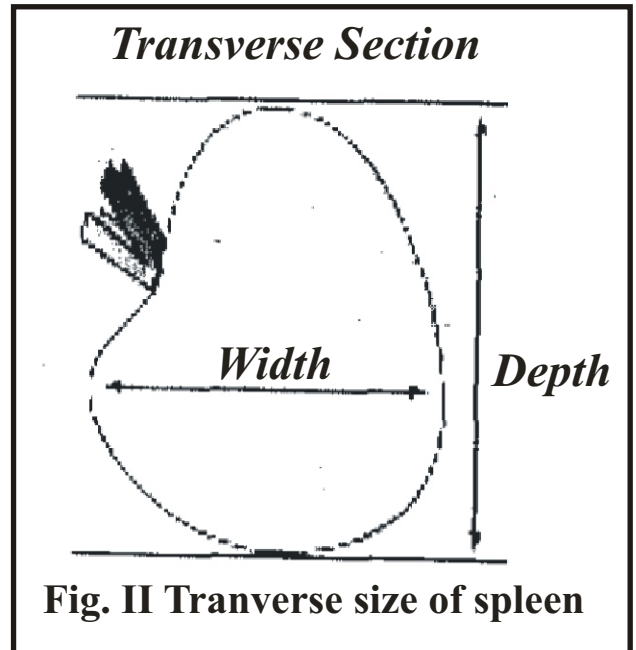
The probe was then rotated about 10° posteriorly in order to bring the long axis of the spleen in full view. The scan for the longitudinal measurement was maintained with a sharp outline of the spleen which cut across the hilum is obtained. The largest superior-interior diameter from below diaphragm superiorly, to inferior border of the spleen was taken (fig. I). The probe was then turned through 90° to the longitudinal axis of the spleen to obtain the transverse axis, measurement of the width was obtained (fig. II).

To determine reproducibility, each measurement was repeated at least 3 times and most repeated value was recorded.



RESULTS

A total of 1012 students were evaluated by ultrasonography there were 725 males and 373 females with age ranging from 18 to 73 years. The following observations were



recorded.

It was observed that the entire population had mean splenic length of 108.6218.266mm and splenic width of 50.89110.905mm, the maximum length was 192mm while the maximum width was 94mm. (Table I)

In male the mean splenic length was 109.34±8.681mm and the female mean splenic length was 106.1216.031. There is significant difference in spleen length of male and female ($P < 0.05$). Hence the male spleen length is greater than of females.

The mean spleen width for the men was 50.84±11.004mm and female 51.07±10.583mm. The differences in size were not significant. (Table II)

It was observed that the mean spleen length in the first age group 18-25yrs was 108.5918.47mm, in the second age group i.e 26-33yrs was 109.06±6.88mm, in the third age group i.e 34-41yrs was 109.25±7.445mm, in the fourth age group i.e 42-49yrs was 107.3516.47mm, in the fifth age group i.e 50-57yrs was 106.2516.47, in the sixth age group i.e 58-65yrs was 95.8123.85mm, in the seventh age group i.e 66-73yrs was 90.20±7.2mm, in the eight age group the results shows that the splenic length increased from 18 yrs up to 41yrs and decreased at a slow rate up to the age of 57yrs after while it decreased rapidly (Table III).

It was observed that the mean spleen width of age group 18-25yrs was

51.29±10.58mm, 4th group i.e. 42-49yrs
 49.06±9.37mm, 5th group ie 50-57yrs
 44.12±2.031yrs, 6th group ie 58-65 was
 56.50±1.82mm, 7th group ie 66-73yrs was
 52.20±6.72 (Table IV) From table V; with the

analysis of variance (ANOVA) of the various population parameters according to their group. There is no significant difference in splenic width according to their age group P>0.05.

Table 1: Summary of Various Parameters

Parameters	N	Minimum	Maximum	Mean	Std
Spleen - L (mm)	1012	52	192	108.62	8.266
Spleen width mm	1012	30	94	50.89	10.905
Age	1012	18	73	25.25	8.106
Height (m)	1012	1.52	1.88	1.6796	0.05143
Weight kg	1012	51.0	98.0	67.752	6.1255

Table 2: Descriptive statistics and independent samples t-test of the parameters for the entire population according to sex.

Parameters	Sex	Mean	Std	t-test	P-value
Spleen-l (mm)	Male	109.34	8.681	5.257	0.000
	Female	106.12	8.037		
Spleen w (mm)	Male	50.84	11.004	-0.285	0.776
	Female	51.07	10.583		

Table 3: Descriptive statistic of spleen length according to age group.

Parameters	Age group	N	Mean	Std	Minimum	Maximum
Spleen - L (mm)	18-25yrs	651	108.59	8.478	29	192
	26-33yrs	256	109.06	6.587	99	129
	34-41yrs	65	109.25	7.446	99	127
	42-49yrs	17	107.35	6.471	100	124
	50-57yrs	8	106.25	4.559	101	112
	58-65yrs	10	96.80	23.846	56	112
	66-73yrs	5	112.20	7.225	102	120
	Total	1012	108.62	8.266	56	192

Table 4: Descriptive statistic of spleen width according to age group.

Parameter	Age group	N	Mean	Std	Minimum	Maximum
Spleen -w (mm)	18-25yrs	651	51.29	11.006	36	93
	26-33yrs	256	49.55	10.583	30	94
	34-41yrs	65	52.52	11.270	41	88
	42-49yrs	17	49.06	9.377	41	80
	50-57yrs	8	44.12	2.031	41	47
	58-65yrs	10	56.5	13.88	45	92
	66-73yrs	5	52.20	6.723	46	63
	Total	1012	50.89	10.905	30	94

Table 5: Analysis of Variance (ANOVA) of the various population parameters according to their age group

Parameters		Sum of Squares	Df	Mean Square	E	P-value
Spleen-l (mm)	Between Groups	1609.502	6	268.250	3.996	.001
	Within Groups	67469.971	1005	67.134		
	Total	69079.473	1011			
Spleen w (mm)	Between Groups	1478.182	6	246.364	2.085	.053
	Within Groups	118753.423	1005			
	Total	120231.605	1011	118.163		

DISCUSSION

The splenic size may give information about the diagnosis and course of the gastrointestinal and hematologic disease. (Niederaw et al 1983). In one study the splenic size was evaluated in patients with sarcoidosis and thrombocytosis, splenomegaly was present in 57% of the patients (using Sonographic criteria to evaluate the size), but only clinically palpable in 8% of the cases (Kataoka et al 1990). Therefore the imaging has become essential for the accurate measurement of splenic size, the serial monitoring of the splenic size over the course of the patient's illness and development of the guidelines for return to play. Several prior studies have sought to develop the standards for the splenic size such as C.T. scan, scintigraphy, M.R.I and sonography. The conventional sonography was found to be well established, widely used and relatively inexpensive means of assessing the splenic size without ionizing radiation.

In the present study, the average length of spleen was 109.34±8.68mm in males and 106.12±6.037 in females, in elderly subjects from 58 years above the length decreased rapidly to 92.20±7.26mm. This was similar to the findings of Loftus and Metreweli 1997. They observed rapid growth in the splenic length up to the age of 50 years and then rapidly fall after the age of 50 years.

In the present study, it was revealed that the splenic length of males was found to be 3mm larger than the splenic length of females. This was different to the findings of the Loftus and Metreweli 1997. They observed that the splenic length of the males was 5mm larger than the splenic length of the females. Perhaps this may be due to the differences in height, weight, body surface area and genetic factors.

In the present study, it was observed

that the splenic length was found to be less than 11cm in most of the subjects. This was similar to the findings of Frank et al 1986. Mital et al (2010) demonstrated that the upper normal limits of the splenic length was observed to be 94 ± 0.91mm in males and are lower than those of the present study. Comparatively in a previous study by Spielman et al (2005). The range length of the spleen was found to be 114 ± 1.7mm in males and 108±1.3mm in females in tall healthy athletes in the US, which was higher than that found in our study. This difference may be due to the genetic factors, nutritional factors or the environmental factors.

Niederaw et al 1983 demonstrated that the mean longitudinal diameter of the spleen was found to be 58±18mm and transverse diameter 55±14mm. These dimensions were much smaller than these of the present study because the authors did not measure the maximum length of the spleen.

In the present study, the average width of the spleen in males as well as in females was 52.89±10.9mm while in males it was 50.84±11mm and in the females the width was 51.07±10.58mm.

The average width of the spleen obtained by Spielman et al (2005) was 50±8mm in males and 42±7mm in females and both those value were comparatively lower than that found in this study. In the present study the splenic width was observed to be less than 60mm in most of the subjects. This was different from the findings of Frank et al 1996 who observed the splenic width below 7cm in most subjects.

CONCLUSION

In the present study on attempt has been made to determine the normal range of the length and width and to correlate these

dimension with the age in male and female subjects.

On the basis of the above study, the following conclusions were drawn.

- ? The splenic length of men is greater than that of females
- ? The splenic length decrease with increase in age in both female and male
- ? The splenic length is greater than that of caucasians
- ? The differences in splenic width is not significant between the sexes

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