

## Ultrasonographic Morphometry of Adult Spleen in Chhattisgarh

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### ABSTRACT

*Introduction- Spleen is an integral organ of the reticulo-endothelial system which functions by removing old and damaged Red Blood Cells, thereby, filtering blood, apart from synthesising Immunoglobulin G, Properdin and Tuftsin. Aims & Objectives- To evaluate the average spleen length (SL), spleen breadth (SB) and spleen thickness (ST) in adult population of Chhattisgarh. Materials & Methods- 400 subjects (239 females and 161 males) were recruited for the study who underwent abdominal ultrasonography in the department of Radiodiagnosis. Result- mean splenic length, spleen breadth and spleen thickness in females was  $92.35 \pm 7.98\text{mm}$ ,  $46.25 \pm 8.42\text{mm}$  and  $33.38 \pm 4.59\text{mm}$  respectively, while in males was  $100.44 \pm 8.79\text{mm}$ ,  $47.88 \pm 7.52\text{mm}$  and  $37.49 \pm 5.21\text{mm}$  respectively. Conclusion- Average splenic dimensions for Chhattisgarhi population were established and it was noted that there is a significant difference between splenic dimensions of female and male population.*

*Keywords- Spleen, Morphometry, Ultrasonography, Chhattisgarh, Sick Cell Disease*

### INTRODUCTION

Spleen, the graveyard of red blood cells(1,2), varies in dimensions in different age groups, genders and ethnicity. Even in the same individual it's size and weight may vary in different periods of life and under different conditions. Knowledge of spleen size might give a lot of information on the condition of a patient. Hence, proper estimation of spleen size helps in diagnosis, prognosis and treatment of many infectious, gastro-intestinal and haematological conditions.

Normally, the spleen is not palpable on examination. So palpation might seem a very easy method to rule out splenomegaly, but, a palpable spleen is not necessarily an enlarged spleen, as found out by a study by Arkles et. al.(3) Another drawback of palpation is that, the exact size of spleen cannot be assessed. Moreover, palpation of spleen for assessment of its growth is a subjective thing. Some clinicians may palpate mild splenomegaly whereas some may not. So there was always a need for imaging of the organ to be assessed for its size.

There are various modalities of investigation present in today's world. Some of the best investigations are CAT scan and MRI. But CAT scan has its own disadvantage of radiation, whereas CAT and MRI scan, both are very costly. So the best investigation with minimal cost for the assessment of size of spleen is Ultrasonography. Ultrasonographic evaluation of spleen size is a very low cost non-invasive investigation and hence used maximum in routine practice (4).

A wide spectrum of pathological conditions can affect the size of spleen(5,6), of which, the state of Chhattisgarh is endemic to some infectious diseases Malaria and Tuberculosis(7–10) and hematopoietic diseases like Sick Cell Disease and Thalassessmia(11–13). Madhya Pradesh, Orissa, Maharashtra and Gujarat were the states with the highest frequency of sickle cell trait cases whole of Central India, as told by Anthropological Survey of India in one of its reports. (14–16)

More than 10% of total population of other backward class and scheduled tribe are sickle cell trait in Chhattisgarh. Halba with 16%, Ghasia with 24% and Agariya with 19% are the most common scheduled tribe, scheduled caste and other backward class affected with sickle cell gene. (17)

In another study conducted at NIT Raipur, prevalence of sickle cell trait was found out to be 10.04% and Thalassemia was found out to be 10.60% in Chhattisgarhi population. (18)

Due to high prevalence of diseases involving spleen like sickle cell anaemia, Thalassemia and Malaria, in Chhattisgarh, it is need of the hour to know the normal spleen size in Chhattisgarhi population. As no similar study, has been done before in Chhattisgarh, this study had been taken up to establish a normal database for the state.

## MATERIALS AND METHODS

The study was performed in the departments of Anatomy and Radiodiagnosis at Pt Jawaharlal Nehru Memorial Medical College and attached Dr Bhim Rao Ambedkar Memorial Hospital, Raipur, over a period of 1 year. After obtaining ethical approval from the Institute Scientific Committee, a total of 400 subjects were studied, of which 239 were female and 161 were male subjects. Subjects in the age group of 25-60 years and having domicile of Chhattisgarh were included in the study. Subjects with conditions involving spleen, with haemoglobinopathies, with any type of lesion or scar on the surface of skin overlying the spleen, with history of splenectomy, with lympho-proliferative conditions such as lymphomas, leukaemias, or gravid females were excluded from the study.

The subjects were registered for study, after taking written informed consent at Dr Bhim Rao Ambedkar Memorial Hospital, Raipur.

The proforma was filled which asked for their name, father's/husband's name, date of birth, sex, caste, religion, education status, address, economic status and domicile status. Thereafter, a detailed medical history was taken from cases, to rule out any point of the exclusion criteria.

The subjects counselled and relaxed when taken into the investigation room, where they were then asked to lie straight on the couch in supine position. They were asked to take shallow breaths and were told when needed, they would have to take deep breaths, in order to move the spleen from under the ribcage.

The subjects once relaxed and reassured, were made to lie in right lateral decubitus position. Using a 3.5MHz USG probe, scanning was done along the anterior, mid and posterior axillary lines in the left costal margins from ninth to eleventh ribs. When necessary, patient was also asked to turn supine. The intercostal spaces were used as scan window, for proper visualization of the entire spleen. All measurements were made on sections through the splenic hilum in order to create a constant reference point for repeating measurement according to the guidelines of the American Institute of Ultrasound in Medicine (19) and as described by Lamb et al. (20)

Splenic length, defined as the maximum distance between the dome of the spleen and the splenic tip, was done on the longitudinal section. Splenic width defined as the maximum distance between the medial and lateral borders of the spleen was measured on a plane perpendicular to the length. Transverse scans were obtained with the transducer rotated through 90°. Splenic thickness was

defined as the maximum antero-posterior dimension was measured on the transverse section. Each dimension was rescanned and recorded three different times to the nearest millimeter and the median value obtained for accuracy of result.

Descriptive analysis was carried out and mean, standard deviation and p-value ( $<0.05$ ) were computed. Analysis was be done by using Windows Microsoft Office Excel 2010 and statistical software SPSS. **Results-**

400 subjects underwent ultrasonography for estimation of normal splenic dimensions, of which 239 were females and 161 were males. It was observed that the mean length, breadth and thickness of spleen in females was  $92.35 \pm 7.98$ mm,  $46.25 \pm 8.42$ mm and  $33.38 \pm 4.59$ mm respectively. While that in males was observed to be  $100.44 \pm 8.79$ mm,  $47.88 \pm 7.52$ mm and  $37.49 \pm 5.21$ mm respectively, as shown in Table 1.

Table 1 : Splenic dimensions according to gender

Sex	No. of cases	Spleen Length $\pm$ S.D. (mm)	Spleen Breadth $\pm$ S.D. (mm)	Spleen Thickness $\pm$ S.D. (mm)
Female	239	$92.35 \pm 7.98$	$46.25 \pm 8.42$	$33.38 \pm 4.59$
Male	161	$100.44 \pm 8.79$	$47.88 \pm 7.52$	$37.49 \pm 5.21$

## DISCUSSION

Ultrasonographic evaluation is a regular practice, and it provides a very useful means of noninvasive examination of the spleen(4). Kluhs et al(21) measured splenic weight after autopsy or splenectomy and correlated it with ultrasonographic measurements to find out a significant correlation between the two..

In this current study, it has been shown that the mean dimensions of splenic sizes, for the males; the mean splenic length, breadth and thickness were  $100.44(\pm 8.79\text{SD})$ mm,  $47.88(\pm 7.52\text{SD})$ mm and  $37.49(\pm 5.21\text{SD})$ mm, respectively, and for the females the corresponding values of splenic length, breadth and thickness were  $92.35(\pm 7.98\text{SD})$ mm,  $46.25(\pm 8.42\text{SD})$ mm and  $33.38(\pm 4.59\text{SD})$ mm, respectively.

Table 2 shows comparison of splenic dimensions between present study and study by various authors around the world and in India. Splenic length in female in present study resembles that of study on Korean female population, while it is also close to data on Rajasthani population. The splenic length in males is closest to that of male population of study conducted in Chennai.

Splenic width in present study did not find resemblance with any of the studies mentioned in the table.

Splenic thickness in females of present study is closest to that of female population data in the study conducted in Turkey, while it is also close to that study conducted on Rajasthani population.

While splenic thickness in males find resemblance to that of male population in study conducted in Rajasthan and Chennai.

There was statistically significant difference observed in splenic length, width and thickness of female and male spleen, in present study.

Table 2 : Comparison of splenic dimensions with those of previous studies by various authors

Study by various authors	Place of study	Spleen Length		Spleen Width		Spleen Thickness	
		Female	Male	Female	Male	Female	Male
Present Study	Chhattisgarh, India	92.3±7.9	100.4±8.7	46.2±8.4	47.8±7.5	33.3±4.5	37.4±5.2
Ehimwenma et al (22)	Nigeria	101±7	111±9	71±5	78±6	40±4	44±5
Celiktas et al (23)	Turkey	98.7±12.8	110.1±11.8	75.8±15.6	87.5±18.4	33.4±7.9	41.2±10.9
Badran et al (24)	Jordan	102.5±12.2	110.9±13.7	75.5±11.6	72.8±11.6	37.3±10	49.3±15.6
Spielman et al (25)	USA	103±13	114±17	95±12	108±14	42±7	50±8
Yon-Min Kim (26)	Korea	92±13	109.5±10.7	-	-	35.5±4.4	44.8±6.1
Mittal et al (27)	Rajasthan, India	93.4±9.5	94±9.1	-	-	34.5±5.9	34.5±5.9
Chakraborti et al (28)	Tripura, India	87.2±8.9	88.5±15.4	-	-	-	-
Kanakraj K et al (29)	Chennai, India	88±12.3	96±14.4	79±12.6	85±14	36±6	39.9±8

## CONCLUSION

An attempt has been made in the present study to evaluate normal dimensions of spleen in male and female adults of Chhattisgarh.

The following points can be concluded, on the basis of the present study:-

1. The average splenic dimensions (i.e. length, breadth and thickness) in a normal healthy male are 100.44±8.79mm, 47.88±7.52mm and 37.49±5.21mm, respectively.
2. The average splenic dimensions (i.e. length, breadth and thickness) in a normal healthy female are 92.35±7.98mm, 46.25±8.42mm and 33.38±4.59mm, respectively.
3. There was a statistically significant difference in all the splenic dimensions of male and female population.

This data will provide a database for splenic size in population of Chhattisgarh and will assist further studies in the future.

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**Conflict of interest-** None.

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