TO DETERMINE AVERAGE SPLEEN SIZE OF LOCAL PEDIATRIC POPULATION BY ULTRASONOGRAPHY

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ABSTRACT

Objective: To determine Average Spleen size of local pediatric population by ultrasonography.

Material and Methods: This was a cross-sectional descriptive study using non-probability (consecutive) sampling technique, conducted at Radiology Department, Hayatabad Medical Complex Peshawar. The duration of study was 6 months and the sample size was 295 using a Mean of 8.7cm (SD=1.84) spleen size of children, between 8-10 years of age, 95% confidence interval and absolute precision of 0.21.

Results: In this study mean age was 8 years with SD ± 0.17. Fifty five percent patients were male while 45% patients were female. Mean height was 130 cm with SD ± 1.95 and mean weight was 20 Kg with SD ± 2.16. Sixty one (21%) patients had spleen size ranged 6-7 cm, 83(28%) patients had spleen size ranged 7-8 cm, 86(29%) patients had spleen size ranged 8-9 cm, 65(22%) patients had spleen size ranged 9-10 cm. Mean spleen size was 8 cm with SD ± 1.71.

Conclusion: This study shall stand as a good reference to Radiologists, Pediatricians, Hematologists and Physicians in an undiagnosed and complicated cases and will also helpful to determine the mode of treatment in thalassemia major with splenomegaly.

Key Words: Splenomegaly, splenic size, ultrasonography

INTRODUCTION

Understanding and defining the normal is usually the most difficult part of labeling something as abnormal. Normal spleen size varies widely according to age in children. Many diseases can affect its size, ranging from infective processes to malignant disorders. Palpation and percussion are the standard bedside techniques to document spleen size, but are far from accurate to detect small increase in size. The spleen has to be enlarged two to three times its normal size to be clinically palpable, although it may be normally palpable in 15-17% of healthy neonates and 10% of healthy children.

Spleen length has lower values and a smaller rate of growth in preterm than term neonates and infants.

The length of the spleen in the healthy children is in a close relation with the increasing age of the children, with their length or with their height, without any sexual differences. Therefore, in children, knowledge of normal splenic size in relation to age and other biometric parameters (height and weight) of physical growth is essential for the determination of mild splenomegaly.

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There are many conditions in which splenomegaly may be the only feature on ultrasonography e.g., malaria and kala-zar.

Ultrasonography is routinely used to determine the internal structures of the body because the examination is real time, three-dimensional and independent of organ function. It allows a doctor to see inside a patient without resorting to surgery.

Ultrasonography is a non-invasive, established, safe, quick and accurate method for measurement of spleen size. The spleen length at the hilum is considered the most reproducible linear measurement.

There are few previous studies giving the standard size of spleen by ultrasound in children, but none has been done on population in Pakistan. Among the most recent one, Dhingra et al. has provided ultrasonographic data on spleen size in Indian children, according to which the mean spleen length is 4.9 cm (SD=1.44) at age of 1_<3 months, 5.4cm (SD=0.61) at 3_<6months, 6.0cm (SD=0.86) at 6_<12months, 6.4cm(SD=1.01) at 1_<2years, 6.9cm (SD=1.01) at 2_<4years, 7.4cm (SD=0.99) at 4<6years, 7.9cm (SD=0.94) at 6_<8years, 8.2cm (SD=1.02) at 8_<10 years, and 8.7cm (SD=1.84) at 10_<12 years of age in children. According to KebedeT, Admassie D. in Ethopia, the average spleen size for children with age of 0-3 and 3-6 months, 10-12 and 12-14 years are 5.6 cm, 6 cm, 11.2 cm and 11.97 cm respectively.

As already mentioned no such study has been done on our local population and we lack local data regarding normal spleen sizes in different age groups of our children. I conducted this study to establish

standards of spleen length by ultrasonography in healthy children in Peshawar, based on age, sex and somatometric parameters. This study could be used as a practical and comprehensive guide to indicate the normal spleen length range for every child; according to his / her age and his / her body habitus.

MATERIALS AND METHODS

This study was conducted in the Department of Radiology, Hayatabad Medical Complex, Peshawar over a period of six months, from July-2014 to Dec-2014. Through a Descriptive Cross Sectional Study Design, a total of 295 children between 8-10 years of age were sampled using non-probability (consecutive) sampling technique, using mean 8.7 cm (SD=1.84) spleen size, 95% confidence interval and absolute precision of 0.21.

Spleen size was

After approval from Post Graduate Medical Institute ethics and research committee, children visiting the outpatient department, either for routine immunization or accompanying their siblings, for treatment of simple common conditions, such as mild upper respiratory tract or urinary tract infections and for follow-up radiographs of extremities, meeting the inclusion criteria were scanned after obtaining informed, written consent from the accompanying caregivers / parents.

Baseline data including the age, sex, height / length and weight was recorded for all the children in a structured proforma. The age was recorded to the nearest completed month. An electronic weighing scale (accuracy 50 g) and a wall mounted stadiometer (1 mm markings) was used to measure the weight and height / length, as per standard methodology.

All the included children underwent measurement of spleen length, operationally defined as the optically maximal distance at the hilum on the longitudinal coronal view (between the most supero-medial and the most infero-lateral points), on a Toshiba Nemio 20 Color Doppler system with a multi-frequency 3.5 to 5 MHz convex probe, without any preparation or sedation.

All the ultrasonographic procedures were conducted by single expert radiologist having minimum of 5 years of experience and same ultrasound machine was used for all children.

All the above mentioned information including name, age, gender and other relevant information was recorded in pre-designed Performa. Strict exclusion criteria were followed to control confounders and bias in the study results.

DATA ANALYSIS PROCEDURE

Statistical analysis was carried out with SPSS/PC version 20.0. Mean and SD was calculated for numerical variables like age, spleen size, height, weight of the child. Frequency and percentage was calculated for numerical variables like gender. Spleen size was stratified among age, gender, height, weight of the child to see the effect modifications. All the results were presented in the form of tables and charts.

RESULTS

Age distribution among 295 patients was analyzed as 53(18%) patients were in age range 5-6 years, 56(19%) patients were in age range 6-7 years, 59(20%) patients were in age range 7-8 years, 59(20%) patients were in age range 8-9 years, 68(23%) patients were in age range 9-10 years. Mean age was 8 years with SD ± 0.17.

Table No 1: Gender-Wise Distribution of the Sample (n=295)

Gender	Frequency	Percentage
Male	162	55%
Female	133	45%
Total	295	100%

Table No 2: Spleen Size (n=295)

Spleen size (cm)	Frequency	Percentage
6-7	61	21%
7-8	83	28%
8-9	86	29%
9-10	65	22%
Total	295	100%

Mean spleen size was 8 cm with SD ± 1.71

Stratification of spleen size with age distribution was as under:

Table No 3. Stratification of Spleen Size with age Distribution (n=295)

Spleen size (cm)	5-6 years	6-7 years	7-8 years	8-9 years	9-10 years	Total
6-7	11	12	12	13	13	61
7-8	15	16	16	17	19	83
8-9	15	16	17	18	20	86
9-10	12	12	14	11	16	65
Total	53	56	59	59	68	295

Chi square test was applied in which P value was 0.63

Stratification of spleen size with height of the patients was as under:

Table No 4. Stratification of Spleen Size with Height (n=295)

Spleen size (cm)	110-120	121-130	131-140	>141	Total
6-7	13	15	19	14	61
7-8	18	21	23	21	83
8-9	17	22	27	20	86
9-10	19	19	11	16	65
Total	67	77	80	71	295

Chi square test was applied in which P value was 0.47

Gender distribution among 295 patients was analyzed as 162 (55%) patients were male while 133 (45%) patients were female.

Spleen size among 295 patients was analyzed as 61(21%) patients had spleen size ranged 6-7 cm, 83(28%) patients had spleen size ranged 7-8 cm, 86(29%) patients had spleen size ranged 8-9 cm, 65(22%) patients had spleen size ranged 9-10 cm. Mean spleen size was 8 cm with SD ± 1.71.

DISCUSSION

The normal value of the spleen dimensions are important parameter during sonographic examination[10,11].

No two individuals are alike in this world, not even identical twins. Although the spleen in general has common anatomical features, they widely differ in their measurement (according to age) in pediatric age group Ultrasonography provides probably the most dependable information for assessing the splenic length because of its relatively established safe, quick and reliable method[1,2,3].

Very few studies in the past have been done by performing a normogram analysis of the splenic size in childhood. They were either exclusively concerned with spleen or included more parenchymal organs[4].

The present study entitled Ultrasonic measurement of normal splenic size in infants and children and its comparison with the size in various medical disorders involving spleen in Pediatric Indian Population" was aimed to evaluate splenic length with ultrasonography as a reliable and reproducible measurement and correlation of splenic size in medical disorders like malaria, typhoid, portal hypertension and thalassemia major [5].

In splenomegaly, the anterior border, anterior diaphragmatic surface and notched superior border may become clearly palpable below the left costal margin; the notches are often exaggerated and may be clearly palpable. The transverse colon and splenic flexure are displaced downward[6,7,8].

In individuals suffering chronic breakdown of erythrocytes, for example in malaria and other haemolytic diseases, the splenic tissues may be permanently hypertrophied and the spleen greatly enlarged (splenomegaly). These changes involve the distension of the reticular spaces of the red pulp with macrophages loaded with damaged red cells or their breakdown products, the proliferation of reticular cells, increase in macrophage numbers and hypertrophy of the fibrous framework[4].

In thalassemia major, there is extramedullary haemopoiesis, which leads to splenomegaly. When there is venous congestion, for example in portal hypertension and other congestive diseases, there also occurs splenomegaly.

In the present study, the splenic length was measured ultrasonographically in 160 children of both sexes in 0-12 years. Out of these, in 80 children the spleen was not affected while the other 80 children were suffering from medical disorders like malaria, typhoid, portal

hypertension and thalassemia major, which affect the splenic size[6].

In the present study, the coronal measurements of the spleen were obtained in 80 patients with clinically apparent and explainable splenomegaly 55 patients had thalassemia major, 13 had malaria, 9 had typhoid and 3 had portal hypertension. The maximal coronal measurement of each enlarged spleen was compared with the maximal coronal measurement of the normal spleen in the same age group in Indian population.

Rosenberg Henrietta Zhang B et al[6] 199112 used data from 230 healthy children of all ages and suggested upper limit guidelines for splenic length in 11 definite age groups without mention of somatometric factors. A roughly logarithmic correlation between the splenic length and age (r=0.7) was found. A good correlation was found between the splenic length and patient's height (r=0.73) and weight (r=0.78).

In the present study, for normal spleen group There is a strong correlation between the splenic length and age (r=0.9) and between the splenic length and patient's height (r=0.8). There is a partial correlation between the splenic length and weight (r=0.6). The observations of the present study were almost similar to the above author[3].

In the present study, the mean and standard deviation were calculated in different age groups. In the present study, for normal spleen group there is a strong correlation between the splenic size and age and there is also a strong correlation between the splenic size and height and partial correlation between the splenic size and weight.

William K. Loftus et al[8] 199814, sonographically measured both the splenic length and the kidney length in 256 healthy Chinese children and they compared the splenic lengths with the results of the study of Henrietta Kotlus Rosenberg et al. They have found that the splenic length in Chinese children upto the age of 15 years was similar to that of Western children. They have also suggested that splenomegaly should be suspected in children if the spleen is 1.25 times longer than the adjacent kidney. For this, they have calculated the median of splenic size in different age groups which is as follows:

In 0-1 year age group: 6.10 cm

In 1-2 years age group: 6.20 cm

In 2-4 years age group: 6.70 cm

In 4-6 years age group: 7.20 cm

In 6-8 years age group: 7.70 cm

In 8-10 years age group: 8.00 cm

In 10-12 years age group: 8.40 cm

Both the values i.e. mean and standard deviation are measures of central values. In the present study, the mean is used as a central value and standard deviation is also calculated. By comparing the median values of the above study with mean and standard deviation of the present study, there is not much difference in these values as such. So both the results are almost similar.

Oznur L. Konus et al[7] 19981, sonographically evaluated normal liver, spleen and kidney dimensions in 307 pediatric patients (169 girls and 138 boys). The relationships of the dimensions of these organs with sex, age, body height, weight, and body surface area were assessed. They have proposed that body height should be considered the best criteria to correlate with longitudinal dimensions of these organs.

In the present study, it is observed that it is the age which is the best criterion to correlate with the splenic length (r=0.9) and not the body height.

There were no significant differences in the measure spleen size with respect to sex this finding are similar to the other previous studies[8,9].

In the present study, there is a strong correlation between the splenic size and age and other body parameters like height and weight i.e. as the age, height and weight of the child increases, the splenic size increases.

In the present study, the comparison was done between the normal splenic size and the splenic size in medical disorders like malaria, typhoid, portal hypertension and thalassemia major. In the present study, for abnormal spleen group, there is a strong correlation between weight and splenic size, and between age and splenic size.

There is a partial correlation between height and the splenic size, in all the children with clinically obvious splenomegaly, the splenic length exceeded at least 2 cm than the normal splenic length at that particular age.

CONCLUSIONS

In normal spleen group, there is a strong correlation between age and the splenic size i.e. as the age increases, the splenic size increases. There is also a strong correlation between height and the splenic size i.e. as the height increases, the splenic size increases. There is a partial correlation between weight and the splenic size i.e. as the weight increases the splenic size increases.

In abnormal spleen group, there is a strong correlation between weight and the splenic size i.e. as the weight increases, the splenic size increases. There is also a strong correlation between age and the splenic size i.e. as the age increases, the splenic size increases. There is a partial correlation between height and the splenic size i.e. as the height increases, the splenic size increases.

It also shows that at a particular age, the splenic

size exceeded at least 2 cm in the abnormal spleen group as compared to the normal spleen group.

This splenic size measurement would be of great help in determining the final mode of treatment in thalassemia major.

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