



Original Article

Sonographic Assessment of Spleen to Left Kidney Ratio among School Going Children Ranging in Age from 8 to 15 years

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ABSTRACT

Spleen is a vital organ of the lymphatic system and it provides immunity against infections, the spleen in affected people may be large. To diagnose small or infarcted spleen and splenomegaly, the splenic size must be determined. **Objective:** The objective of this study was to assess the ratio of the spleen to the left kidney for the detection of mild splenomegaly. **Methods:** It is a cross-sectional study conducted at the private health care center in Sialkot. Data were collected during three months from January 2022 to March 2022 after informed consent. This study included 101 school-going children ranging in age from 8 to 15 years, all of whom had normal spleen and kidneys. A SonoAce 100 ultrasound machine with a 3.5MHz convex transducer was used to measure the length of the spleen and left kidney. **Results:** This study included 101 subjects with 54 boys and 47 girls. Children were in the range of 8-15 years. The mean age was 11.11 ± 2.16 years, the mean height was 134.2 ± 12.69 cm, and the mean weight of the subjects was 34.5 ± 10.36 Kg. The mean of spleen length was 9.67 ± 1.25 cm, the mean of kidney length was 8.69 ± 1.16 cm and the mean S/K ratio was 1.1 ± 0.07 . The mean of spleen and left kidney length was almost the same in both genders while the S/K ratio for boys (1.13 ± 0.08) was greater than for girls (1.08 ± 0.05). **Conclusion:** It is concluded that the minimum and maximum values of the S/K ratio were 0.94 and 1.3 respectively. Splenomegaly should be suspected in those subjects whose ratio of the spleen to left kidney exceeds 1.3 without kidney disorders. Boys had a greater S/K ratio as compared to girls.

INTRODUCTION

Spleen is a vital organ of the lymphatic system of the body [1,2]. It is found in the left hypochondrium right below the diaphragm, superior to the left kidney and it is protected by the 9th and 10th ribs [3]. In adults, it is a semi-lunar-shaped structure around the size of a closed fist. The dimensions of the spleen including size and weight vary with the change in height, age, and weight in both genders, which might lead to misinterpretation of splenic size [4]. Normal spleen is not palpable and is mostly less than 13cm in the longitudinal plane and less than 6cm in the transverse plane [5]. It weighs 15g at birth and about 150g in adults [6]. Small nodules of splenic tissues are often found close to the spleen in the left hypochondrium. These are referred to as accessory spleen [7]. Splenic artery is a branch of the celiac trunk which supplies blood to the spleen [8]. The

splenic vein drains into SMV which finally drains into the portal vein. On ultrasound examination, the splenic parenchyma seems to be quite homogeneous and is more hyperechoic as compared to the liver and much more echogenic than the left kidney. Its echogenicity is nearly the same as the pancreas [9]. There are two main parts of the spleen each of which serves a particular function. White pulp forms white blood cells that produce antibodies and fight against antigens [10]. The red pulp serves as a blood filter. Spleen eliminates the waste from the blood and also removes old and damaged red blood cells [11]. As the spleen provides immunity against infections, it is possible that the spleen in affected people will be larger as compared to non-exposed people [12]. During the early stages of embryonic life, the spleen is involved in the

formation of blood cells. This function steadily deteriorates around the 5th or 6th month, when the spleen develops adult characteristics and ceases its blood cell forming functions [13]. The use of the size of the spleen as an index of disease activity has been common practice for decades [14]. To diagnose small or infarcted spleen and splenomegaly, the splenic size must be determined [15]. It is important to visualize the superior and inferior poles in the same picture to acquire the correct spleen length [16]. With increasing age, the spleen shrinks slightly in size. The splenic size can alter based on the nutritional health of body and BMI of an individual [17]. One of the aspects that can aid in the identification of splenic disorders and systemic diseases is the assessment of spleen dimensions [18]. For a complete assessment of disease, evaluation of a particular organ and laboratory findings are required. In rare situations, enlargement of the spleen may be only characteristic on ultrasonography such as splenomegaly in glycogen storage disease [19]. Conversely, palpable spleen may or may not indicate disease. A spleen that has been pressed down due to the sub-diaphragmatic illness is an example of a palpable spleen that has no clinical importance [20]. The comparison of spleen and left kidney length served as the benchmark for determining splenic size [21]. The left kidney is located inferior to the spleen and is about 7-12cm in a longitudinal plane. Knowledge of the normal splenic size range and the ratio of the spleen to the left kidney in a sample being analyzed is essential as the normal size of the spleen can change due to various medical conditions [22]. Diseases such as malaria, anemia, and portal hypertension are associated with splenomegaly [23]. Upper limit for S/K ratio is 1.3 and mean value is 1 for all age groups [24]. Splenomegaly should be suspected in those subjects whose value exceeds 1.3 [25]. It has been proven that there are also racial variations in spleen size [26]. Ultrasound is a non-invasive, well-accepted, reliable, and fast approach for the determination of the spleen to kidney ratio. This study has emerged as a potential approach for detecting mild splenomegaly that is not palpable clinically. This current study might be made more accessible to a wider audience by using population charts to account for demographic variations in the spleen to kidney ratio. The comparison of spleen and left kidney length served as the benchmark for determining splenic size [21]. The left kidney is located inferior to the spleen and is about 7-12cm in a longitudinal plane. Knowledge of the normal splenic size range and the ratio of the spleen to the left kidney in a sample being analyzed is essential as the normal size of the spleen can change due to various medical conditions [22]. Diseases such as malaria, anemia, and portal hypertension are associated with splenomegaly

[23]. Upper limit for S/K ratio is 1.3 and mean value is 1 for all age groups [24]. Splenomegaly should be suspected in those subjects whose value exceeds 1.3 [25]. It has been proven that there are also racial variations in spleen size [26]. Ultrasound is a non-invasive, well-accepted, reliable, and fast approach for the determination of the spleen to kidney ratio. This study has emerged as a potential approach for detecting mild splenomegaly that is not palpable clinically. This current study might be made more accessible to a wider audience by using population charts to account for demographic variations in the spleen to kidney ratio.

METHODS

It is a cross-sectional study conducted at a private health care center in Sialkot. The sample size was calculated using a convenient sampling technique and considered from a previously published study [13]. This study included 101 school-going children ranging in age from 8 to 15 years, all of whom had normal spleen and kidneys. Patients with spleen and kidney pathologies as well as subjects over the age of 15 years were excluded from this study. Each subject's demographic information was taken into account including age, gender, height, and weight. A SonoAce 100 ultrasound machine with a 3.5MHz convex transducer was used to perform trans-abdominal examination. Water-based ultrasound gel was applied to the area of examination. The scan was performed in the right lateral decubitus position and the length of the spleen and the left kidney was measured. Data analysis was done by using SPSS version 28.

RESULTS

Table 1 is showing 101 subjects including 54 boys (53.5%) and 47 girls (46.5%). Table 2 is showing children between 12-13 years and 8-9 years are highest in frequency. Table 3 shows the mean age of the subjects is 11.11 ± 2.16 years, the mean height is 134.2 ± 12.69 cm and the mean weight of the subjects is 34.5 ± 10.36 Kg. The mean of spleen length is 9.67 ± 1.25 cm, the mean of kidney length is 8.69 ± 1.16 cm and the mean S/K ratio is 1.1 ± 0.07 . Table 4 shows that age is divided into four groups. The mean S/K ratio increases from 1.13 ± 0.07 to 1.14 ± 0.09 for children of 8-9 years and 10-11 years. For 12-13 and 14-15 years of children, the S/K ratio decreases gradually with the mean value of 1.08 ± 0.05 and 1.06 ± 0.03 respectively. Table 5 is showing the mean spleen and left kidney length was almost the same in both boys and girls. The mean S/K ratio for girls was less (1.08 ± 0.05) as compared to boys is (1.13 ± 0.08).

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Girls	47	46.5	46.5	46.5
	Boys	54	53.5	53.5	100.0
	Total	101	100.0	100.0	

Table 1: Showing Gender of Subjects

Age (years)		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	8-9	29	28.7	28.7	28.7
	10-11	24	23.8	23.8	52.5
	12-13	30	29.7	29.7	82.2
	14-15	18	17.8	17.8	100.0
	Total	101	100.0	100.0	

Table 2: Shows the frequency of subjects according to age groups

Variables	N	Minimum	Maximum	Mean	SD
Age	101	8.00	15.00	11.1188	2.16003
Weight	101	19.00	61.00	34.5644	10.36090
Height	101	110.00	160.00	134.2970	12.69058
Spleen length	101	6.80	12.80	9.6772	1.25107
kidney length	101	6.30	11.80	8.6960	1.16618
Spleen to kidney ratio	101	.94	1.30	1.1104	.07513
Valid N(listwise)	101				

Table 3: Shows Descriptive Statistics of variables

Age	Mean	N	SD	SE of Mean
8-9 years	1.1338	29	.07552	.01402
10-11 years	1.1454	24	.09084	.01854
12-13 years	1.0877	30	.05782	.01056
14-15 years	1.0639	18	.03274	.00772
Total	1.1104	101	.07513	.00748

Table 4: Shows the mean of S/K ratio according to age groups

Length	Gender	N	Mean	SD	SE Mean
Spleen length	Girls	47	9.4617	1.19684	.17458
	Boys	54	9.8648	1.27785	.17389
kidney length	Girls	47	8.6766	1.17699	.17168
	Boys	54	8.7185	1.17346	.15969
Spleen to kidney ratio	Girls	47	1.0868	.05394	.00787
	Boys	54	1.1309	.08486	.01155

Table 5: Showing group statistics according to gender

DISCUSSION

Sonographic assessment of the S/K ratio is important in the early diagnosis of mild splenomegaly among children as well as adults. The goal of this study was to measure the spleen to kidney ratio in children for the assessment of splenomegaly. In the current study, 101 school-going children of 8-15 years old were included. All of the participants had normal spleen and kidneys without any disorders such as malaria, anemia, or portal hypertension. The current study showed that the mean spleen length and kidney length were almost the same. This was also proved in a study by Taha Elserag et al. published in 2021 and a study by Eze CU et al. published in 2014 that spleen and kidney lengths were not significantly different between boys and girls. Furthermore, data demonstrated that sex hormones had no role in the growth of the spleen and

kidney in children of age 8-15 years. This led to the other method of detection of mild splenomegaly in children i.e. sonographic assessment of spleen to kidney ratio. In this study, the minimum and maximum values of the spleen to kidney ratio were 0.94 and 1.3. Splenomegaly should be suspected in those children whose ratio of the spleen to left kidney exceeds 1.3 in the absence of kidney disorders. This result was the same as a study conducted by Shivanand V Patil et al. published in 2020, stating that the upper limit for the S/K ratio is 1.3. The current study showed that the ratio of the spleen to the left kidney was greater in boys as compared to girls. This was also proved by the study of Awadia G Suliman et al. published in 2019 that was conducted on the pediatric population. He found that there was a minor change in the ratio of the spleen to the left kidney between boys and girls. Spleen and kidney dimensions were slightly marked up in boys than in girls. This study showed that the mean ratio of the spleen to left kidney in all age groups was almost 1.1 ± 0.075 . There was just a minor difference of measurements that is not significant statistically. A study by Awadia G Suliman et al. published in 2019 also stated the same findings that the S/K ratio was the same for all ages and the mean value of the S/K ratio is 1.13 with an upper limit of 1.3.

CONCLUSION

It was concluded that ultrasound is the best modality to detect a minor increase in splenic size. In this study, the S/K ratio among Children was constant at about 1.11 with a minimum value of 0.94 and a maximum value of 1.3. Splenomegaly should be suspected in those subjects whose ratio of the spleen to the left kidney exceeds 1.3. There was a significant difference in the splenic size of boys and girls. S/K ratio in boys was greater than in girls.

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