Original Article

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Normal Splenic Size in Children from 1 to 5 year of Age: Sonographic Measurements

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Abstract

The spleen is an organ found in virtually all vertebrates. Similar in structure to a large lymph node, it acts primarily as a blood filter. The spleen plays important roles in regard to red blood cells (also referred to as erythrocytes) and the immune system. It removes old red blood cells and holds a reserve of blood, which can be valuable in case of hemorrhagic shock, and also recycles iron. As a part of the mononuclear phagocyte system, it metabolizes hemoglobin removed from senescentred blood cells (erythrocyte). The spleen is brownish in color and is located in the left upper quadrant of the abdomen. The purpose of this study was to establish guidelines for normal splenic size at different ages by using a simple and reproducible sonographic method. In our study span of 1 year we examined spleen on children from 1 to 6 year who had sonography because of abdominal and/or pelvic problems unrelated to the spleen. Findings on sonograms of the liver and kidneys were normal in all cases. Splenic size was measured by obtaining a coronal view that included the hilum, while the patient was breathing quietly. The greatest longitudinal distance between the dome of the spleen and the tip (splenic length) was measured and correlated with age, height, and weight. The following guidelines are proposed for the upper limit of normal splenic length based on this simple, easy to use, one-measurement technique: 7.0 cm at 12 months, 8.0 cm at 2 years, 9.0 at 4 years, 9.5 cm at 6 years. Normal values of a single measurement of the greatest longitudinal diameter of the spleen, from the dome to the tip measured at the hilum in the coronal plane, were obtained in patients from 1 to 6 years.

Keywords: Spleen; Ultrasonography.

Introduction

Evaluation of splenic size by percussion and palpation is notoriously inaccurate. Radiologic methods and scintigraphy, although dependable, require radiation exposure. The calculation of splenic volume in children by using sonographic measurements can be cumbersome and time-consuming and therefore impractical for routine clinical use [1]. The purpose of this study was to establish guidelines for normal splenic size at different ages by using a simple and reproducible sonographic method. Fifty patients, from 1 year to 6-year-old, had sonography because of abdominal and/or pelvic problems unrelated to the spleen. Findings on sonograms of the liver and kidneys were normal in all cases. Splenic size was measured by obtaining a coronal view that included the hilum, while the patient was breathing quietly [2]. The greatest longitudinal distance between the dome of the spleen and the tip (splenic length) was measured and correlated with age, height, and weight Twenty-two patients with known abnormalities of the spleen were randomly selected and their splenic lengths compared with the proposed guidelines; in each case, the length of the spleen exceeded the upper limit of normal for that age [3].

Material and Methods

We prospectively studied 40 nonconsecutive patients, including 25 boys and 25 girls. The patients selected for the study were being evaluated

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sonographically for abdominal and/or pelvic problems unrelated to the spleen, most often because of urinary tract infection or abdominal pain [4]. They had no history of disease related to the liver or spleen and no gastrointestinal, hematologic, oncologic, or traumatic conditions. Their liver and both kidneys had to be normal in size, position, and echotexture to qualify for inclusion in the study. Splenic length was measured sonographically during quiet breathing with the patient supine or in a slightly right lateral decubitus position [5]. Firstly In 8 of these patients, we measured four different parameters. On the transverse coronal image, a measurement of the width of the spleen was made at the hilum, followed by a depth measurement taken at a point bisecting the line indicating the width. The width of the spleen was also measured at the hilum on a longitudinal coronal image and the maximal splenic length, determined optically, was made in a plane where the hilum was visualized (Figure 1). As it became obvious that the only reliable, reproducible measurement was the one made in the longitudinal coronal plane, we obtained only this measurement in rest 32 patients. The data were plotted as a function of age in months, sex, height, and weight. We ascertained that the height and weight of our patients followed normal growth curves. We compared the maximal coronal measurement of each enlarged spleen with the upper limit of normal seen in the same age group in our normal population [6].

Result

A roughly logarithmic correlation between splenic length and age (r = .7) was found for the total group of 40 children (Figure 2). Likewise, good correlation was found between splenic length and patient's height (r = .73) and weight (r = .78). No statistically significant difference was seen between boys and girls. The data were grouped by age, and calculations of the median splenic length and the 10th and 90th percentile were made for each group (Table 2). These results are shown graphically in Figure 3. A suggested upper limit of normal was derived by using the next highest whole integer above the 90th percentile Figure. Note that exceptions were made for three groups in which a half integer higher was thought to be more appropriate. In all the children with clinically obvious splenomegaly, the splenic length exceeded the suggested upper limit of normal (Figure 4).

Table 1: Median splenic length in children from 1 to 5 year

Age (*n* = 18)	Male (*n* = 22)	Female
1-2 years	7.4 (*n* = 5)	6.8 (*n* = 8)
2-4 years	7.3 (*n* = 6)	7.5 (*n* = 9)
4-6 years	7.8 (*n* = 11)	7.8 (*n* = 11)

Table 2: Age and Splenic Length in 40 Children

Age	(Number)		Length o f Spleen (cm)	
10th%ile	Median	90th %ile	suggested upper limit	
1-2years *(n=07)*	5.4	6.9	7.5	8.0
2-4years (*n* = 14)	6.4	7.4	8.6	9.0
4-6 years (*n* = 19)	6.9	7.8	8.8	9.5
Female	9.0	10.0	11.7	12.0
Male	10.1	11.2	12.6	13.0

Fig. 1: Coronal sonography of spleen: Maximal splenic length, determined optically is measured in longitudinal coronal plane with visible splenic hilum.

Discussion

Discussion Sonography provides a simple, practical, reliable means for obtaining splenic length measurements in children. Our technique, however, does not allow volume measurements as other authors' techniques have, but instead serves as a guide for selecting those patients who require more

quantitative estimations of splenic size. Several groups have determined normal splenic volume and weight [7]. He noted that splenic weight decreases from 20 to 29 years of age and above 60 years, but is relatively constant from 30 to 59 years. He also observed that splenic weight is lower in women than in men [8]. For practical everyday use and suggest the following upper-limit guidelines for sonographically assessing splenic length in children with our one-step coronal measurement 1 -2 years: 8.0 cm; 2-4 years: 9.0 cm; 4- 6 years, 9.5 cm [9,10].

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