

ULTRASOUND RELATION BETWEEN THE DIMENSIONS OF THE SPLEEN AND LEFT KIDNEY IN CHILDREN

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Abstract: Spleen and left kidney are anatomically close. A parallel ultrasound investigation of the spleen and the left kidney may show to what extent there is a concordance between the two organs in children and whether the ratio varies with age. The absence of gender differences in the dimensions of both ultrasound of left kidney and spleen suggests a non-involvement of sex hormones in the development of these organs until the age of 17 years. The study shows that the transverse diameter of the spleen is a more precise ultrasound parameter in assessing spleen size in children and the relationship between subject's height and spleen's size as a criterion is confirmed by ultrasound evaluation.

Cuvinte cheie: splină, rinichi stâng, copil, ecografie

Rezumat: Splina și rinichiul stâng se află în vecinătate anatomică. O investigație paralelă între splină și rinichiul stâng poate arăta în ce măsură există concordanță între cele două organe la copil și dacă prezintă variații în raport cu vârsta. Absența diferențelor pe sexe ale dimensiunilor ecografice atât ale splinei cât și ale rinichiului stâng sugerează neimplicarea hormonilor sexuali în dezvoltarea acestor organe până la vârsta de 17 ani. Studiul arată că diametrul transversal al splinei este un parametru ecografic mai precis în evaluarea dimensiunilor splinei la copil și că relația dintre înălțimea subiectului și dimensiunile splinei se confirmă a fi un criteriu de evaluare ecografică.

INTRODUCTION

The kidneys are paired organs, placed symmetrically retroperitoneal in the lumbar-diaphragmatic fossae. The sizes of the kidneys vary according to age and their functional status. The shape of the kidney has been compared with that of a "bean", vertically oriented with an anterior-medial concavity. On the left, the anatomic relations of the kidney are with the left colic flexure, the renal side of the spleen, the pancreas body, the back part of the stomach and small intestine. The spleen is located in the left hypochondrium, in the splenic lodge. By the visceral surface, the spleen has relations with the body of the stomach, the kidney and the left suprarenal gland, respectively with the left colic flexure and the transverse mesocolon. A parallel investigation of the spleen and left kidney may show to what extent there is a concordance between the two organs in children and whether the ratio varies with age.

THE PURPOSE OF THE STUDY

Our study proposes to investigate concomitantly the spleen and the left kidney to show the concordance between the two organs in child and if there are any variations with the age.

MATERIAL AND METHODS

The study includes 158 children (79 girls and 79 boys), with similar age ($p = 0.94$) and height ($p = 0.76$) from Sibiu county and has been developed during January 2008-March 2009.

The anthropometric data and the organ size values obtained from the ultrasound investigations have been recorded in the patient's chart. The medical examination has been performed with a Medison 8800-MT with opportunities for review in 2D, Color Doppler and Power Doppler.

The patient's sedation during the medical exam was

not necessary. The values obtained after measuring the spleen and left kidney have been grouped according to age and we have calculated the average values for each age group. We have studied the relations between the ultrasound values of spleen length, transverse diameter of the spleen, left kidney length, age, birth weight, length and sex of the child.

The statistical evaluations of data we have performed were with the factorial analysis of variance (ANOVA) and the Spearman's rank correlation coefficient, with the level of significance $p \leq 0.05$.

RESULTS AND DISCUSSIONS

The mean values of the spleen length have been in progressive increase ($r = 0.75$) with age and correlated ($p = 0.000$) with the height of the subjects, but also with some individual features certified by a high standard deviation. The length of the left kidney presented a progressive increase with age ($r = 0.75$) (Figure 1).

The left kidney length has reached adult values at the age of 15 years, unlike the spleen which has shown a different growth rate from the left kidney, she didn't reach the adult values at this age (Table I).

The length of the left kidney has been correlated with the children's age ($r = 0.83$) and height ($r = 0.87$).

The parents have been very compliant; they have shown a great interest in their children's health. The study showed a close correlation between the length and transverse diameter of the spleen and left kidney length. These parameters have been correlated with the children's height. The dynamics of the length of the left kidney recorded in the present study (1) has recorded a decline at the age of five years, which we think it is due to the small number of cases (2) and to the individual variations in this subgroup certified by the high standard

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deviation. It seems this didn't influence the variance analysis, the dynamic of the left kidney length presenting a smooth and uniform increase. There haven't been any ultrasound differences of the two organs in relation to the gender.

Figure no. 1. Variation of the left kidney length by age

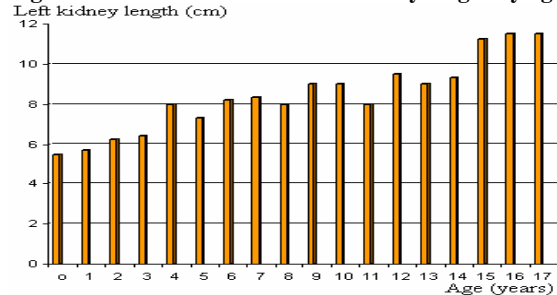


Table no. I. The sizes of the spleen and left kidney by age

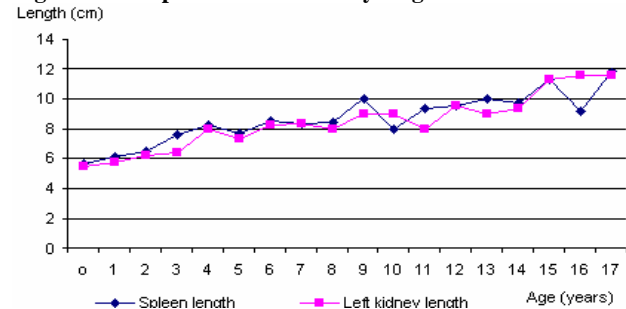
Age (years)	Spleen		Left Kidney
	Length (cm)	Transverse diameter (cm)	Length (cm)
0	5,66 ± 0,516	2,66 ± 0,516	5,50 ± 0,548
1	6,10 ± 0,937	3,15 ± 0,375	5,73 ± 0,806
2	6,50 ± 0,535	3,25 ± 0,463	6,25 ± 0,786
3	7,57 ± 1,397	3,57 ± 0,535	6,42 ± 1,134
4	8,25 ± 0,500	3,50 ± 0,577	8,00 ± 0,00
5	7,66 ± 1,211	3,83 ± 0,408	7,33 ± 1,211
6	8,50 ± 0,527	4,00 ± 0,327	8,20 ± 0,422
7	8,33 ± 0,577	4,00 ± 0,383	8,33 ± 0,577
8	8,40 ± 0,894	4,20 ± 0,447	8,00 ± 0,453
9	10,00 ± 0,000	5,00 ± 0,256	9,00 ± 0,556
10	8,00 ± 0,000	4,00 ± 0,355	9,00 ± 0,527
11	9,33 ± 0,577	4,66 ± 0,577	8,00 ± 1,000
12	9,50 ± 0,707	5,00 ± 0,533	9,50 ± 0,707
13	10,00 ± 0,000	5,00 ± 0,475	9,00 ± 0,337
14	9,66 ± 0,577	5,00 ± 0,337	9,33 ± 0,577
15	11,25 ± 0,957	5,00 ± 0,466	11,25 ± 0,500
16	9,16 ± 2,137	4,833 ± 0,408	11,50 ± 1,049
17	11,80 ± 0,919	5,500 ± 0,527	11,50 ± 0,527
P	P= 0,000	p= 0,000	p= 0,000

The mean values of the length of both the spleen and left kidney length have been correlated with the height of each child, indicating a consistent increase by age, and reporting the dimensions of these organs to the child's height dimensions seems to be an accurate criterion in the ultrasound assessment of a healthy child. The average size of the length of the spleen and of the left kidney in the children investigated in this study (1) fall in the values observed by Zebouni Haddad, et al. (3) in children aged 0-15 years in Lebanon and by Safak et al. (4) in schoolchildren aged 7-15 years in Turkey, which stands for no geographic or socio economic differences. The results of this study argue for a different pace of growth of spleen and left kidney after 15 years of age. In the scientific literature we didn't find any reports about the transverse diameter of the spleen in children. The decrease of the length of the left kidney at the age of 5 years is not reflected in the values of the transverse diameter of the spleen at this age, which confirms the existence of own growth rhythms of the two parameters detected by ultrasound.

In assessing the spleen size there have been used different techniques. Some of them were used for the measurement of serial sections by planimetry and for the volume calculation by adding values for each section (5,6). However, these techniques are cumbersome and not very popular (7). As with other parts of the body, it is helpful to have measurements to determine the upper limits of normal. The wide range of normal spleen size values, combined with a complex three-dimensional form, makes the establishing of the normal range of the

ultrasound measurements more difficult. These measurements may be useful in borderline cases (8). Rosenberg and collaborators use an image that includes both the hilum and the maximum longitudinal distance for ultrasound evaluation of the spleen in infants and children (9). Because the ultrasound investigations have shown no sex differences in the sizes of both spleen and left kidney, which have been found by other researchers, the sex hormones seem not to be involved in the development of these organs until the of age 17 years (Figure 2).

Figure no. 2. Spleen and left kidney length



CONCLUSIONS

1. The length of the spleen in the healthy children is in a close relation with the increasing age of the children, with his length or with his height, without any sexual differences.
2. The transversal diameter of the spleen is in close relation with the increasing in age of the children, with no differences in the gender.
3. The transversal diameter of the spleen is a more precise ecographic parameter in the evaluation of the spleen dimensions.
4. The relation between the subject's height and the spleen dimensions is confirmed to be an ecographical evaluation criterion.

REFERENCES

1. Achim O.F.: Raportul lungime splină/lungime rinichi stâng în evaluarea splenomegaliei la copii., Jurnalul Român de Pediatrie. 2005; vol.IV, nr.4: 29-33.
2. Emery KH.: Splenic emergencies. Radiol Clin North Am, 1997, 35, 831-843.
3. Haddad-Zebouni S, Hindy R, Slaba S, Aoun N, Mourani C, Abi Ghanem S, Attalah N: Evaluation Echographique de la Taille des Reins, du Foie et de la Rate chez L Enfant. Arch Pediatr 1999; 6: 1266-70.
4. Safak A, Simsek E, Bahcebasi T: Sonographic Assessment of the Normal Limits and Percentile Curves of Liver, Spleen, and Kidney Dimensions in Healthy School-Aged Children. J Ultrasound Med 2005; 24: 1359-1364.
5. Schlesinger A.E., Edgar K.A., Boxer I.A.: Volume of the splin in children as measured on CT scans: normal standards as a function of body weight. AJR. 1993; 160: 1107-1109.
6. Breiman R.S., Breck J.W., Korobkin M.: Volume determinations using computed tomography. AJR. 1982; 138: 329-333.
7. Markisz J.A., Treves S.T., Davis R.T.: Normal hepatic and splenic size in children: scintigraphic determination. Pediatr. Radiol. 1987; 17: 273-276.
8. Mathieson J.R., Cooperberg P.L.: The spleen. Diagnostic ultrasound (Eds. Rumack C.M., Wilson S.R. and Charboneau J.W.), Mosby, St.Louis 1991: 87-10.
9. Rosenberg H.K., Markowitz R.I., Kolberg H., Park C., Hubbard A., Bellah R.D.: Normal splenic size in infants and children: sonographic measurements. AJR. 1991; 157: 119-121.