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Anatomical Measurement of Kidneys, Liver and Spleen by Ultrasonography among Children 6 months to 15 Years Old

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Abstract **Original Research Article**

Objective: In this study our main objective is to develop a standard chart of anatomical measurement value of kidneys, liver and spleen by ultrasonography in children age group, so that Sonologist can use this chart as a standard reference of pediatrics age group. ***Method:*** This cross-sectional study was carried out at Patuakhali Medical College Hospital, Patuakhali. 100 patients were enrolled in this study aging between 6 months to 15years-visiting the outpatient and inpatient department of pediatrics of this college for different health problems. In this study 6months to 1year old children regarded as Group-1(n=7), 1years to 5 years old children regarded as Group-2(n=31), 5years to 10 years old children regarded as Group-3(n=51) and 10 years to 15 years old children regarded as Group-4(n=11)**.** ***Result:*** In group -1 and group-4 majority children were male and in group -2 and group-3 majority children were female. Assessments of size of liver, both kidneys and spleen according to age and gender-shows more significant variation of size with the variation of age, less significant variation of size with gender and between left and right kidneys. **In Age Group-1: Male** -Liver span varies from 4.56 cm to 8.02 cm, Spleen 4.59x3.38 cm to 6.40 x3.45cm, Right kidney 5.11x2.20cm to 6.45x3.14 cm, Left kidney 5.04 x1.82cm to 6.02x3.03 cm**. Female**- Liver span varies from 4.2 cm to 7.6cm, Spleen4.68x1.6cm to 6.68 x3.02cm, Right kidney 5.1x2.58 cm to 5.59x2.67 cm, Left kidney4.96 x2.67 cm to 5x2.68 cm. **In Age Group-2: Male**-Liver span varies from 6.45 cm to10.2 cm, Spleen 5.71x3.29 to7.56x4.46cm, Right kidney 5.51x2.42 cm to 6.88x3.1cm, Left kidney 5.15x319 cm to7.21x3.43cm. **Female**- Liver span varies from 7.17 cm to10.5 cm, Spleen 5.29x3.12cm to 7.74x4.99 cm, Right kidney 5.55x3.19cm to 8.08x2.91cm, Left kidney 4.96x2.67 cm to 8.86x3.74 cm. **In Age Group-3: Male**-Liver span varies from 7.65 cm-11.8 cm, Spleen4.42x3.95 cm to 9.45cm x4.68cm, Right kidney 6.79x2.73cm to 9.11x3.76 cm, Left kidney6.62x2.85cm to 9.82x3.13 cm. **Female**-Liver span varies from 7.23cm to 11.9cm, Spleen 5.9x3.28 cm to 8.06x4.75cm, Right kidney 6.31x2.97cm to 9.11x3.76 cm, Left kidney6.28x3.75cm to 9.82x3.13 cm. **In Age Group-4: Male**-Liver span varies from7.65 cm to10.6 cm, Spleen 4.42x3.95 cm to 8.42x4.07, Right kidney 7.22x7.71 cm to9.75x3.81cm, and Left kidney6.84x3.74 cm to 9.47x3.85cm. **Female**-Liver span varies from8.14 cm to 8.26cm, Spleen 5.87x5.18 cm to8.52x4.62cm, Right kidney8.11x3.09cm to 9.27x3.49 cm, Left kidney9.05x2.78cm to 9.81x4.22 cm. ***Conclusion:*** Longitudinal parameters of liver, spleen and kidneys correlated with age and gender. There was a statistically difference of the longitudinal length of liver between two gender-more in female than in male. The result of this study shows that Ultrasonologist can be use this value as a slandered guide to interpret the normal size of the liver, spleen and kidneys of the children age group.

Keywords: Anatomical measurement of the liver, spleen and kidneys of the children by ultrasonography.

INTRODUCTION

The normal size of the liver, spleen and kidneys of the children varies greatly with age. Many illnesses ranging from infectious process to malignant condition might have an impact on their growth [1, 2].

Palpation and percussion are the conventional bedside procedure for measuring liver and spleen size. However this is insufficient for detecting minor changes in size of abdominal organ.

To be clinically palpable the spleen must be enlarged two to three times of its normal size. Yet it may be palpable in 15-17 percent of healthy neonates and 10% of healthy children [3, 4].

Clinical Palpation and percussion evaluation of hepatomegaly has also been demonstrated t be inaccurate and unreliable [5].

However in recent days ultrasonography is a non-invasive, established, safe, quick and accurate method for measurement of the liver, spleen and kidneys size.

In this study our main goal is effective use of ultrasound for anatomical measurement of kidneys, liver and spleen in children age group and develop a standard chart, so that Sonologist can use this chart as a standard reference for pediatrics age group.

OBJECTIVE

Effective use of ultrasonography for anatomical measurement of kidneys, liver and spleen in in children age group.

METHODOLOGY

This cross-sectional study was carried out at Patuakhali Medical College Hospital, Patuakhali from January 2021 to December 2021.

100 patients were enrolled in this study aging between 6 months to 15years-visiting the outpatient and admitted into inpatient department of pediatrics of this college for different health problems except liver, spleen and kidney disease.

In this study 100 patients were enrolled, among them 6 months to 1year old children regarded as Group-1(n=7), 1year to 5 years old children regarded as Group-2(n=31), 5years to 10 years old children regarded as Group-3(n=51) and 10 years to 15 years old children regarded as Group-4(n=11).

During the study, any child under evaluation for follow up case of a condition which could affect the size of the spleen or liver e.g. viral hepatitis, malaria, hemolytic anemia, enteric fever, congestive heart failure and malnutrition were not included in the study.

All collected data were coding and input in SPSS-25 for further analysis. Both descriptive and inferential statistics done. Descriptive statistics included in frequency distribution, percent, graph, tables and figures.

DATA ANALYSIS

- In this study 100 patients were enrolled.
- This studied age group also distributed into 4 sub age group.

RESULT

Table-1: Distribution of studied group according to sub Age group

Age Group	Age range	Male	Female	Total
Age Group- 1	6months to 1year	5	2	7
Age Group -2	1years to 5 years	13	18	31
Age Group -3	5years to 10 years	23	28	51
Age Group -4	10 years to 15 years	9	2	11
	Total	50	50	100

Table 1 shows distribution of the measurement value according to age group between 6 months to 15 years.

Table-2: Total gender distribution

Sex	Total number	Percent
Male	50	50%
Female	50	50%

Table-2 shows total gender distribution of studied group

Table-3: Gender distribution of age Group- 1 (Age range 6months to 1year)

Sex	Total number	Percent (%)
Male	5	71.42%
Female	2	28.57%
Total	**7**	

Table 3 shows gender distribution of age group-1 where out of total number 7 –male were 5(71.42%) and female 2(28.57%).

Table-4: Range of measurement value of age group- 1(Age range 6months to 1year)

	Liver	Spleen	Right kidney	Left kidney
Male	**4.56 cm to**8.02 cm	4.59x3.38cm to 6.40 x3.45cm	5.11x2.20cm to 6.45x3.14 cm	5.04x1.82cm to 6.02x3.03 cm
Female	4.2 cm to 7.6cm	4.68x1.6cm to 6.68 x3.02cm	5.1x2.58 cm to 5.59x2.67 cm	4.96x2.67 cm to 5x2.68 cm

Table 4 shows no significant sex variation in measurement value in this age group. No significant variation between left and right kidney in measurement value in this age group.

Table-5: Sex distribution of age group -2(Age range 1 years to 5 years)

Sex	Total number	Percent
Male	13	41.93%
Female	18	58.06%
Total	**31**	

Table 5 shows sex distribution of age group-2 where out of total number 31 –male were 13(41.93%) and female 18(58.06%).

Table-6: Range of measurement value of age group-2(Age range 1 year to 5 years)

	Liver	Spleen	Right kidney	Left kidney
Male	6.45 cm to10.2 cm	5.71x3.29 to7.56x4.46cm	5.51x2.42 cm to 6.88x3.1cm	5.15x319 cm to7.21x3.43cm
Female	7.17 cm to10.5cm	5.29x3.12cm to7.74x4.99cm	5.55x3.19cm to 8.08x2.91cm	4.96x2.67 cm to 8.86x3.74 cm

Table 6 shows no significant sex variation in measurement value in this group also no significant variation between left and right kidney in measurement value in this group.

Table-7: Sex Distribution of age group-3(Age range- 5years to 10 years)

Sex	Total number	Percent
Male	23	45.09%
Female	28	54.90%
Total	**51**	

Table 7 shows sex distribution of age group-3 where out of total number 51 –male were 23 (45.09%and female 28 (54.90%).

Table-8: Range of measurement value of age group-3(Age range- 5 years to 10 years)

	Liver	Spleen	Right kidney	Left kidney
Male	7.65 cm-11.8cm	4.42x3.95 cm to 9.45cm x4.68cm	6.79x2.73cm to 9.11x3.76 cm	6.62x2.85cm to 9.82x3.13 cm
Female	7.23cm to 11.9cm	5.9x3.28 cm to 8.06x4.75cm	6.31x2.97cm to 9.11x3.76 cm	6.28x3.75cm to 9.82x3.13 cm

Table 8 shows no significant sex variation in measurement value in this group also no significant variation between left and right kidney in measurement value in this group.

Table-9: Sex Distribution According of age group-4 (Age range 10 years to 15 years)

Sex	Total number	Percent
Male	9	81.81%
Female	2	18.18%
Total	**11**	

Table 9 shows sex distribution of age group-4 where out of total number 11 –male were 9 (81.81%%and female 2 (18.18%).

Table-10: Range of measurement value group -4(Age range 10 years to 15 years)

	Liver	Spleen	Right kidney	Left kidney
Male	7.65 cm to10.6 cm	4.42x3.95 cm to 8.42x4.07	7.22x7.71 cm to9.75x3.81cm	6.84x3.74 cm to 9.47x3.85cm
Female	8.14 cm to 8.26cm	5.87x5.18 cm to8.52x4.62cm	8.11x3.09cm to 9.27x3.49 cm	9.05x2.78cm to 9.81x4.22 cm

In table 10 shows significant variation in measurement value with age in this study group. No significant gender variation in measurement value in this study group and no significant variation in measurement value between left and right kidney in this study group.

DISCUSSION

Normal percentiles of the liver, spleen and kidneys have been previously described by age and height [6]. However, in our cases part from age, we took gender as a parameter, where longitudinal parameters of liver, spleen and kidneys are measured, were highly correlated with gender, similar to findings of previous studies [7-9].

Age was also correlated with organ dimensions but not to the extent of gender. This is clearly seen in age being a predictor of the dimensions of all organs, unlike gender-which was supported by one study where percentile curves of the liver, spleen and kidneys were thus defined according to age categories [10].

There was no significant difference in the longitudinal measurement of the liver, spleen and kidneys between the sexes as reported by many other authors [11, 12]. However, there was a significant difference in the longitudinal length of liver between two sexes.

One study also reported that the difference in the longitudinal length of the kidneys is negligible [13]. In comparing the normal parameters of abdominal organs on ultrasonography assessment, it was found that the liver span was significantly lower in the present study compared to other study [14]. Another study has reported a mean renal length for children in India by age [15].

CONCLUSION

Longitudinal parameters of liver, spleen and kidneys correlated with age and gender. There was a statistically difference of the longitudinal length of liver between two gender-more in female than in male.

The result of this study shows that Sonologist can be use this value as a standard guide to interpret the normal size of the liver, spleen and kidneys of the children age group.

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