

Liver Size In Childhood

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Summary

Akinbami FO and Akindele JA. Liver Size in Childhood. *Nigerian Journal of Paediatrics* 1992; 19:89. In an effort to establish normal values for Nigerian children, liver span was measured in 527 healthy children, aged between three and ten years. As determined by percussion, the upper hepatic border coincided with the 5th right intercostal space in 65 percent of the children, while the lower border was at the right costal margin in 93 percent. The mean liver span ranged from 4.1 - 6.3cm and increased with increasing age. Age and height were found to be the major predictors of liver size ($r = 0.59$; $p < 0.001$). Liver span was, not related to sex, weight, head, chest or mid-arm circumferences.

Introduction

Estimation of the liver size is an essential part of the routine clinical examination of children. The clinical evaluation of the liver size by palpation of the lower border alone, at the right mid-clavicular line (MCL), is a well-known practice. This method of evaluation is however, influenced by variations in the liver axis, the presence or absence of a Riedel lobe and the position of the diaphragm and may therefore, not give a reliable result. Other methods of assessing liver size, such as determining the liver span by percussion of the upper border and palpation, or percussion of the lower border and multiple radiographs have been used and found to be superior to palpation alone, in assessing hepatomegaly.¹⁻⁴ Although normal values of liver size in children have been obtained else-

where,³⁻⁵ to our knowledge, there is no published data on normal liver size in Nigerian children. The present study was thus undertaken to obtain reference values of liver size for Nigerian children, aged between three and ten years.

Subjects and Methods

Five hundred and twenty seven apparently healthy children (285 boys and 242 girls) were selected from three Nursery and primary schools in Ibadan. Their ages ranged from three to ten years (median age, 6.3 years). The following criteria obtained from clinical examination, were used in patient selection: (a) absence of abnormality of any organ which might affect the position or size of the liver, or preclude its accurate measurement, (b) absence of liver disease, such as jaundice from any cause and (c) absence of history and signs suggestive of haemoglobinopathy. The following data were recorded: liver span, age in years, sex, weight, height, occipitofrontal circumference (OFC), mid-upper arm circumference (MAC) and chest circumference (CC).

Liver span measurement was made in the

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supine position, along the right MCL in all the subjects and at full inspiration in those older than five years and where possible also, in the younger children. The level of the lower edge of the liver was determined both by palpation and by gentle percussion, starting at the right lower abdominal quadrant and ascending toward the liver. The lower edge was taken as the point of distinct change in the percussion note from resonant to dull. This point was then recorded with a skin-marker pen. The upper border was located by percussion along the MCL in a downward direction from the clavicle and the point of distinct change in percussion note was similarly marked. The distance between the two pen-marks was measured with a steel tape and recorded in centimetres. Similarly, the distance between the lower edge of the liver and the costal margin in the right MCL was also measured. The measurements were repeated independently, on all subjects by the second investigator (JAA), after completely removing the pen marks from the initial measurements. The liver span for each subject was taken as the mean of the measurements by the two investigators. In the first 50 subjects, the measurements were made in duplicate by both investigators and the results were compared for intra-observer reproducibility.

Statistical analysis of the data was performed, using a multiple linear regression, analysis of variance and Pearson's correlation coefficient.

Results

The difference between duplicate liver span values did not exceed 0.5cm in any of the 50 subjects, measured by either of the investigators. The mean difference for each investigator was 0.35cm and 0.3cm, respectively. There was also no significant difference ($p > 0.05$) between corresponding liver measurements in all the subjects by the two investigators. The upper liver

border was at the level of 5th right intercostal space in 342 (65 percent) of the 527 subjects and in the remaining 185 (35 percent), was found to be either in the 4th or 6th intercostal space. The lower border was at the right costal margin in 490 (93 percent) and in the remaining 37 children, most of whom were below six years of age, the lower edge was palpable 1-3cm below the costal margin along the MCL. The difference between the position of the lower liver border determined by percussion and by palpation was less than 0.5cm in 510 cases.

The liver span ranged from 2-9cm in the 527 children and increased with increasing age, the mean of the yearly age groups ranging from 4.1-6.3cm (Table). When the predictive value of

TABLE
Liver Span in 527 Children

Age (yr.)	No of Subjects	Mean (SD)		
		Weight (kg)	Height (cm)	Liver Span (cm)
3	66	12.8 (1.4)	98 (4.0)	4.1 (0.8)
4	85	15.0 (1.7)	104 (4.9)	4.3 (1.1)
5	60	16.3 (2.0)	109 (4.7)	5.2 (1.1)
6	87	17.0 (2.1)	115.5 (4.7)	5.4 (1.1)
7	68	20.3 (2.5)	122.0 (5.3)	5.8 (1.0)
8	56	21.5 (2.7)	127.0 (6.1)	5.9 (1.1)
9	52	23.0 (2.7)	130.8 (6.0)	6.1 (1.1)
10	53	25.5 (4.2)	137.5 (7.9)	6.3 (1.1)

each variable (height, weight, age, OFC, MAL, CC sex) was determined, using the multiple linear regression analysis, only the age and height were found to strongly and positively predict the liver span ($r = 0.59$; $p < 0.001$). There was no correlation between actual liver size determined as liver span and by measuring the extension of the liver below the costal margin.

Discussion

The present study has established the normal values of liver span for apparently healthy children in the age range of three to ten years.

To the best of our knowledge, this is the first time reference values for liver size has been obtained for Nigerian children. The range of values covered by the mean liver span for the yearly age groups was similar to that obtained by Lawson *et al*⁵ for the same age range, but lower than the range of 7cm to 9cm obtained by Younoszai and Muller³ for American children. Younoszai and Muller³ determined the liver span by percussing the upper border and palpating the lower border, while in our study, percussion was used to determine both borders. Lawson *et al*⁵ have suggested that substantial quantities of air in the hepatic flexure of the colon, or an unusually thin liver edge could produce an erroneous position for the lower border, if percussion alone was used in its determination. It does not appear that the difference in technique alone would account for the difference between our data and those obtained by Younoszai and Muller,³ especially as both palpation and percussion were used to determine the lower border in our subjects, whereas they used only palpation to determine the lower border in their subjects. The different socio-economic and nutritional status between our subjects and theirs could account for the difference, Nigerian children on average, being relatively shorter and lighter than American children of the same age.⁶ In the present study, height and age were the only variables that could independently, predict liver span. This finding agrees with those of others.^{3 5 7} This finding is also to be expected, as the liver, like most other organs in the body, will increase in size and weight with increasing age and height.

The choice to determine liver span where

possible, at full inspiration, was to facilitate comparison with other studies reported in the literature and more so because a minimally enlarged liver is more likely to be felt below the costal margin during inspiration. However, liver span is independent of the position of the diaphragm or the relation of the liver to the costal margin^{1 2} and it has been shown not to vary with the phase of respiration during which it is determined.^{3 4}

A good correlation between liver span as determined by the percussion-percussion and the percussion-palpation methods was found in the present study. The range of position of both upper and lower liver borders obtained in the present study was similar to that determined radiologically by Deligeorgis *et al*.⁴ As has been previously observed in the literature¹⁻³ and in the present study, the distance the liver edge protrudes below the costal margin is an unreliable index of liver size. The practice of measuring liver size by determining the distance the liver edge projects below the costal margin by palpation, is inaccurate, being influenced by changes in the position of the liver^{3 5} and its use should be discontinued. When attempting to establish the presence of hepatomegaly during clinical examination, measurement of the liver size should be made and recorded as the liver span.

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