

The Normal Borders of the Liver in Infancy and Childhood

Clinical and X-ray Study

D. DELIGEORGIS, D. YANNAKOS, P. PANAYOTOU, and S. DOXIADIS

From the Queen Anna Maria Institute of Child Health, and the 'Agia Sophia' Children's Hospital, Athens, Greece

Deligeorgis, D., Yannakos, D., Panayotou, P., and Doxiadis, S. (1970). *Archives of Disease in Childhood*, 45, 702. **The normal borders of the liver in infancy and childhood. Clinical and x-ray study.** In 365 healthy infants and children the normal range of the liver borders was defined by clinical and x-ray examination. It was found that in supine position and at the end of expiration the liver edge projects considerably below the costal margin in newborns and infants, and as the age increases the liver edge approaches the costal margin. In a considerable number of infants up to 6 months, the liver edge projects 3.0 to 3.5 cm. In children 10 to 16 years, the liver edge usually projects no more than 1 cm., though in occasional cases as much as 2 cm. below the costal margin. The clinical and x-ray examinations were in agreement in 95% of the cases.

Estimation of the liver borders is always included in a clinical examination of any child, but the question frequently arises as to whether the liver is normal in size or enlarged.

Few studies have been reported on the normal range of liver borders in infancy and childhood, and the results of these studies do not agree with each other. Standard textbooks give vague descriptions and do not define positions and phases of respiration (Logan, 1969; Nelson, 1964; Caffey, 1961).

The present study was undertaken to define the normal range of the liver borders in infancy and childhood by clinical and x-ray examination, using stricter criteria for the selection of normal infants and children.

Material and Methods

Healthy infants and children between birth and 16 years were selected from maternity hospitals, orphanages, and schools according to the following criteria.

- (1) Good general condition.
- (2) No history of disease which might have affected the liver, such as jaundice from any cause, typhoid fever, kala-azar, brucellosis, etc., or of any infection in the previous 10 days.
- (3) Clinical examination: absence of any indication of

abnormality of any organ, which might affect the position or the size of the liver or which might accompany hepatomegaly, such as chest deformities, organic cardiac murmurs, palpable abdominal masses, palpable spleen at the end of expiration, or enlarged lymph nodes.

(4) Laboratory data: Hb > 8.5 g./100 ml. Exclusion of congenital haemolytic anaemias by examination of the red cell morphology and, if necessary, sickle-cell test and electrophoresis of haemoglobin.

In all, 365 children, 193 males and 172 females, fulfilled these criteria. These were 20 neonates, 32 from 1-5 months, 33 from 6-11 months, 27 from 12-23 months, 43 from 2-4 years, 76 from 5-9 years, 134 from 10-16 years.

During the clinical examination each child was lying supine without a pillow, with the lower extremities extended and the upper extremities parallel to the body. All the measurements were made in the end-expiratory position 1 to 2 hours after a light morning meal. It was not always possible to assess with accuracy the end of expiration in small babies.

The upper borders of the liver were estimated by percussion in the right midclavicular line, and the results were recorded in relation to the intercostal spaces. The lower borders were estimated by percussion and palpation at two places, in the right midclavicular line and the right anterior axillary line. The results were recorded in centimetres below the costal margin. The measurements in centimetres were made with a short ruler and the palpation of the liver was performed

with the left hand from the patient's left side as proposed by McNicholl (1957).

The x-ray of the liver was taken whenever possible in the end-expiratory position, with the child placed in the same position as it was for the clinical examination. Pieces of lead wire were attached on the skin with adhesive tape along the costal margin, the right mid-clavicular line, and the right anterior axillary line, so they could be seen on the x-ray film. The x-ray tube was placed above the child perpendicular to the liver area and at a distance of 140 cm. from the film.

X-ray study and clinical examination of each child were both made on the same day.

Results

Because no obvious differences were found between the two sexes, the figures for males and females are presented together. With both methods, clinical and x-ray, the upper liver borders were found to be from the 4th to the 6th intercostal space, the great majority being in the 5th intercostal

space. Percussion proved to be an unreliable method for estimation of the lower liver borders.

The results of the palpation and the x-ray examination of the lower liver borders expressed in centimetres below the costal margin are given in Fig. 1 and 2.

During the first 5 months of life the range of projection of the liver edge was found to be 0 to 3.5 cm., from 6 months to 4 years it was 0 to 3 cm., and in the older children the projection of the liver edge did not exceed 2 cm. In the great majority of older children the projection of the liver edge was less than 1 cm.

The findings from the clinical and x-ray examinations differed by less than 1 cm. in 95% of the cases. The remaining 5% were mostly aged under 1 year. This was possibly due to difficulties in the radiological examination of this age-group. In the over 5 years age-groups there were no such differences.

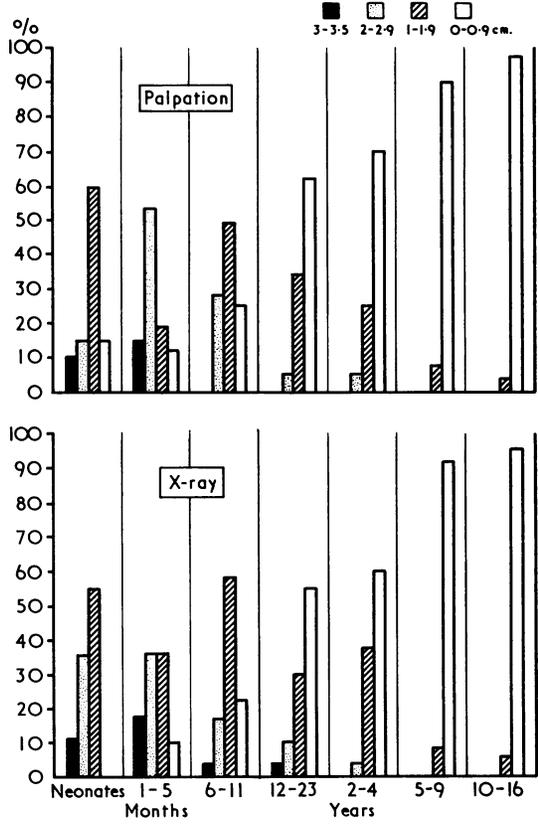
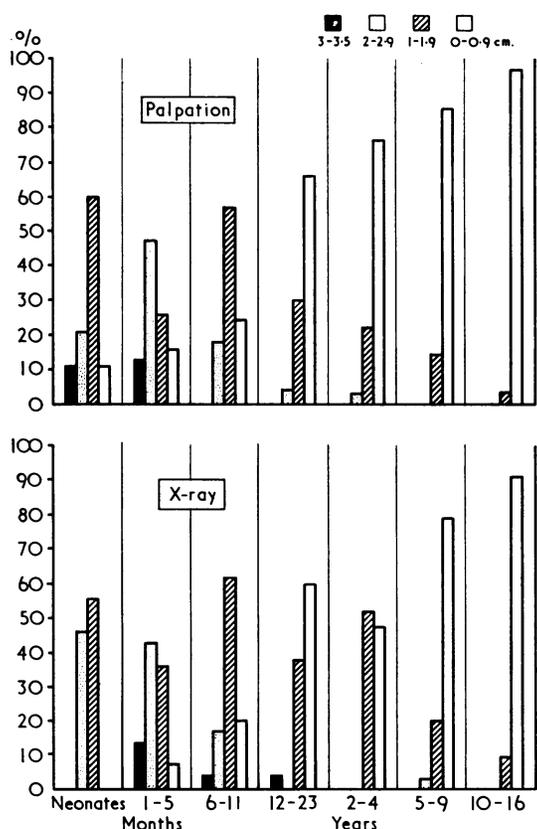


FIG. 1.—Projection of the liver edge in the right mid-clavicular line.

FIG. 2.—Projection of the liver edge in the right anterior axillary line.

Discussion

Previous studies on the normal projection of the liver edge below the costal margin are not in agreement (Cruchet and Sérège, 1908; Zamkin, 1926; McNicholl, 1957). Only McNicholl (1957) states clearly that the measurements were made at the end of normal expiration and his findings can therefore be compared to ours. Our results are in accordance with his for the infants and young children but for the over 10 years age-group McNicholl's figures suggest a larger liver. In this age-group he also found a palpable spleen in 16.6%, and he thought that since most of the children were living in an institution, there might have been an unrecognized infective or other factor.

In our study infants and children with palpable spleens in the end-expiratory position were excluded. Though the spleen is palpable in some normal children, we believe that by excluding them from the study we have avoided cases where the spleen was pathologically enlarged and it could have accompanied pathological hepatomegaly. We think that the strict criteria we applied for the selection of our cases made our material more representative of normal population.

The present study is the only one in which *x-ray* examination of the liver was done on the same children at the same time as clinical examination. It is interesting that with few exceptions, and these in the younger age-groups, there was no difference between the findings of the two methods of examination in the same child. This shows that *x-ray* examination is not necessary for an assessment of the size of the liver and especially the lower borders, if the clinical examination is conducted with care and under standardized conditions.

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Correspondence to Dr. D. Deligeorgis, Institute of Child Health, Athens 608, Greece.