

RADIOLOGY IN THE DIAGNOSIS OF HYPERTROPHIC PYLORIC STENOSIS

BY

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Most text-books on paediatrics mention the employment of radiology in the diagnosis of hypertrophic pyloric stenosis. There is, however, little evidence of unanimity not only concerning its value in this direction but also regarding the precise diagnostic indications to be gained by this particular method of investigation.

Paterson (1937), for example, merely states that 'resort to x-rays settles the diagnosis definitely' without giving any idea of the special features which are of diagnostic importance. Pearson and Wyllie (1935) can also be classed with those who believe that radiology is of considerable value in the diagnosis of hypertrophic pyloric stenosis, since they write that by its use 'pyloric stenosis, if present, can usually be demonstrated.' These latter writers do admit, however, that this method of investigation is 'not generally a necessary procedure for diagnosis, but,' they continue, 'it is of value as an aid to the differential diagnosis of pyloric stenosis and pylorospasm.' The sole diagnostic indication from the radiological point of view given by Pearson and Wyllie is that in 'stenosis little or nothing leaves the stomach for hours,' since 'normally immediately after a meal food begins to leave the stomach, which is completely emptied in three hours.' Sheldon (1937) is another author who gives almost similar diagnostic indications, since he writes that 'the stomach (in hypertrophic pyloric stenosis) is not empty after three or four hours.' Teall (1933) also considers that 'the results of the radiological investigation in infantile pyloric stenosis are reliable' and gives as the diagnostic features, 'no passage of the meal into the duodenum within $\frac{1}{4}$ hour' and 'the opaque meal remaining in the stomach for six hours.' Parsons and Barling (1933) speak of the radiological examination being valuable in two ways, viz. by providing 'an accurate idea of the size of the stomach' (although the real use of this information is not stated), and in addition by being the 'best means of observing the rate of emptying of the stomach' (but the degree of delay which is indicative of stenosis is not mentioned).

Some writers are less enthusiastic concerning this aid to the diagnosis of pyloric stenosis and, while they admit that the radiological investigation may have some value, they do not consider it necessary.

Richter (1924), for example, speaks of it only being confirmatory and deprecates 'its routine use, as it leads to unnecessary delay' in instituting treatment. Neff (1927) advises that the radiological examination should only be carried out early in the disease, when, apparently, he considers the real difficulties in diagnosis arise. Griffith and Mitchell (1937) only see a value in such investigations in 'differentiating pyloric stenosis from oesophageal conditions,' a difficulty, however, which could be more easily and just as certainly overcome by the use of the oesophageal tube.

And, finally, there are authors who consider radiology of little or no diagnostic value.

Grulee and Bonar (1926) say that 'x-ray is not a great help in doubtful cases and the diagnosis can be made without it in the more doubtful ones,' and F. M. B. Allen (1930) writes, 'opaque meal examination is not worth the labour, as the result is most unreliable and may even confuse the issue more than illuminate it.'

It is interesting to contrast with the above views of the clinician those expressed by the radiologist. It would seem, however, that the radiologist as a rule has been more concerned with affirming the presence of the condition than with deciding upon its absence, at least judging by the diagnostic indications which he formulates.

For example, Cecil H. Bull (1935) states that 'food does not leave the stomach for two hours and remains in the stomach in a true case of hypertrophic pyloric stenosis indefinitely.' Hotz (1933) in his discussion of the subject refers to the thickness of the stomach and 'delay in emptying up to twenty-four hours.' While Köhler (1935) writes, 'If within an hour the stomach of a newly-born child has not allowed any of the contrast meal to pass through the pylorus—which normally happens at once—there is as a rule a congenital hypertrophic stenosis of the pylorus present, even though no corresponding tumour can be palpated.'

While I am one of those physicians who believe that radiology is quite unnecessary for arriving at a diagnosis of hypertrophic pyloric stenosis and that the pathognomonic feature—the pyloric tumour—can be palpated in all the cases, I recently submitted to a radiological examination after a barium meal a series of examples of this disease, and as controls a number of infants who appeared quite healthy or were suffering from vomiting, but in whom no pyloric tumour could be felt. The object was to discover what value, if any, this method of investigation really possessed, and it is the findings obtained during this study which form the subject of the present communication.

Method

The same procedure was employed in all the cases. As soon as the child came under observation and a diagnosis was made, a 'plain skiagram' was taken. Thereafter, a barium meal (milk and chocolate barium amounting to

two-and-a-half to three ounces) was given by bottle or spoon and pictures taken immediately, one quarter of an hour, half an hour, three quarters of an hour, one hour, two hours, three hours, four hours, five hours, six hours, seven hours and on one occasion eight hours after the completion of the feed. In some of the examples of pyloric stenosis the examination was repeated after the symptoms had disappeared, either as the result of operation or medical measures, and the child had apparently recovered.

Results

Details of the findings are given in the table (p. 152) and in charts I and II. The course of the investigation has been divided into two periods, (a) during

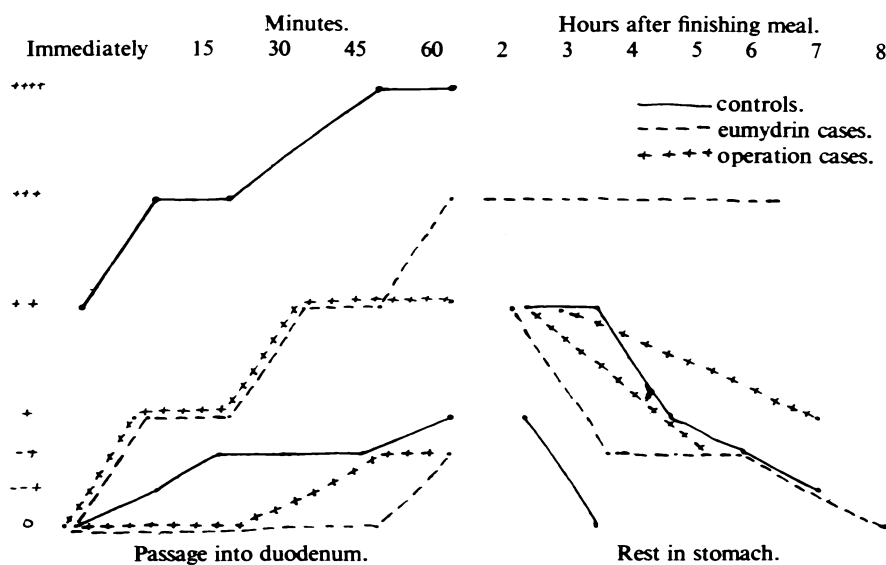


CHART I.—Chart showing the maximum and minimum rates of emptying of stomach with and without hypertrophic pyloric stenosis.

— normal.
 - - - - hypertrophic pyloric stenosis treated with eumydrin.
 + + + + hypertrophic pyloric stenosis treated by operation.

the first two hours after ingestion of the meal, and (b) from two hours after ingestion onwards. In the first period attention was directed to the passage of the meal through the pylorus and this is indicated in the table and on the charts by + and - signs. During the second period it is the amount of the meal still retained in the stomach which is indicated by the + and - signs. It was thought that in this way the best idea of the complete cycle of 'gastric motility' would be provided.

The skiagrams obtained in a typical example of pyloric stenosis and in one of the control group of children are reproduced on pp. 155 and 156. For these pictures I am indebted to Dr. Calthrop, Honorary Radiologist to the Princess Elizabeth of York Hospital for Children.

A scrutiny of both the table and the charts shows that in the absence of hypertrophic pyloric stenosis, the opaque meal as a rule begins to leave the stomach immediately, and that within thirty to forty-five minutes a considerable amount of the meal has entered the small intestine. Sometimes, however, in the absence of stenosis food does not leave the stomach immediately, and even by the end of an hour after ingestion comparatively little may have entered the duodenum. On the other hand, in hypertrophic pyloric stenosis it is usual for the passage of the meal into the small intestine to be delayed, but even in undoubted examples verified by operation, the opaque meal may enter the duodenum as soon, and at the same rate, as in the normal child. Thus from

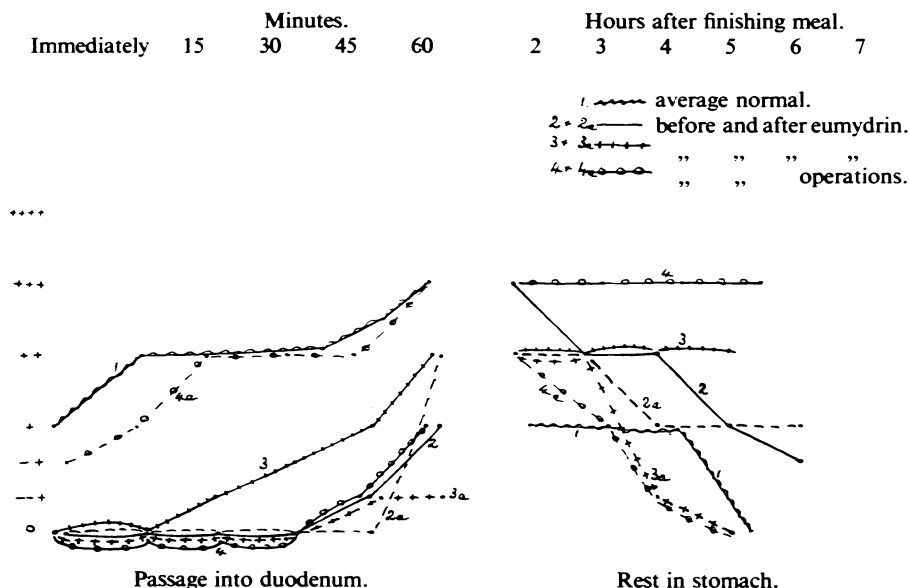


CHART II.—Graphic representation of rate of emptying of the stomach before and after recovery from hypertrophic pyloric stenosis.

this aspect of the investigation there is no sharp line of distinction between the case with pyloric stenosis and the one without pyloric stenosis.

It is also apparent from the table and charts that there exists, so far as the time required for complete emptying of the stomach is concerned, the same great variations in both the normal stomach, and in the presence of hypertrophic pyloric stenosis. In my experience the normal stomach is not usually completely empty until five or six hours after the ingestion of the opaque meal, and in the presence of hypertrophic pyloric stenosis until six or seven hours after ingestion. On occasion, however, complete emptying of the normal stomach may be delayed till eight hours after the meal, whereas the stomach with undoubted hypertrophic pyloric stenosis may be practically empty by the fifth hour, thus again revealing the overlap which deprives this method of investigation of any diagnostic value.

Some authors mention evidence of hyperstalsis during the period of observation as being of importance in indicating the presence of stenosis, but in my experience this is not an invariable feature in the skiagrams and is seen almost as frequently in the normal as in the abnormal case.

Discussion

When the variations in the severity of the symptoms in this condition are remembered, it is quite understandable how there should not be any sharp line of distinction between the case with stenosis and the case without stenosis. Nevertheless, it might be suggested that this method of examination would still provide a readier means of recognizing those more severe examples which require immediate surgical treatment than is possible by paying attention to the faecal output and the general appearance of the patient. My experience, however, has not lent any support to such a contention. For some time past it has been my practice to institute medical measures as a routine and only to resort to surgical intervention when this seemed the only means of saving the child. In the table and in the charts it is indicated whether pyloric stenosis was or was not present, and if present what method of treatment was adopted. The findings show definitely that there was much greater interference with the motility of the stomach in some cases which responded to medical measures than in others which ultimately required surgical intervention. Indeed, in one case (no. 2) the symptoms were so slight that I recorded it in detail (Findlay, 1937) as an instance of pyloric stenosis without symptoms, and yet radiologically it is one of the most marked examples of the series.

In this connexion it is interesting to contrast the behaviour of the motility of the stomach in this condition at the height of the symptoms and after recovery when all symptoms had disappeared. The findings are noted in the table and in a few typical examples are graphically represented in chart II. A difference between the findings in this respect according to whether the treatment had been medical or surgical might be expected. As a result of surgical intervention all constriction of the pyloric canal is removed at once and consequently an immediate and marked improvement in conditions would be anticipated, and such is indeed what occurs. In those cases in which a barium meal was performed three or four weeks after operation the emptying rate, as judged by the passage of the meal into the duodenum and by complete emptying of the stomach, had returned to the normal. But this was not so in the examples treated medically, since even as long as six to eight weeks after all symptoms had disappeared the typical radiological picture of pyloric stenosis persists. This suggests that there are two factors causing the obstruction: spasm of the muscle (which is relieved by medical measures) and narrowing of the pyloric canal from the mass of the hypertrophied muscle (which is rectified by Rammstedt's operation). It is interesting to note that of the two examples treated medically (no. 2 and 3 in chart II) one (no. 2) showed practically no change after the symptoms had disappeared, whereas the other (no. 3) revealed an even

slower passage into the duodenum after recovery, but an ultimate emptying rate which compared favourably with the normal child. These are findings which still further support the contention that radiological investigation is of no value in differentiating the case requiring immediate operation from the one which would recover by the adoption of medical measures.

Meuwissen and Sloff (1932) also came to the conclusion that dilatation of the stomach, increased peristalsis, delay in passage of the meal into the duodenum or delay in complete emptying of the stomach were unreliable as guides to the diagnosis of hypertrophic pyloric stenosis, because all these features may be present when no stenosis exists. For these workers the only reliable radiological feature is a lengthening of the pyloric canal. This normally has a maximum length of 4 mm., whereas in hypertrophic pyloric stenosis it is invariably four or five times as long.

For the demonstration of this characteristic the Berg technique is necessary, but this, it must be remembered, involves an amount of exposure which is not without danger in the young infant. Certainly the skiagrams which these authors reproduce in their communication support their contention, but in the few instances in which we have attempted to emulate their example we were quite unsuccessful. However, apart from the danger of this type of examination, it absorbs an amount of time which, at least from the practical point of view, is quite unwarranted, for, a pyloric tumour, which is pathognomonic of hypertrophic pyloric stenosis, can invariably be detected.

Summary

- (1) The current opinion regarding the value of radiology in the diagnosis of hypertrophic pyloric stenosis is discussed.
- (2) The findings after a barium meal in twelve examples of hypertrophic pyloric stenosis and in twelve 'normal' children are described.
- (3) While the motility of the stomach in hypertrophic pyloric stenosis is shown to be as a rule impaired, this is not the invariable rule. In some cases of hypertrophic pyloric stenosis the motility is as good as in the normal stomach.
- (4) When the time involved in this method of examination and the variability of the findings are considered, the only justifiable conclusion is that it has no place in the diagnosis of hypertrophic pyloric stenosis.
- (5) The most reliable evidence of hypertrophic pyloric stenosis is the presence of a tumour, which is palpable in all cases.

Thanks are due to Dr. Calthorp for his co-operation and permission to reproduce the skiagrams of the barium meals, and to Dr. Chodak Gregory for the observations on Case No. 21.

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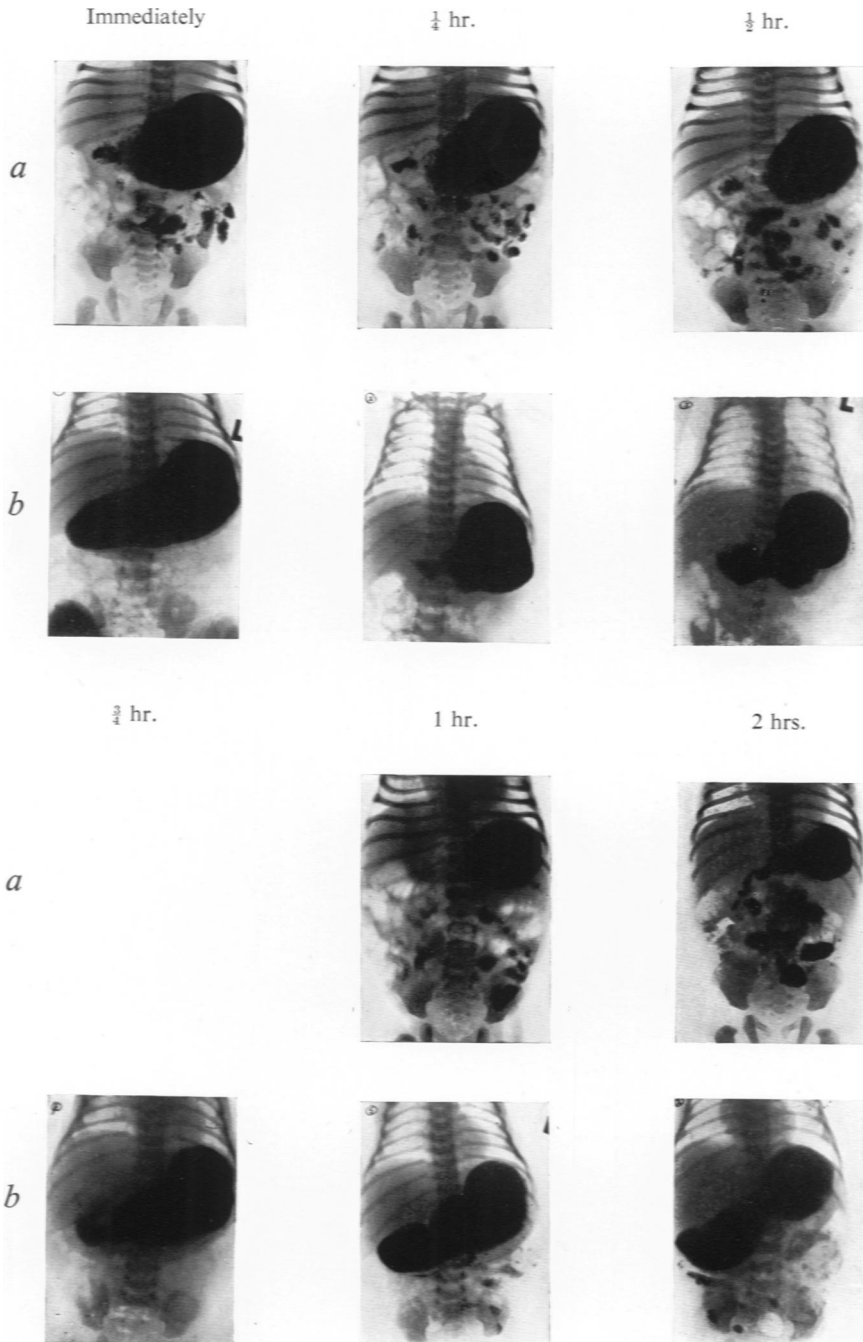
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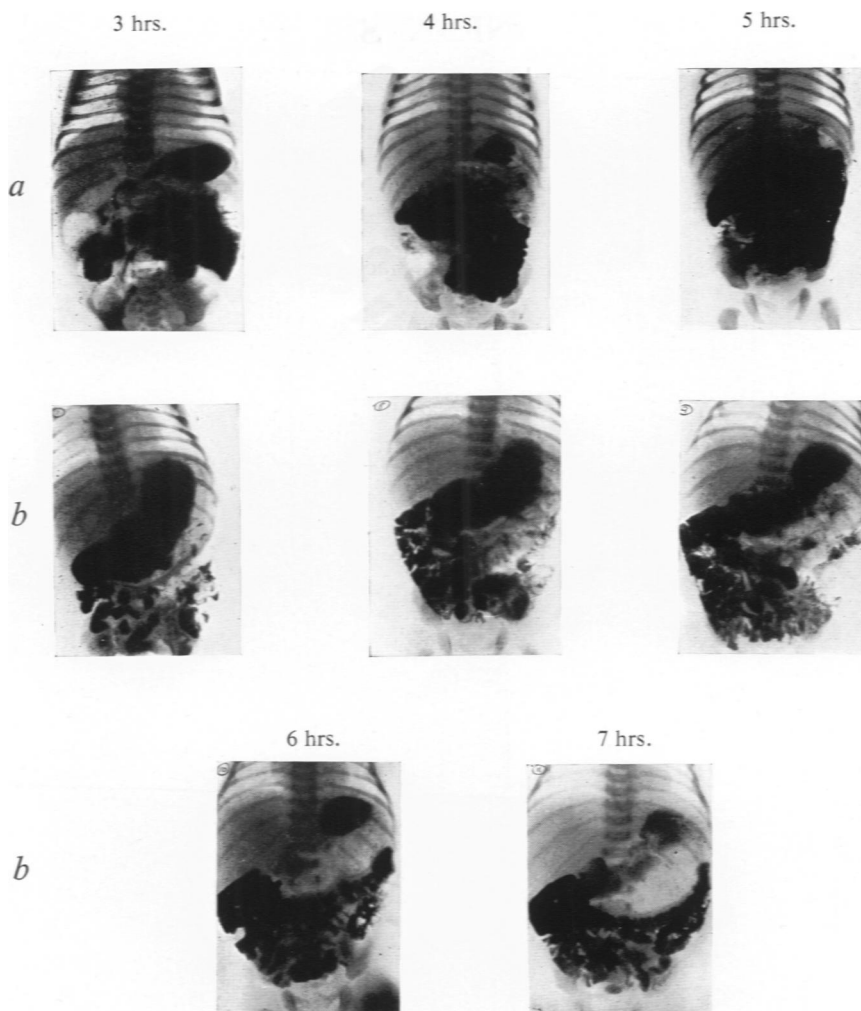
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SKIAGRAMS OF PROGRESS OF BARIUM MEAL IN (a) NORMAL CHILD AND (b) HYPERTROPIC PYLORIC STENOSIS



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