disregard the pain and discomfort he can be confidently assured of recovery. The ability to give this advice with confidence, with the certain knowledge that we can exclude gastric or duodenal ulcer, is one of the strongest arguments for exploring every doubtful case of chronic abdominal pain.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, December, 1919.

X RAYS AND THE APPENDIX.*

BY

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IN examining the alimentary canal by the help of opaque meals the observer is apt sometimes to overlook the fact that he is not dealing with organs under normal conditions, but with organs placed in circumstances entirely novel and unwonted and, indeed, reacting under the stimulus of a foreign body.

Before we allow ourselves to draw conclusions from the pictures seen on the screen or in the plate, we are bound to consider what unusual effect the presence of a large mass of barium sulphate may have upon the behaviour of the stomach or the duodenum, or, for that matter, upon any portion of the alimentary canal. So, when the peristalsis of the stomach is noted on the screen, it becomes a nice point to ascribe the proper proportion of movement to the ordinary gastric activity and to make the necessary allowance for an organ faced with an unusual problem and doing its possibly exaggerated best to pass on an unwonted foreign body.

Again, there may come a time in the progress of every bismuth meal when all, or nearly all, the salt may be collected in a narrow segment of the transverse colon. Weight for weight the metal is heavier than a collection of faecal matter of equal bulk, and it may be that the extra weight is sufficient to cause a notable dropping of the bowel and so induce the observer to believe that there is a real ptosis of the colon, whereas, under natural conditions, the intestine is kept by its supports in the proper position.

As for the appendix, claims are made that 75 or more appendices out of 100 may be demonstrated by opaque meals of one kind or another; but putting aside for a moment the actual value of a picture of the appendix, the means sometimes adopted to separate the organ from its surrounding coils of intestine introduce an element of violence to which the parts are never exposed during the process of ordinary digestion. I refer to the massage of the caecal region by the hand, or by some instrument, for convenience sake transparent to the rays—a wooden spoon, for example.

Considerable importance is attached by some observers to the medium in which the opaque salt is given; one recommends gruel, another buttermilk, and a third will obtain his best results with some proprietary mixture such as that sold by Burroughs and Wellcome. Trials made with 6 oz. of barium sulphate in 20 oz. of various fluids showed that all or nearly all the salt separated from the various fluids in a comparatively short time: from water in ten minutes, from milk in thirty minutes, from thin gruel in two and a half hours; it may therefore be assumed that whatever the medium used in an opaque meal the nature of the suspension will have greatly altered long before any of it has reached, let us say, the ileo-caecal region. It seems more reasonable to give the opaque salt under natural conditions—spread over the various foods that make up the patient's usual breakfast; the result is not so unpleasant as it sounds, and though the salt is more diffused, and the shadow thrown by it less dense, the proceeding has no practical disadvantage, and at least avoids the unnatural act of swallowing a large quantity of foreign material in a mass. Lastly, there should be no preparation of the patient by purging, at least within twenty-four hours of the examination; the only object of the investigation should be to watch the alimentary canal as nearly as possible under normal conditions, not when it has recently been a prey to more or less violent emotions.

Screen Examinations and Skiagrams.

No doubt a series of good skiagrams of a bismuth meal is of some use as a record, but its value is insignificant in comparison with the report on a series of screen observations; moreover, the interpretation of skiagrams will vary with the reader, and no one is really competent to give an opinion on the constantly changing picture presented by a bismuth meal except the radiographer who watches it. The last word on this subject is found in a sentence of Sir Arbuthnot Lane:

The utility of a complete report on the passage of a bismuth meal by a competent radiographer who is experienced in this work cannot be exaggerated . . . it is futile to expect the surgeon to obtain much useful information from a series of radiograms, however good, taken at intervals. By far the most valuable portion of the information afforded by the skilled radiographer is obtained by means of screen work. . . .

And, indeed, some of the published radiograms of diseased conditions in the ileo-caecal region are unconvincing. One sees a mass of ileum and caecum, and, indistinguishable save by the eye of faith, a narrow band is marked by a confident arrow and labelled "kinked and adherent appendix." Such a picture can be of no use in diagnosis, and tends to discredit the whole science; it would be invidious to point to examples, but there is scarcely a work on radiography which is not disfigured by imaginative efforts of this kind.

In the series of 50 consecutive opaque meals given for one purpose or another, but always having in view the behaviour of the parts in the ileo-caecal region, the appendix was definitely recognized in a much smaller percentage of cases than might have been expected; no massage of the abdominal wall or other interference was permitted, and whether the patient was screened from the front, or the back, or the side, in only 45 per cent. could one be sure that what one was looking at was really the appendix. Of the appendices seen (22) 20 were found diseased at the subsequent operation, 2 were apparently normal. Of the remaining 28 in the series—the 28 in which the appendix was not identified on the screen—15 were diseased, 13 were normal; of the 15 the lumen was obliterated in 3, and in 12 the organ was so bound down to the side or back of the caecum that even with a patent lumen full of barium, it would have been impossible to differentiate its shadow from that of the surrounding coils of intestine.

Visible appendices, 22—

Diseased	...	...	...	...	...	20
Normal	...	...	...	...	...	2

Invisible appendices, 28—

Diseased	...	...	...	...	...	15
Normal	...	...	...	...	...	13

The numbers are no doubt small to draw any very definite conclusions from them, but if they prove nothing they at least suggest that the barium does not tend to enter the normal appendix at all. Not that this assumption helps us very much; even if we could say definitely that the barium enters a diseased appendix and does not enter a normal one, we cannot say that an invisible appendix is a normal one because, for the reasons given above, a proportion of diseased organs will be invisible too.

Pursuing this question, preparations were made of the bowel in the ileo-caecal region from 15 consecutive *post-mortem* examinations; the last 12 inches of the ileum, the caecum and appendix, and the first part of the ascending colon, were removed, the distal end of the preparation was clamped, and through the cut ileum a barium suspension was poured into the segment of gut. Among the 15 specimens there were 4 in which there was obvious disease of the appendix; in these the barium entered the caecum, filled it and the ascending colon, and, at the same time, overflowed into the appendix. In 7 of the remaining 11 normal appendices this overflow did not occur; it required a certain amount of manipulation and squeezing of the caecum to overcome the resistance offered to the progress of the fluid; in the other four normal preparations the barium entered as freely as it did the diseased specimens.

Skiagrams of two of these preparations are reproduced. Fig. 1 shows a long-standing inflammation with plentiful adhesions; Fig. 2 a normal appendix. The examples were chosen for the sake of contrast, and emphasize the difficulty of drawing useful conclusions from the inspection of a bismuth-filled appendix.

* Read at the South-Western Branch of the British Medical Association, March, 1920.

Here again the numbers are small, and the conclusions drawn from them, especially as we are dealing with *post-mortem* preparations, are not convincing, but the results fairly point to the assumption that Gerlach's valve has to be reckoned with as a structure which justifies its function, which is that of preventing the regurgitation of fluid from the caecum into the appendix while allowing free passage in the reverse direction. It is easy to imagine a permanent crippling of this mechanism by any inflammatory change in the appendix itself, and not difficult to see how the rough handling of the part entailed by the massage and squeezing necessary to separate the appendix from the surrounding coils of gut might overcome the resistance offered by the valve, a resistance perfectly competent under ordinary conditions.

All this favours the view that the etiology of appendicitis is not to be sought in the passage of food or foreign body into a normal organ and its stagnation there; no doubt such retention is the immediate cause of the greater number of attacks, but the organ has been damaged already, and the original cause is that which first attacked it, altered its structure, interfered with its function, and crippled the mechanism which kept it shut off from the general alimentary canal. There is no evidence that food ever enters the normal appendix; if it did, there does not

FIG. 1.—Chronic inflammation of the appendix with many adhesions.

seem to be any reason why it should be held up there, nor, being held up, that it should occasion the train of symptoms which constitute appendicitis. We have no right to ascribe an undue sensitiveness to the mucous membrane of the organ. What is there so deadly in themselves in an orange pip or a faecal concretion? Consider the length of time that stercoral masses remain in the colon and the infrequency of stercoral ulcers.

The work of Dr. Poynton and Dr. Payne¹ in 1913, established appendicitis as a blood-borne disease; briefly, they ascribed it to streptococcal infection, and emphasized once more the likeness between the appendix and the pharyngeal tonsil. Nothing has been done to upset the conclusions of these observers; unfortunately their work attracted little attention at the time it was published, and seems to be forgotten now, but it appears to me to have settled the question once for all as to the origin of appendicitis, and it should have succeeded in displacing some of the hoary traditions which still cling round the ileo-caecal region.

In any case, the question of seeing the appendix in the course of a bismuth meal is not of great moment. If we see it, in the greater number of cases we do not know whether it is normal or diseased; and if we do not see it, it may either be normal, or diseased and invisible for mechanical reasons. I do not remember one instance among the many opaque meals observed in the Torbay Hospital where the visibility or invisibility of the appendix had the slightest influence in deciding for or against operation.

Where the diagnosis of chronic appendicitis was made or helped by the findings of the bismuth meal the points determined were those associated with the grosser local changes in the ileo-caecal region, or with the distant lesions of gastric and duodenal ulceration. Chief among these points are the mechanical effects which may result from an inflamed organ, for the familiar symptoms of the controlling appendix are largely due to interference with the

structures guarding the junction of ileum and caecum. No doubt the ileo-caecal valve has some effect in preventing the regurgitation of fluid from the caecum, but its influence is small compared with that exercised by the ileo colic muscle, the long sphincter which encircles the termination of the ileum. This muscle has an intimate connexion with the appendix, for of the three longitudinal bands of the colon, the posterior passes directly over the junction of ileum and caecum, its fibres interlacing with those of the ileo-colic muscle and so runs to the appendix. When the ileo-colic muscle acts the longitudinal muscle acts also, and the effect of the two is certainly to exaggerate the folds of mucous membrane which form the ileo-caecal valve if it does not actually call them into existence.

The sympathetic nerve supply of this region must be briefly considered: the ileo-colic, right colic, and middle colic divisions of the superior mesenteric artery are accompanied by the appropriate branches of the superior mesenteric plexus, itself the continuation of the inferior coeliac plexus; the parasympathetic supply comes from that branch of the right vagus which joins the inferior coeliac plexus and is distributed in the same way as the sympathetic. Now the functions of these two nerve supplies being antagonistic one to the other, the defensor

FIG. 2.—Normal appendix.

muscles are made to contract by the parasympathetic and to relax by the sympathetic; the sphincters are made to contract by the sympathetic and to relax by the parasympathetic. The adjustment of the two, whereby harmonious action of the parts is secured, must be extraordinarily delicate, and extraordinarily liable to be upset by any pathological change in the organs which the nerves supply, or through which they pass. The influence a diseased appendix may exert, for example, on the ileo-colic sphincter must, then, be very great. It is not difficult to conceive a state where over-action of the parasympathetic would entirely inhibit the controlling function of the ileo-colic sphincter, with the result that regurgitation from the caecum would be free and constant; on the other hand, sympathetic irritation would lead to over-action of the sphincter, and a consequent hold up of the intestinal contents on its proximal side.

One other point of interest is that after appendicectomy, associated or not with caecoplication, pain in the right iliac region may remain unrelieved; it is suggested that this pain may be due to a tonic contraction of the ileo-colic muscle, and Groedel² states that it has been abolished by exposing the ileo-colic muscle in the wall of the gut and incising it. Again, the influence of the appendix must extend to the whole region in which antiperistalsis occurs, that is, from the caecum to the sixth sphincter of Professor Keith—the point in the transverse colon which lies below the pylorus; to allow an efficient peristalsis, this sixth sphincter and the one above it—the ileo-colic—must be simultaneously in action, any interference with either rendering one or both inefficient and throwing the whole mechanism out. It may be that the appendix has an even closer connexion with the intestinal movements than a simple mechanical control suggests; it is credited by Heile³ with a hormone, which powerfully excites peristaltic action, and it is probable that a pathological change in the appendix would in some way check or alter the formation of this internal secretion.

In any case the appendix is not of vital importance—in health at least; it is true that a proportion of patients who have had appendicectomy performed suffer afterwards from constipation, but, as will be shown in the series considered in another paper, the disability in uncomplicated cases is seldom great and generally tends to right itself with time.

REFERENCES.
¹ *Researches on Rheumatism*. ² *Fortschritte für Röntgenologie*, vol. xx, H. 2. ³ *Physiologie des Blinddarmmanhanges*, *Beiträge zur Klinischen Chirurgie*, vol. xciii, 1914.

ANAESTHESIA IN TONSIL AND ADENOID OPERATIONS.

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THE purpose of this note is to advocate the use of nitrous oxide or local anaesthesia, in preference to ether and chloroform, in the removal of tonsils and adenoids.

FIG. 1.—A. Principal artery to tonsil. B. Plica triangulæ. X. Sites for novocain injection.

In children below the age of 14 or so the operation can always be efficiently performed under gas. In adults the same is true where adenoids only require removal; if in them tonsils are to be enucleated, some can be dealt with under gas, but the majority must be dissected out, and for such a procedure gas is not suitable. A more prolonged anaesthesia is necessary, and it is in these cases that I strongly recommend local anaesthesia rather than ether or chloroform.

In stating the grounds on which the discontinuance, as far as possible, of the use of ether and chloroform for tonsil and adenoid work is urged, it will be convenient to consider separately the case of children and adults.

I. Operations in Children.

Anyone who has had considerable experience of removing tonsils and adenoids in children knows that, with a guillotine of suitable size and form, enucleation of the tonsils can be easily and rapidly performed, while with a sharp curette the adenoids can be removed with one clean sweep.

Nitrous oxide anaesthesia affords ample time for the completion of the operation, if the following method is adopted:

FIG. 2.—A. Outline of buried part of tonsil. B. Capsule of tonsil exposed.

The child lies on the back, with the head extended over the end of the table. The operator stands immediately behind the head, while the anaesthetist places himself on one side of the table and a nurse on the other. A strap above the knees secures the legs, while the arms are held by the nurse. Just before commencing the anaesthetic a scissor gag is introduced, but only slightly opened, so as to cause no alarm. As the child goes under the gas the gag is fully opened, and when the anaesthesia is complete the anaesthetist puts the facepiece on one side and securely holds the head in a well-extended position. The tonsils are first dealt with and enucleated by a modification of Sluder's method. In this procedure the tongue is depressed with a spatula and the lower tonsil pole is then engaged in the ring, and the whole organ drawn upwards and forwards against a tubercle on the lower jaw, just behind the last molar tooth. By dint of strong pressure of the guillotine, combined with manipulatory movements, the aforementioned tubercle is made to forcibly thrust the tonsil through the ring of the instrument.

It is, of course, understood that a size of ring has been chosen which is large enough to allow the upper tonsil

pole to pass through with a moderate degree of ease. It is the upper pole of the tonsil which is most likely to be left behind if the pressure and manipulation are inadequate. The method of finger pressure advocated by Whillis and Pybus takes longer, and in my experience is no more efficient. The method described is competent to deal with any case, unless the adhesions to the faucial pillars and peritonsillar tissues are such as to prevent evagination of the tonsil. After the enucleation of the tonsils the adenoids are removed. The whole operation does not occupy more than twenty seconds. The position of the head allows the blood to gravitate away from the larynx, and on turning the head to one side at the conclusion of the operation the blood flows out of the mouth. The child is made to sit up almost immediately, and will cough or spit out the blood instead of swallowing or inspiring it. The return to consciousness, together with the upright posture, arrests the haemorrhage directly and the child can be safely returned to its home within an hour.

The whole proceeding is simple and safe, and free from any anxiety. Haemorrhage is reduced to a minimum, and the child is fit and well again in a very short time. The one untoward circumstance that may arise is a sudden cessation of breathing from overgagging, but if the cause be recognized the trouble can be rectified in a moment by easing the gag. In my opinion overgagging as a cause of asphyxia in young children is not sufficiently recognized and taught.

The foregoing remarks concerning the use of gas in tonsil and adenoid operations require qualifying in this very important respect, that the best results can only be obtained with "team" work. The anaesthetist must be skilled in the administration of gas, and must understand exactly how to hold the head and assist the operator. An experienced nurse is also invaluable.

To instance the safety of tonsil and adenoid operations under gas I should like to refer to the statistics of school children operated on by me during the past three years for the Education Committees of Liverpool, Bootle, and Southport. These statistics have not been worked out by myself, but have been furnished me by those responsible for the care of the children after the operation.

Altogether 3,577 children have been operated on, with no fatalities, immediate or subsequent, and no recurrences. In 25 cases only (considerably under 1 per cent.) has severe bleeding occurred, that is, bleeding sufficient to cause faintness and collapse.

When I review all my work during the past eight years I must certainly have operated on upwards of 6,000 children under gas, and I have never experienced any fatal case, either at the time or subsequently. Of course, I am well aware that very striking statistics have been published of series of cases in which the major anaesthetics had been used, but, broadly speaking, I am convinced that with ether and chloroform anaesthesia, especially the latter, there is much greater risk, firstly

FIG. 3.—A. Tonsil bed. B. Scissors used both for cutting and blunt dissection. C. Upper tonsil pole drawn out from between the pillars.

FIG. 4.—A. Lingual attachment divided with the guillotine. B. Buried part of tonsil shaded.