DUODENAL OBSTRUCTION AS SHOWN BY RADIOGRAPHY.

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(With Special Plate.)

In a paper published recently on Distension Changes in the Duodenum in Chronic Intestinal Stasis,¹ to which I furnished the radiographic evidence, Mr. W. Arbuthnot Lane described a condition of kinking at the duodeno-jejunal junction, and the changes resulting from it. The matter is dealt with further by him in a clinical lecture on the Kinks which Develop in our Drainage System in Chronic Intestinal Stasis.² I am now in a position to give definite radiographic proof of the actual existence of the changes he describes.

The duodenal obstruction clearly is of an intermittent nature. This should be carefully noted at the outset, for it is not to be expected that positive evidence will be obtained in every case and at every examination. In many cases with the typical signs of duodenal inflammation, and in some in which the fact of the presence of

Fig. 2.—Diagram to illustrate the normal duodenum and jejunum (firm line), and the dilated duodenum and pendulous jejunum (dotted line) due to kinking, at the duodeno-jejunal junction, by the sharp lower margin of a peritoneal fold, indicated by the point X. The distension of the duodenum is most marked in its first part, where it is least supported, and has a fairly complete peritoneal covering. It is in this part that inflammatory changes are set up in consequence of the abnormal distension. Py, Pylorus. a, b, c, First, second, and third parts of the duodenum. J, J', Jejunum in its normal and in its pendulous position.

a duodenal ulcer was subsequently proved by operation, the bismuth meal was seen to pass out of the stomach at a rapid rate as the result of the peristaltic contractions of that organ, and to course through the duodenum without showing any deviation from the normal. Now and then, however, while the gastric contents are passing through the pylorus rapidly, there is some delay in the passage from the duodenum to the jejunum, as in Fig. 1, which represents the stomach and duodenum of a woman of 56 suffering from nausea and vomiting with hæmatemesis. There had been melaena before admission. I found an hour-glass constriction of the stomach due to spasm, possibly set up by a gastric ulcer. The presence of a duodenal ulcer was not proved in this case, as the patient was discharged relieved a fortnight later.

This case gave me a hint: it was clear that I should only succeed in demonstrating abnormalities of the duodenum while there was obstruction to the passage of food through it. Fortunately Mr. Arbuthnot Lane was

able to show me, in the course of several operations, the actual occurrence of obstruction due to kinking at the duodeno-jejunal junction. The diagram (Fig. 2) explains the condition. The end of the duodenum is normally fixed by a peritoneal band, while the jejunum is perfectly mobile at its commencement. The jejunum, instead of continuing in the line of the duodenum, as in normal cases, passes directly downward from this band, and kinks the tube abruptly. This is specially apt to occur in persons in an exhausted or enfeebled state.³ The block which results from this kink produces distension in the duodenum; the dilatation is greatest in the first part of the duodenum because this part alone is movable and unsupported. The distension may not be sufficient to produce any change in the duodenum; it may, however, lead to engorgement, or in more severe cases ulceration of the mucous membrane. When the patient assumes the supine posture, the loop of jejunum no longer hangs down vertically, and the kink is relieved. The curative effect of rest in bed is thus explained; with the obstruction relieved, the duodenum

Fig. 4.—Tracing of the stomach and duodenum, taken immediately after Fig. 3, to show duodenal obstruction. C, P, Cardiac and pyloric portions of the stomach. Py, Pylorus. a, b, c, First, second, and third parts of the duodenum. The arrow shows the direction of the duodenal peristaltic contractions, which, though very powerful, were quite unable to overcome the obstruction, due to kinking, at the duodeno-jejunal junction. (See Fig. 5.)

is freed from the distension which persisted while the patient was upright, the dilatation of the duodenum passes off, and its mucous membrane soon returns to a healthy state.

The reality of this explanation was brought home to me very forcibly by the case of a patient sent to me for examination by Mr. W. Arbuthnot Lane—a very emaciated girl of 19, who had been healthy up to the age of 14, although she had suffered from obstinate constipation since childhood. At the age of 14 she began to suffer from pain after eating, and therefore to refuse food. The pain came on within a few minutes after food, and was obviously very severe. She had wasted gradually, but there was no vomiting. Her stomach was washed out frequently; large quantities of fluid and air were apt to accumulate in the stomach.

The Roentgen-ray examination was commenced with the patient in the upright posture. An emulsion containing 3 oz. of bismuth carbonate was introduced through a stomach tube, and showed the stomach to be dropped, so that the great curvature was in

TO ILLUSTRATE DR. A. C. JORDAN'S PAPER ON DUODENAL OBSTRUCTION.

Fig. 1.—Stomach and duodenum after a bismuth meal, showing a spasmodic hour-glass constriction of the stomach, and delayed passage through the duodenum. C, P, Cardiac and pyloric portions of the stomach separated by a spasmodic constriction at S. a, b, c, First, second, and third parts of the duodenum. U, Umbilicus, marked by a penny.

Fig. 3.—Large, dropped stomach, containing bismuth, as seen on the couch. The cardiac portion, C, and the pyloric portion, P, are filled with the emulsion which is passing freely through the pylorus, Py, into the duodenum, D. The intermediate portion is raised upon the vertebral bodies, and hence contains no emulsion. U, The umbilicus, marked by a penny.

Fig. 5.—Duodenum, in the subject of Figs. 3 and 4, showing two phases of the powerful peristaltic contractions by which it sought (in vain) to overcome the effect of kinking at the duodeno-jejunal junction. (Confirmed by operation.) The duodenum appeared to be writhing. a, b, c, First, second, and third parts of the duodenum. Cr, Crest of ilium. U, Umbilicus, marked by a penny.

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Fig. 6.—The long dropped stomach and the duodenum in a case of suspected duodenal ulcer, examined on the couch after a bismuth meal. The behaviour of the duodenum was similar to that in Figs. 4 and 5, though less extreme. C, P, Cardiac and pyloric portions of the stomach. Py, Pylorus. a, b, c, First, second, and third parts of the duodenum. Cr. Crest of ilium.

Fig. 8.—Stomach and duodenum in the same subject as Fig. 7, taken two hours later. The cardiac portion no longer contained any bismuth emulsion. The isolated pouch, H, and the pyloric portion, P, still contained bismuth, and the duodenum was seen to be contracting actively against an obstruction, due to kinking at the duodeno-jejunal junction. (Confirmed by operation.) a, b, c, First, second, and third parts of the duodenum. U, Umbilicus, marked by a penny.

Fig. 7.—Stomach and duodenum examined on the couch after a bismuth meal, showing, at H, a cicatricial hour-glass constriction and a small isolated pouch. C, P, Cardiac and pyloric portions of the stomach. Py, Pylorus. D, Duodenum.

Fig. 9.—Dilated duodenum with partial obstruction, due to kinking at the duodeno-jejunal junction. a, b, c, First, second, and third parts of the duodenum. U, Umbilicus, marked by a penny. Cr, Crest of ilium.

the pelvis. Active gastric peristalsis was observed. Examining the patient on the couch (Fig. 3), the bismuth emulsion was seen to be passing through the pylorus freely and entering the duodenum. On reaching the third part of the duodenum, the bismuth advanced no further, and repeated powerful contractions of the duodenum took place in the endeavour to forward the contents into the jejunum (Fig. 4). The attempts were seen to be ineffectual, and were accompanied by great pain. Fig. 5 shows the duodenum in two phases of its violent contractions. One hour later some of the bismuth was scattered through the ileum, but by far the greater part was still in the stomach. The pylorus was again seen to be normal, while the duodenum was contracting violently but uselessly to expel its contents. After four hours a similar condition still obtained, though a good deal of bismuth was now scattered through the ileum, and a fair amount had reached the lower end of the ileum. At the end of nine hours there was still some bismuth in the stomach, and the appearances of the stomach and duodenum were as before. The duodenum appeared to be writhing in an unsuccessful effort to expel its contents. There was a mass of bismuth in the lower end of the ileum; none in the caecum or beyond.

During the examinations the duodenal obstruction was seen to relax occasionally and allow part of the contents to proceed. After twenty-seven hours the stomach and duodenum were empty. There was some bismuth in the caecum and ascending colon, but the greater part was dried up in the end of the ileum. At the end of fifty hours there was some bismuth (about one-third of the original amount) in the rectum. There were traces in the caecum. Powerful contractions of the duodenum were seen to be taking place, although it contained nothing more opaque than Benger's food. Clearly the third part of the duodenum was the seat of an acute obstruction which yielded partially from time to time.

Mr. Lane operated, and the actual state of affairs was revealed. The duodenum was dilated, especially in its first part, while the duodeno-jejunal junction was kinked over a sharp peritoneal fold or band, and the jejunum hung down vertically over this band as shown in Fig. 2. Mr. Lane performed a posterior gastro-jejunostomy, and the patient made a very good recovery.

This was an extreme case, and as usual the duodenal trouble was not the only abnormality. For not only was the stomach greatly dropped, but there was very great delay at the lower end of the ileum. The case is of great importance; it shows that the condition of duodeno-jejunal kinking over a band (Fig. 2), described by Mr. Lane, may occur in an extreme degree, and may lead to distension of the duodenum with most severe symptoms.

I next proceeded to ascertain the conditions in less extreme cases, and my investigation presently led to positive results. I find it necessary to give a full-sized meal, containing as a rule 4 oz. of pure bismuth carbonate in the form of a thick emulsion. This may be made up with sugar of milk and water; a little corn-flour or other ingredient may be added to thicken the emulsion, which should contain no lumps, lest they set up pyloric spasm, and prevent the rapid filling of the duodenum. Hence bread and milk is not appropriate unless it be thoroughly broken up.

The stomach is examined in the usual way after taking this meal—first in the vertical posture, then upon the couch. It is usually necessary for the patient to lie on the right side for two or three minutes to enable a large proportion of the meal to enter the pyloric part of the stomach, and to pass through the pylorus into the duodenum. The patient now lies on the back once more, when the duodenum may be examined. If it contains little or no bismuth, the patient is asked to sit in a chair for from ten to fifteen minutes, and is then examined upon the couch once more. If there is still no appreciable quantity of bismuth in the duodenum, the patient sits up for a further period of from ten to fifteen minutes; after this time—half an hour from the time of taking the bismuth meal—I have never yet succeeded in obtaining any information regarding the duodenum except in one case, to be described presently (Figs. 7 and 8), in which an hour-glass constriction prevented the emulsion from entering the pyloric portion of the stomach

in sufficient quantity to give the desired result in the first half-hour.

When duodenal obstruction is present it may persist for several hours, and I have little doubt further experience will show that the first evidence of duodenal obstruction sometimes appears later than I have observed hitherto. This would seem especially likely in the case of patients whose pain commences two or three hours after meals, for the pain is due to distension of the duodenum resulting from obstruction.

In searching for a reason why positive information was obtained in certain cases and at certain times only, and absolutely withheld in many others, two or three facts soon appeared. It was found that patients who were up, and perhaps continuing their ordinary vocation, were more apt to show definite results than those who were resting. Hence I was most successful with ambulatory patients, and with these only when they were in pain, showing that their pain was due to obstruction. I have shown that rest in bed usually abolishes the x-ray signs of duodenal obstruction which existed prior to treatment by recumbency, and it is well known clinically that rest in the supine posture usually relieves all symptoms of duodenal ulcer.

A point to note is that the successful discovery of duodenal obstruction depends almost necessarily upon an unobstructed pylorus. When the pylorus is obstructed or the stomach is not contracting actively the duodenum never becomes properly filled and the characteristic appearances are not obtained.

Fig. 6 illustrates the case of a woman of 30 who had suffered from dyspeptic pain for six months. In her case the appearances greatly resembled those shown in Fig. 5, though they were not nearly so extreme. The stomach was dropped and very long; the duodenum was seen to be in active peristaltic contraction, but its contents, instead of passing on into the jejunum, were returned time after time, and the duodenum contracted over and over again in the endeavour to forward its contents into the jejunum. Three weeks' rest in bed under the care of Dr. Lauriston E. Shaw led to the relief of all her symptoms, and to the abolition of the duodenal obstruction, as shown by the x-ray examination. Several weeks later this patient came to report progress, and stated that she had been free from pain for four or five weeks, but that the pain was beginning to come on again. This is a frequent occurrence in the medical treatment of duodenal ulcer.

Another most instructive case was under the care of Mr. L. A. Dunn. A provisional diagnosis had been made of pyloric obstruction due to the cicatrization of an old gastric ulcer. The x-ray examination with a bismuth meal showed that there was, in fact, cicatricial contraction of the stomach, but that its position was not at the pylorus as anticipated, but in the middle of the stomach, where it gave rise to a form of hour-glass contraction (*h*, Fig. 7), with a small portion of stomach in this region forming an isolated pouch. There was no obstruction at the pylorus; in fact, the bismuth emulsion which entered the pyloric portion of the stomach passed through the pylorus at the normal rate as the result of active peristaltic contractions. Had the examination ended here, the information gained would have been but partial; for, observing the patient again two hours later on the couch, it was seen that the duodenum showed obstruction at the duodeno-jejunal junction of much the same kind as in the cases already described (Figs. 5 and 6); repeated peristaltic contractions of the duodenum failed to forward its contents into the jejunum (see Fig. 8). This was an important point when it came to treatment, for there was obstruction at two distinct parts, at the cicatricial hour-glass constriction and at the duodeno-jejunal junction. Thus a cure could not have been expected from either of the ordinary operations—that of connecting the two parts of the stomach above and below the hour-glass constriction by a new opening, or the ordinary operation of posterior gastro-jejunostomy. Mr. Dunn solved the problem in a very practical way by making his anastomosis between the upper portion of the stomach (*c*, Fig. 7) and the jejunum, thus cutting both obstructed portions out of the circuit, and supporting the jejunum. The patient made an excellent recovery.

Quite recently a patient was brought to me by Dr. A. P. Beddard and Mr. D. J. Armour for an examination of the alimentary canal. She was 48 years of age, and had

suffered from attacks of pain and nausea for seven years, with vomiting when the pain was severe. Her digestion had always been weak; there was great headache, and she had been getting thinner for the last year; there was tenderness to pressure in the caecal region.

I found the stomach dropped, much as in the case of Fig. 6. Gastric peristalsis was very active, the bismuth emulsion passing through the pylorus rapidly and entering the duodenum; there was considerable dilatation of the duodenum, and a good deal of obstruction to the passage from the duodenum to the jejunum (see Fig. 9). I have no doubt the obstruction becomes absolute whenever the patient is at her worst.

The subsequent course of the bismuth meal showed no delay or obstruction at any other point, but the large intestine was dropped so that the caecum, the sigmoid flexure, and the rectum were all in the pelvis together with the great curvature of the stomach and a dropped loop of the transverse colon.

Duodenal obstruction is frequently associated with obstruction at the lower end of the ileum or in the large intestine. Many of the patients exhibit dropping, not only of the stomach, but also of the large intestine. There is frequently great delay in the passage of faeces through the large intestine, and in some cases there is considerable delay in the last portion of the ileum. However, the duodenal obstruction is often the most marked abnormality, and may be the only one which calls for active treatment. In such cases the operation of gastro-jejunostomy relieves all symptoms, and this operation may be expected to do more than place the duodenum at rest by cutting it out of the circuit. As Mr. Lane has pointed out, the jejunum, when attached artificially to the stomach, is supported in such a way that it cannot drop and cause kinking at the duodeno-jejunal junction.

Much controversy still rages round the diagnosis and treatment of inflammatory diseases of the duodenum. I hope that the observations I have described, based as they are on fact, will be of real value.

REFERENCES.
¹ *Surgery, Gynaecology, and Obstetrics*, March, 1911. ² *BRITISH MEDICAL JOURNAL*, April 22nd, 1911. ³ W. Arbuthnot Lane, *Kinks in Chronic Intestinal Stasis*, *Ibid.*

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

THE EFFECT OF SALVARSAN ON TREPONEMA PALLIDUM.

WITH reference to my two notes on the infective granule in certain protozoal infections, which you were good enough to publish in the *JOURNAL* for April 1st and April 15th respectively, I think it is of interest to record that I have now, thanks to the courtesy of Major F. F. Carroll and Captain McK. Saunders, of the Egyptian Medical Service, had an opportunity of examining by the dark-field method a preparation put up by Captain R. G. Archibald from a case of syphilis. It consisted of serous fluid obtained by scraping the surface of a buccal mucous tubercle which had previously shown the presence of *T. pallidum* in fair numbers. The hanging-drop was prepared without any addition of salt or citrate solution four hours after the patient had received a dose of 0.3 gram of salvarsan subcutaneously.

Captain Archibald and I found at first many motile, highly refractile granules, recalling very strongly those found in fowl spirochaetosis. There were also motionless and empty "periplasts" or cell membranes. After some search a *T. pallidum* was discovered actively engaged in granule-shedding, apparently in a manner identical with that displayed by *Sp. granulosa penetrans*.

Doubtless this phenomenon is evidence of a protective action on the part of the spirochaete. It is endeavouring to preserve itself from total extinction by expelling bodies which are undoubtedly resistant and which may possibly be of the nature of spores. It is evident that such action on the part of the spirochaete must have a distinct bearing on the treatment of the disease it produces. I notice that the Yakimoffs,¹ who have been testing the value of

salvarsan in the case of rats and mice infected with *Sp. duttoni*, find that it is advisable rapidly to follow the first dose by a second. Now, as Leishman has found granule formation in the case of the spirochaetes of African tick fever ingested by *O. moubata*, it is almost certain that these are granule-shedders at the natural crises, and also under the influence of such a drug as salvarsan. It seems to me, then, not only possible, but probable, that this second dose recommended by the Yakimoffs acts by killing the granules which are being shed as a result of an inefficient first administration. In this way there is no storing up of resistant forms in the internal organs, and relapses are thereby prevented. If this is true of African tick fever, why not also of syphilis in the light of what I have stated? It should be easy to put the matter to the test, and if the observation is confirmed we should be a step forward in the use of the valuable drug which the genius of Ehrlich has added to our therapeutic armament.

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SUPPRESSION OF URINE.

I HAVE been attending for the last ten weeks a patient, aged 72, suffering from senile dementia. During that time, on at least five occasions, she passed no urine for periods of five, six, or seven days. When the urine was passed it was highly concentrated, very dark brown in colour, but contained no albumen. She ultimately died in a condition of coma, but, beyond some twitching of muscles, had no distinct convulsions. I have always understood that suppression of urine was fatal in a much shorter time.

Hastings.

E. R. MANSELL.

GUNSHOT INJURY INVOLVING RIGHT ELBOW JOINT.

AT sea, in H.M.S. *Cornwall*, on October 25th, 1910, a gunnery instructor, while taking a class in aiming practice, got his right arm in front of the gun, and was struck by a Morris tube bullet. He ran to the sick bay, where I was at the time.

There was profuse arterial haemorrhage from the wound, which was situated in the fold of the elbow, just internal to the border of the bicipital fascia. The edges of the wound were scorched. There was no wound of exit. The haemorrhage, though considerable, was easily controlled by pressure. On probing, the bullet track was found to pass backwards and inwards towards the point of juncture of the internal condyle and the humeral shaft. Sensation and movement in the hand and forearm were perfect. The pulse at the wrist was found absent, and the hand cold.

The forearm was covered with wool and bandaged to the elbow. The wound was dressed with gauze and a large pad of wool, and the elbow well flexed by a figure-of-eight bandage, and the patient put to bed.

In an x-ray plate the bullet could be seen broken up on the internal condyle, but further detail could not be made out owing to the position of the arm.

The wound was dressed on November 1st and found quite healed, excepting a small pustule of suppuration at the surface. There was a great deal of swelling about the elbow and surface discoloration. The bullet track led down to a large hard swelling to the inner side and slightly above the joint, apparently a haematoma. The pulse at the wrist could only just be felt. Treatment was now very gentle massage twice daily; a carbolic fomentation 1 in 40 was put on for fear the superficial suppuration might infect the haematoma below. The forearm could not be straightened at the elbow by about 15 degrees.

By November 7th all fear of suppuration had gone and the swelling had so much subsided that it was possible to make a more minute examination; with the x-ray screen it could be clearly seen that the bullet had struck and broken up upon the internal condyle. The lower end of the right humerus was considerably broader than the left and crepitus was obtained, there being evidently a fracture of the internal condyle. The forearm was at once put up in the fully flexed position with figure-of-eight bandage and strapping. This caused extreme pain, but after a few

¹ W. L. and N. K. Yakimoff, *Nouvelle communication relative au traitement de la maladie du sommeil et de la tick-fever par le "606"* (*Bull. Soc. Path. Exot.*, March 8th, 1911).