the centre of the tube run two grooves $\frac{1}{4}$ inch apart, sufficiently deep to prevent a ligature from slipping, and the intervening portion is on a slightly lower level than the rest of the tube, in order to allow the fold formed, when the operation is completed, to lie smoothly.

The experiments were performed as follows, a smaller sized tube of course being used than that above described. A coil of small intestine was withdrawn through a median incision, and 3 or 4 inches of its length resected. A stitch was then passed through all the coats of the bowel and the mesentery of one side and then on through mesentery and bowel of the other and tied, thus bringing the divided ends together and preventing retraction of the mesentery. The tube was then inserted and the two ends slipped together evenly over it; each was in turn brought down well over its corresponding groove in the tube and firmly secured by a circular ligature passed through the gap in the mesentery. The part beyond the ligature was trimmed with scissors to remove any excess of tissue in that situation. The seat of operation was well flushed with carbolic lotion, and the enterorrhaphy completed by bringing the serous surfaces together with Lembert's sutures, five in number, one on each side of the mesenteric attachment, the remainder round the rest of the circumference.

OPERATION I. May 30th.—On June 5th the abdominal wound reopened and the animal was therefore at once killed. On *post-mortem* examination the omentum was found firmly adherent to the scar. There was no leakage under considerable pressure of water. On stripping off the omentum which required considerable force, the ends of the bowel were separated for a little space opposite the mesenteric attachment; everywhere else union was good. In spite of this slight imperfection the ultimate result would in all probability have been good as the space was quite closed by adherent omentum and plastic exudation.

OPERATION II. July 17th.—On August 30th the animal was killed while in perfect health. *Post-mortem*: The proximal and distal portions of the intestine were seen to be of the same size. There was no contraction of the scar. Inside the scar was found to be represented by a flattened band scarcely projecting at all into the lumen of the bowel.

OPERATION III. July 31st.—The animal was killed on August 30th, while in perfect health. *Post-mortem*: The intestine was seen to be rather sharply kinked, and the proximal side slightly dilated. There was no contraction of the scar. Inside the scar was represented by a fibrous ring projecting somewhat into the lumen, but admitting the end of the index finger.

OPERATION IV. August 9th.—The animal was found dead on August 14th. *Post-mortem* examination showed general peritonitis, due probably to introduction of septic matter at the operation, as there was no leakage from the bowel.

OPERATION V. October 23rd.—The animal was killed on January 18th, while in perfect health. On *post-mortem* examination, no dilatation of the proximal side was found, and no contraction of scar.

OPERATION VI. November 14th.—The animal was killed on January 18th, while in perfect health. On *post-mortem* examination slight dilatation of proximal side was found, but no contraction of scar.

OPERATION VII. November 16th.—The animal completely recovered from the operation, but died suddenly on December 13th. *Post-mortem*: On the distal side of the scar the intestine was collapsed and empty. The proximal side was dilated to three or four times its normal size, forming a pouch, which contained a hard mass of short straws and pieces of bone, with difficulty broken up and removed. No contraction of the scar was visible from the outside, and on introducing the finger it passed readily through a thin fibrous ring.

Thus, of the seven dogs operated upon: One died on the fifth day from peritonitis, one was killed on the sixth day, one died on the twenty-seventh day from obstruction, one was killed on the thirtieth day, one on the forty-fourth day, one on the sixty-fifth day, and one on the eighty-seventh day. In all the immediate results were good, there being no escape of feces; and in the five which lived for periods ranging from one to three months the condition of the scar was satisfactory.

From the above results I think it may fairly be claimed that the tube I have described satisfactorily meets the objections I have stated to exist in the unaided use of sutures.

(1) It reduces the time necessary for the performance of the operation enormously. This it does by—

(a) Securing absolute steadiness and close approximation of the divided ends.

(b) Lessening the number of sutures required.

(c) Rendering absolute accuracy in the manner of suturing unnecessary, since all that is required is that the serous surfaces should be approximated, the circular ligatures, not the sutures, preventing faecal extravasation.

(d) The immediate restraint of all hæmorrhage from the divided ends by the circular ligatures.

(2) It completely and absolutely prevents escape of the intestinal contents till the tube is absorbed, and prevents the

contact of faecal matter with the sutures, so that union is rapid and sufficiently strong of itself to prevent extravasation when the tube becomes inefficient.

(3) Obstruction by swelling of the edges is impossible owing to the presence of the tube.

No less important than the immediate result is the ultimate behaviour of the scar; and, since this being circular is necessarily badly placed, no effort should be spared to render it otherwise satisfactory. True, in time the contractility of a scar in the intestine may tend to disappear, but the wider the band of uniting material, and the more it encroaches upon the lumen from the first, the less likelihood is there of this result being attained.

In both of these respects the use of the tube contrasts favourably with that of sutures. In the former the intestine is united by a thin layer thrown out between the ends, which are in contact at one point only all the way round, in the latter between a considerable width included between the two rows of stitches. In the former, too, the scar at first does not project into the lumen at all, while in the latter the projection inwards from the first is considerable—in some cases so great as to produce obstruction, as mentioned above.

The description I have given of the operation presupposes the fact that the two ends to be united are approximately of the same size; but should one be larger than the other, a slight alteration in detail, whereby the smaller is invaginated, is easily carried out, and is equally satisfactory. In cases where the disproportion was very great, it might be convenient to have the tubes made conical instead of cylindrical as figured in the diagram.

CONCLUSIONS.

In conclusion, I would insist upon the following details, as more or less essential to the success of the operation:

1. The ends should be drawn together by a single stitch through the mesenteric border, before the tube is introduced.

2. The circular ligatures should not be passed through the mesentery, but through the gap and then round the bowel. The former, though slightly easier, might subsequently produce trouble in two ways; for since the vessels pass in a circular manner round the intestine, the part beyond the ligature might not have its blood supply cut off, and thus might continue to pour out its secretion, which would collect in and distend the space enclosed between the tube and the row of sutures, and then burst into the peritoneal cavity. Later, if this danger were escaped, a polypoid mass projecting into the intestine might result.

3. Too much rather than too little should be included beyond the ligatures, as any excess is easily removed with scissors, whereas, if too little be taken, a portion of the circumference may escape inclusion. If this occur, a second ligature should be applied without removing the first, special attention being paid to the part which at first escaped.

4. Before approximating the serous surfaces, the parts between the ligatures should be thoroughly cleansed to remove any faecal matter which may be adhering to the mucous membrane.

6. In the experiments interrupted sutures were used, as the thick intestine of the dog rendered a continuous suture unsafe; but in human intestine a continuous suture answers well, and is quickly applied.

The tubes have been made for me by Messrs. Maw, Son and Thompson.

THREE CASES OF INTESTINAL OBSTRUCTION TREATED BY LAPAROTOMY.

By EDWARD J. CAVE, M.D.LOND.,
Surgeon to the Crewkerne Hospital.

In some remarks on a case of intestinal obstruction by a band, which was successfully treated by laparotomy, published in December, 1890, I ventured to insist on the necessity of early surgical interference, and I added that until this doctrine was recognised as a surgical canon it was desirable to record every case with the conditions determining failure or success.

The three cases which follow are all that have occurred in my practice since that date, external hernia, and malignant disease of the rectum being excluded.

CASE I. Tuberculous Peritonitis: Obstruction of Ileum: Operation: Relief: Death one month later from Apoplexy.—S. B., aged 50, a labourer, was admitted to the Crewkerne Hospital on May 28th, 1892. He had been suffering for two or three months from symptoms of chronic intestinal obstruction, with increasing emaciation. On admission the obstruction had been absolute for a week with fecal vomiting for two days. Laparotomy was at once performed, and disclosed dry contracting tuberculosis of the peritoneum. The matting of the intestines was particularly dense in the right lower segment, and immediately above the right ileo-cæcal valve the bowel was so dragged and kinked as to be completely obstructed. Some troublesome dissection so far remedied matters that the intestinal contents passed readily from the enormously-distended ileum into the empty large bowel. The abdomen was then freely washed out and closed. The bowels acted next day, the wound healed, and the man's general condition improved very markedly for a fortnight, when diarrhoea set in. He got up at the end of three weeks; the diarrhoea still continued and we concluded that it was due to tuberculous ulceration of the bowels. On June 20th, with no nervous prodromata, he had two epileptiform convulsions, and died comatose half an hour after the second fit. No post-mortem examination was permitted.

CASE II. Diabetes: Intussusception; Laparotomy: Coma.—On the evening of December 9th, 1893, I saw with Mr. C. Alford a gentleman, aged 66, who for the past three months had been suffering from a succession of boils on his right hand and forearm. He denied any noticeable degree of thirst, polyuria, or wasting; but the urine had a density of 1040, and contained a large quantity of sugar. There was no albumen and no reaction with perchloride of iron. The occasion of my seeing him was that on the previous day he had in the morning a tendency to diarrhoea. At 11 A.M. he conducted a service in his church, but was then seized with severe pain in the abdomen, so that he went home and lay on his bed. He had a feeling that he required relief, and took two rhubarb pills. At night he had slight pains and constant tenesmus, and in the morning took an ounce of castor oil. Still there was no satisfactory stool, only a few table-spoonfuls of blood-stained mucus being evacuated. Two starch enemata with opium were administered through the night, which lessened the pain, but the tenesmus persisted as before. There was no vomiting. The next day, and also on December 11th, the colon was distended under pressure, but without relief. The tenesmus was most distressing, and he became slightly delirious. On December 12th he was weaker, still insisting on going to the stool every few minutes. The pulse was 102, the temperature 98°. The abdomen was rather more distended, but not tense. The bowel was again forcibly distended, but without avail. He had been taking extract of belladonna with opium every two hours in a pill. Later in the day he got drowsy and easier, and the pills were omitted. Still no relief was obtained, and at 10 P.M. at the urgent request of his friends, I decided to make an artificial anus. The intussusception was found at the ileo-cæcal valve, and a loop of ileum 6 inches above was drawn out, the mesentery transfixed with a bone knitting needle, and the operation, which lasted only five or six minutes, completed rapidly. He was at this time half-unconscious, and this developing into coma he died the following day.

CASE III. Acute Obstruction of Ileum by a Band: Laparotomy: Cure.—On February 3rd, 1894, I saw J. M., aged 25, a robust young farmer, 6 feet high, who gave the following history: He had had a serious "abdominal" illness about eleven years earlier, when he was very ill for three weeks; he said that every "spring and fall" for a year or two thereafter he had a recurrence of pain and indigestion, but had enjoyed good health since with the exception of occasional attacks of spasmodic asthma. On January 30th he went to a party at a neighbouring farm and was shooting rabbits all day. He ate a heavy dinner at 6 P.M.; after that he played cards and drank several glasses of cider and one of whisky and water. At midnight he had some tea and a piece of cake. Soon afterwards he was seized with severe pain in his abdomen, his bowels acted, and he vomited the dinner which he had eaten six hours before. He went to bed, but the pain was so bad all night that he could not sleep, and at 5 A.M. he got up and walked home, a distance of three or four miles, in drenching rain; it was as much as he could do to get to his house. During that day (January 31st) he vomited two or three times, and the pain still persisted about the navel. His food was mostly milk. He took castor oil, but without effect. At night he sent to the doctor, and had a sedative mixture of opium and soda to take every four hours. On February 1st, after a better night, he was easier, but vomited once or twice. He took more castor oil, but this, too, he vomited, and in the evening the pain was much worse. On February 2nd he passed one small costive-looking fragment of fecal matter. He vomited several times, but kept down some milk. The opiate mixture was repeated. On February 3rd he had severe pain from 7 to 9 P.M., and vomited once. The bowels had not acted, nor had he passed any flatus. The urine was scanty and loaded with lithates. The temperature was 97°, the pulse 84. There was no abdominal tenderness nor distension; nothing amiss was to be felt. His expression was quite calm; the tongue was dry, with a rough fur. A copious enema returned unchanged. He was ordered calomel gr. v. On February 4th the temperature was 98.5°, and the pulse 88. No wind or feces had passed. He had not had much pain, but had vomited twice; the vomit contained curdled milk. He looked a little anxious, and there was slight tympanitic distension and frequent rolling of the bowels. To clear up the diagnosis he was given 10 grains of blue pill with colocynth. On February 5th the pulse was 112. He had had a bad night, rolling in pain; had vomited frequently, and the vomit was brown and stinking. The bowels had not acted; he looked a good deal worse, drawn and haggard, and rather blue. The diagnosis being now clear, I washed out the stomach and opened the abdomen. The small intestine was greatly distended and very dark, with a flabby wall. The cæcum was empty. Tracing up the ileum from the valve, I came almost at once on a tight cord-like band about 4 inches long, forming a loop over a large coil of intestine. It was attached at both ends to the back of the abdomen, on the left side at the level of the pelvic brim, but on the right it passed down deeply into the pelvis. This

was tied at each end and removed. I was about to evacuate the distended gut, when the patient ceased to breathe and became pulseless at the wrist from chloroform syncope. The abdomen was hastily washed out with a few pints of hot water and sewn up, artificial respiration going on meanwhile. Ether was injected hypodermically and brandy into the rectum, and in ten minutes he rallied and was removed to bed after an absence of forty-five minutes. He vomited twice an hour later, the vomit being brown and feculent. After this the vomit ceased. The bowels acted freely twenty-four hours later, and the wound, when dressed for the first time on the twelfth day (February 16th) was firmly healed. A week later he got up wearing a belt, and is now in perfect health.

In the first case the obstruction was relieved permanently by the operation, but the tuberculous disease was unchecked.

The coma which proved fatal in the second case was apparently of diabetic origin, and it was the presence of this constitutional dyscrasia which induced us to avoid earlier recourse to operation, hoping against hope that the intussusception would yield. I doubt whether an operation would have been more successful at the beginning of the attack.

The third case illustrates a difficulty that often arises. On the fifth day of obstruction it still seemed possible that the condition was one of obstinate constipation which a brisk aperient might relieve; in such cases one must run the risk of damage to the gut which is involved in violent peristalsis. By a policy of inactivity a greater risk is incurred, and to operate before the diagnosis is clear involves the possibility of an unnecessary and dangerous procedure. As a matter of fact, aperients are given in the vast majority of cases of intestinal obstruction, and it is by their failure to act that the diagnosis is in great measure established. As to the details of the operation, I rarely open an abdomen for whatever purpose without flushing with hot water poured from a large jug, of which I have no objection to leave a considerable quantity in the cavity. In closing the wound I no longer sew up the abdominal wall in three layers, but include the whole with one continuous suture; this saves time, and does not in my experience increase the risk of a yielding cicatrix. Out of a considerable number of abdominal sections for various conditions, I have had but one case of ventral hernia, and this in an elderly woman who left off her support immediately on leaving the hospital three weeks after the removal of a large ovarian tumour. No doubt the tendency to protrusion is greatly increased by the use of a drainage tube; but this is an appliance for which in abdominal, as in other branches of surgery, I find rarer occasion every year. When the wound is once closed and dressed I prefer not to see it again for ten or twelve days.

OVARIOTOMY ON A PATIENT IN HER 85TH YEAR.

By J. PAUL BUSH, M.R.C.S.,
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A. M., a widow, aged 84, was transferred to my care in the Bristol Royal Infirmary by my colleague, Dr. Shaw, with the following history. For the past twelve months she had noticed her abdomen was increasing in size; for nine months she had been much troubled with pain in that region; three months before coming under our treatment vomiting had commenced, and on admission was severe.

When first seen the patient was quite unable to move about on account of her size, and on account of the severe pain and vomiting which all movements caused; all the usual physical signs of a large ovarian cyst were present.

On September 12th, 1893, by means of a small incision, I exposed the cyst, tapped it, and removed a large thin-walled multilocular ovarian cyst; there were no adhesions; the fluid measured 19 pints. The first week after the operation the temperature ranged from 96° to 97° F., and then remained steady at 97°, which appeared to be her normal temperature. The wound healed rapidly, and, excepting a little bronchitis, which she said she always had in the winter, she had no bad symptom. She went home on October 16th cured. I heard of her being alive and well and able to get about some months after this.

I report this case now, having lately had to refer to the interesting paper of Dr. Spencer in the BRITISH MEDICAL