sue, and strict aseptic precautions should be taken. The skin should be well washed with an antiseptic, and the syringe should be boiled immediately before use. As to the dose, 20 c.cm (660 units) should be injected, and it would probably be well to inject more frequently than in the cases above recorded. I would suggest that the injection be made twice a day until the patient is convalescent. It is important to commence the treatment as early in the disease as possible.

REFERENCE.

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THE HUNTERIAN LECTURES

ON

THE PATHOLOGY AND SURGERY OF
INTUSSUSCEPTION.

Delivered at the Royal College of Surgeons of England.

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LECTURE III.—(Concluded).

MORIBUND INTESTINE.

WHEN the surgeon has opened the abdomen and finds that the intussusception is greatly congested and has lost its gloss he must not too hastily assume that it is dead, yet it is often a matter of no slight difficulty to decide whether or not the bowel is capable of recovery. A piece of intestine which is only congested will bleed if it be pricked, even though it has lost its lustre and if it be gently stroked until its vessels are emptied the blood will be seen to pass along the vessels again as soon as the pressure is taken off them. A piece of intestine in such a condition must be handled very tenderly. It is unnecessary to remove it, and the patient is often so collapsed as to render any prolonged operation impossible, even if enterectomy were advisable. The wisest thing to do in such cases is to wrap a layer or two of gauze round the injured intestine as soon as the invagination has been released. One end of the gauze is left hanging out of the abdominal wound, the intestine is laid inside the peritoneal cavity, and the incision is lightly closed with temporary silk sutures. If the bowel ruptures the intestinal contents may then find their way out of the abdominal cavity, whilst if it recovers the gauze can be removed and the wound will close by granulations.

b. IRREDUCIBLE INTUSSUSCEPTION.

We have hitherto considered the operation of abdominal section for the relief of comparatively simple cases of intussusception in which the ingenuity of the surgeon is not taxed unduly, for the intussusception is reducible. The really serious, and by far the most interesting, cases are those in which the intussusception is found to be irreducible after the abdomen has been opened.

Intussusceptions become irreducible under many different conditions. In the first place the intestine may be healthy, but it is kept invaginated by more or less extensive adhesions; by peculiarities of structure, such as twists in its axis or the forcing of one piece of intestine upon another; by great swelling of the intussusceptum, or by the presence of large tumours in the intussuscepted bowel. Secondly, an intussusception may become irreducible because the bowel is so gangrenous or ulcerated that the surgeon dare not exercise traction upon the tumour, nor dare he leave the injured intestine within the peritoneal cavity.

It has already been pointed out that slight and newly-formed adhesions do not necessarily render an intussusception irreducible, even by such a simple method of treatment as irrigation, though their presence is of unfavourable augury, because increased force is necessary to effect reduction. The adhesions formed in an ordinary case of intussusception which has been allowed to run its course unchecked may be very extensive and very dense. I found in ex-

perimental invaginations produced in cats that slight adhesions were formed between the intussusceptum and the returning layer of the intestine as early as twelve hours after the operation, and that the adhesions were formed earlier and were more rapidly converted into scar tissue in the enteric than in the ileo-cæcal invaginations. Clinical observations show how widely different is the tendency to the formation of adhesions in different persons. Mr. Marsh³⁰ performed abdominal section on a child about fifteen hours after the onset of symptoms, only to find that the intussusceptum had become so universally adherent to its sheath that it was impossible to effect a reduction. A similar experience befel Mr. Makins³¹ in a child aged 4 years, who had suffered from symptoms of intussusception for forty-eight hours. The serous coats of the bowel were so firmly united to each other that they could only be separated with difficulty when the bowel had been laid open longitudinally after its removal from the body. On the other hand, the formation of adhesions is sometimes delayed for an indefinite length of time, as in the cases seen by Dr. Lettsom,³² in which the symptoms of intussusception were of three months' duration, and by Dr. Leichtenstern,³³ where they had lasted eleven months, and yet the *post-mortem* examination showed that hardly any adhesions were present. Dr. Carver,³⁴ too, met with a remarkable case of the same kind, in which a boy aged 2 years and 9 months suffered from symptoms of intussusception for seven weeks. He had faecal vomiting for twenty-five days, and the bowel protruded at the anus for a fortnight, yet the intussusception was easily reduced after the abdomen had been opened, as there were hardly any adhesions. The adhesions are formed more readily along the concave than along the convex side of the intussusception, and their extent, at any rate in the ileo-cæcal forms, depends, I assume, upon the varying relations of the mesenteric folds which were described in my second lecture. They are not necessarily associated with suppurative processes, and, in spite of the cases I have just quoted, they are more often found in chronic than in acute cases.

Gangrenous and ulcerating intussusceptions form the second great group of irreducible intussusceptions of the bowel—a group which can be further subdivided into those associated with peritonitis and those in which there is no peritonitis though the belly may be full of stinking gas. I have already occupied some part of your time with a consideration of gangrenous intussusception, so that I shall not deal further with its pathology or causation, except to say that it is only produced with the greatest difficulty in experimental invaginations upon animals. I have quite failed to produce it in cats and rabbits, even when the vessels going to the neck of the tumour have been securely tied.

The treatment of an irreducible intussusception is fraught with danger, whether it be irreducible from mechanical obstacles, on account of extensive adhesions, or because of gangrene. The prognosis in these cases was formerly considered desperate, and with a few rare exceptions the patients were left to die even by those advanced surgeons who had dared to do a laparotomy. But the advance of abdominal surgery has led to a recognition of the extraordinary readiness with which wounds of the intestine repair when their edges are kept in proper apposition, and we now have good hope that our efforts will be crowned with success even in the most unsatisfactory conditions.

I. SIMPLE IRREDUCIBLE CASES.

In chronic cases, when the end of the intussusceptum is gangrenous; when the intussusception is short and when it is irreducible from adhesions landed to its neck from the presence of a polypoid tumour, or from a bulbous enlargement of the end of the intussusceptum, the method recommended by Barker,³⁵ Jessett,³⁶ and Greig Smith³⁷ may give excellent results. The broad principle underlying each modification of the operation is to ensure the union of the intussusciens with the intussusceptum by inserting a continuous suture at the neck of the tumour, then to slit open the intussusciens, remove so much of the intussusceptum as lies dead or free, stop the bleeding, and sew up the wound in the sheath. It is sometimes impossible to remove the intussusceptum after it has

been divided, and in such a case Leszczynski³⁸ left the piece of bowel in the large intestine to be dealt with by Nature, and the patient recovered.

These methods are useless when the intussusceptum is attached to the returning layer by firm adhesions for any great distance, as in these cases the two cylinders of intestine may form a continuous tube. Mr. Sidney Jones³⁹ recorded such a case occurring in a child, aged 9 months, in whom an intussusception proved fatal after the symptoms had lasted nine weeks. The *post-mortem* examination of the body showed that a probe could be passed along the whole length of the intussusception, which began at the ileum and protruded through the anus. The apposed serous surfaces were adherent along their whole length by firm fibrous tissue. An artificial anus would alone be serviceable in the treatment of such a case, or if the adhesions did not extend very low in the rectum Halsted's operation of lateral anastomosis⁴⁰ might be employed. These extensive adhesions usually occur in chronic cases, and the surgeon can therefore select his time and the method of performing the most suitable operation. It should be remembered, however, that death has resulted from starvation in experimental operations where long lengths of the intestine have been thrown out of action.

2. ENTERECTOMY.

Partial operations are useless when the neck of the sac is ulcerated, when the sheath of the intussusception is gangrenous, or when the invagination is associated with malignant disease of the intestine, and it is exactly in these cases that the greatest and most satisfactory advance has recently been made in the surgical treatment of intussusception. The old operation of making an artificial anus for the relief of the worst cases of irreducible intussusception had long been condemned by the more thoughtful surgeons, and Mr. Howse⁴¹ performed a formal enterectomy for the relief of a ruptured intussusception in a child aged 5 months in September, 1876. But it was not until 1885 that Professor Braun⁴² in Germany, and in 1887 that Mr. Lawford Knaggs⁴³ in England called attention to the feasibility of section and subsequent suture of the intestine in these cases, pointing out the great advantage to be gained by the operation over the older methods.

Slow but steady progress has been made since the publication of these papers. Resection was at first associated with simple end-to-end suture of the divided intestine, which is theoretically the most perfect but practically the most difficult method of obtaining union. The results of simple end-to-end suture proved most unsatisfactory, and this method has now been abandoned for more complex operations, which have resolved themselves into the union with and union without the aid of mechanical appliances, the methods of Senn and of Maunsell respectively.

Personally, I have no hesitation whatever in giving in my adherence to the non-mechanical party, for it seems to me that its methods are more simple, whilst its results are at least as good as those obtained by the mechanical school. In cases of intussusception, where of necessity an immediate operation is required, it may cause the most serious results to be obliged to await the arrival of the proper appliance. Maunsell's method, too, is particularly suited for the ileo-cæcal form of intussusception which is the more common, for the two pieces of intestine vary greatly in their calibre, so that the invagination is easy. For the present, however, Murphy's button seems to have the advantage, though I think that it is but a temporary one, for in all the cases where it has been used successfully the intussusception has been of the enteric form, where the serous surfaces are smooth, and can be brought into sufficiently close approximation to ensure union by first intention. It must necessarily prove less useful in intussusceptions involving the large intestine because the appendices epiploicæ then render it impossible to bring the two surfaces into regular and uniform apposition.

My own experiments, carried on without a knowledge of the very valuable and more extensive work done along the same lines by Messrs. Ballance and Edmunds,⁴⁴ have satisfied me that in animals Maunsell's method yields the most satisfactory results. It can be performed at a moment's notice, and the entire operation from the first incision to the last suture in the abdominal wall can be completed easily in thirty minutes. The sutures are carried through the whole

thickness of the walls of both pieces of the bowel, so that even an operator with an unsteady hand, or one who has not had much experience of abdominal surgery, has but little to fear, and the after-results are admirable, as may be seen in this specimen. It is part of the intestine of a cat from which ten inches of the ileum and colon with a small experimental intussusception of a week's duration were removed by Maunsell's operation on August 6th, 1896, the animal being killed on February 2nd, 1897. During this interval of 180 days the cat increased in weight from 2,070 grammes to 2,615 grammes. The line of union is marked externally by a slight bulging of the scar. The parietal layer of the peritoneum is adherent to the serous coat of the intestine for a distance of 22 mm. below the point of circular union. The longitudinal layer in the intestine is so completely healed that its position is only marked by three pinhole scars showing the situation of the sutures. Internally, the line of circular union is absolutely complete and it seems to be covered with healthy mucous membrane, though I have not yet had time to make a microscopic examination. The intestine is a little pouched at this spot because the scar has yielded. The line of the longitudinal incision is marked by a very faint scar in the valvulæ conniventes, but the lumen of the intestine is not narrowed by it. The valvulæ conniventes are modified over the actual line of union but they extend for a distance of 55 mm. before the large intestine begins.

I find that in performing Maunsell's operation especial care must be taken to suture securely the mesenteric borders of the intestine, for the bleeding and the increased thickness of the tissues at this point are apt to deceive the operator, so that he is likely to pass his needle through the wall of only one piece of the bowel. Leakage then takes place, and the animal dies. Several of my cats died from this cause, and in cases of doubt I now insert one or two sutures externally at this part after the intestine has been disinvaginated, taking care to pass the sutures into the submucous tissue, for otherwise they are likely to cut their way out when they are tied. A few point sutures is all that is needed to bring the cut edges of the mesentery together.

The outlook for cases of irreducible intussusception treated by enterectomy is distinctly favourable, whatever method be adopted. When Braun⁴⁵ published his statistics in 1885 he could only find a single case where recovery had followed enterectomy for the relief of intussusception. Rydygier in his addendum to Braun's list, published ten years later, has been able to collect the records⁴⁶ of 25 cases published between the years 1885 and 1895 in which recovery has taken place after the intestine has been resected or an anastomosis has been made between two pieces of bowel for the cure of intussusception. I find that four more recoveries are to be added to this list. Two of these occurred in America,⁴⁷ where the operation was done for the relief of chronic intussusception in women, and two were done in England for subacute gangrenous intussusception in children. One of these cases is recorded by Dr. Mitchell Banks,⁴⁸ who tells me that the boy is still alive and well. The other case came under the care of my colleague, Mr. Pickering Pick, and, though it is still unpublished,⁴⁹ he has very kindly given me leave to say that it was a girl aged 8½ years who had complained of intense stomach-ache after she had jumped off a form at school. The abdomen was opened on the seventh day after the onset of symptoms, and a stinking intussusception was found 2 inches above the ileo-cæcal valve. It was cut away, and the two ends of the ileum were brought together with a Murphy's button, which was passed on the ninth day after the operation.

CONCLUSIONS.

My time, Sir, has almost ended; not so my task, if, indeed, a labour of love can be called by so harsh a name. There is much more that I could have said upon this topic of intussusception, but I am satisfied for the present if I have advanced even but a little our scientific knowledge of so interesting an affection. For the sake of completeness I will sum up the conclusions at which I have arrived in this lecture. Intussusception is a condition which brooks no delay in its treatment, for something must always be done at once except, perhaps, in those slight cases which are indistinguishable from severe colic. In all doubtful cases purgatives should be completely withheld. I found in my experi-

ments that cats and rabbits bore a simple invagination with remarkable freedom from symptoms, and that after a varying period of time the invaginated bowel could be excised and the animal would recover. All the animals, however, to which purgatives were administered after the intestines had been invaginated died when enterectomy was performed. Clinical evidence teaches the same lesson, for all the records of cases show that the symptoms have been seriously increased when the patient has been purged. The routine treatment of intussusception is to chloroform the patient, and steadily to fill his large intestine with hot salt solution under a hydrostatic pressure, of not more than 3 feet in a child, the fluid being allowed to remain in the intestine at least ten minutes. The earlier this method is adopted after the appearance of the symptoms the better are the results obtained, but it should not be adopted in enteric intussusception, in cases where the symptoms are very acute, or in those where the absence of signs or symptoms, with a subnormal temperature, leads the surgeon to suspect that the intestine is becoming gangrenous. In these cases, and when the intussusception is not reduced after irrigation has twice been tried, and when after reduction the intussusception has thrice occurred, the abdomen must be opened. The surgeon must then be prepared to deal effectually with the conditions he may find by such operative means as he can carry out with the least amount of shock and in the shortest space of time that is compatible with the safety of the patient. This will be ensured if he uses the method with which he is the most familiar. But he should bear in mind that hardly a case can arise in which he is justified in closing the abdominal wound without at least an attempt to complete the operation by reducing or removing the intussusception. Such half measures as the formation of an artificial anus are hardly ever justifiable, and the results obtained by them are usually most disastrous. In the light of our present knowledge it appears that the use of a button or bobbin is most likely to give good results when enterectomy has to be done for an enteric intussusception, whilst Maunsell's operation is best adapted for the cure of ileo-cæcal and colo-colic forms of intussusception.

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THE VALUE OF THE ELECTRIC LIGHT CYSTOSCOPE IN LOWERING THE MORTALITY OF NEPHRECTOMY.*

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It is accepted that the high death-rate of nephrectomy is largely due to the ablation of kidneys which have become affected by tubercle or by advanced malignant disease. When criticising in 1890¹ the influence of the Nitze method upon our knowledge and treatment of urinary disease, I pointed out how valuable the cystoscope would prove in helping us to determine the presence and the working capacity of the kidneys, a point of paramount importance in cases in which nephrectomy is contemplated. I have waited until I had completed 100 operations of all kinds on the kidney to sustain this contention. I am now sure that a judicious and skilful use of the instrument not only renders the surgery of the kidney more precise, but tends also to lower the death-rate, especially the high mortality of nephrectomy.

Of the 100 renal cases² in which I have operated I have lost 9. Of these 4 were *in extremis* at the time. I wish, however, to limit this article to the use of the cystoscope in nephrectomy, an operation I have performed 21 times with 2 deaths.

CYSTOSCOPY AS A FIRST STEP IN NEPHRECTOMY.

There should be no misunderstanding about what ought to be considered a judicious cystoscopy. No patient with tuberculous deposits in the epididymis or prostate or obvious malignant disease of the bladder should be examined. Cystoscopy in other cases should be done with a perfect instrument, in a clear medium,³ by a skilled hand, backed by an educated eye. Moreover, it is of the greatest advantage if the surgeon be prepared to operate directly the cystoscope is withdrawn. Rightly used the cystoscope is of the utmost value; carelessly employed it is mere meddling, and has a death-rate of its own. It would be better to do exploration on both kidneys rather than damage both these organs by those ascending septic changes which are induced by bungling on with the bladder. Some renal changes which call ultimately for nephrectomy commence very insidiously, and evoke no symptoms beyond an occasional appearance of blood or pus in the urine. Thus tubercle and carcinoma of the kidney, which are the very diseases which swell the mortality of nephrectomy, may be almost symptomless at first, and that time, "the psychological moment," in which an operation would be of use, is frittered away in hesitation and in doubt. Cystoscopy permits us to detect these cases in their early stages if blood or pus has been passed.

ILLUSTRATIVE CASES.

Calculus Pyonephrosis.—I found five stones in a left-sided pyonephrosis in a patient who had no guiding symptoms to the cause of his extreme malaise and evening temperature. His urine contained flakes of pus. On cystoscopy, I, and several others, saw a thick white pipe of inspissated pus, being forced out of the left ureteral orifice (Fig. 1). This was just

Fig. 1.

like soft macaroni being forced through its gauge. As it slid down the bladder wall—for the pelvis was raised—it arranged itself in rolls, like the figures which treacle forms when dropped from a spoon.

Tubercle.—A lady, aged 32, was brought to me by Dr. Delamotte, of Staines, with pyuria, frequency, pain, and blood. She had been diagnosed to have a movable right kidney, also a displacement of her uterus, for

Fig. 2.

* Abstract of paper read before the Medical Society of London, February 22nd, 1897.