ON THE TREATMENT
OF
STRANGULATED HERNIA
WHEN THE INTESTINE IS GANGRENOUS OR
ULCERATED.

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I HAVE twice had the misfortune to operate upon cases of strangulated hernia in which the intestine was gangrenous or ulcerated. The first case I treated in the usual way; the stricture was divided and the intestine laid open and fixed with sutures, some omentum being also removed. After living four days the patient died, without having had proper relief, although a finger could be pushed either up or down the intestine. No peritonitis was discovered, and the fatal ending seemed rather mysterious. In the second case a part of the bowel, which had been ulcerated by Gimbernat's ligament, gave way after it had been returned. I performed laparotomy by a median

incision, and made an artificial anus; the peritoneum was washed out and drained. The obstruction was completely relieved, but the patient died next day with the symptoms of septic intoxication.

Nothing could be less satisfactory than these results. The first case quite destroyed my confidence in the usual plan of treatment, because it failed even to relieve the obstruction. I surmised that the bowel did not empty itself either because it was paralysed, or because of the condition of the herniated part, which was obviously swollen and not freely pervious. I therefore determined to try and ascertain from the surgical records of St. Bartholomew's Hospital what might be the result of treating the gangrenous intestine by free incision. Moreover, I was aware that information of this kind was urgently needed to enable this method of treatment to be compared with others.¹

Careful records of the surgical practice of St. Bartholomew's Hospital have been kept for the last seventeen years, and I am deeply indebted to the surgeons, under whose care they were, for the kind and cordial way in which they have allowed me to make use of the cases, and to Mr. Bowlby for his assistance in helping me to obtain the notes. I have found thirty-five cases of hernia² in which the strangulated gut was ulcerated or gangrenous, and which had all been treated in the manner recommended so strongly by Sir William Lawrence,³ namely, by "a free incision through the mortified part, in order to unload the distended intestinal canal; or, if the gut should have already given way, to divide freely the integument and sac, and to leave the subsequent process of cure entirely to nature." The stricture was also to be

¹ See concluding paragraph of Mr. Makin's paper on a "Case of Artificial Anus treated by Resection of the Small Intestine," 'St. Thomas's Hospital Reports,' vol. xiii.

² These thirty-five cases were made up as follows:—Men 13, women 22. Femoral herniæ 23, inguinal herniæ 10, umbilical herniæ 1, and ventral herniæ 1. See also Postscript for five additional fatal cases.

³ 'A Treatise on Ruptures,' 5th ed., 1868, p. 364.

divided, if necessary, for the proper flow of fæces.¹ This advice is supported with such a glowing account of the marked benefit experienced by the patient, the casting off of sloughs, the restoration of the continuity of the bowel, and the closure of the wound, that it is easy to understand its general acceptance. But such a sanguine view is by no means warranted by the results of the operation when tested by a series of cases taken without any selection. Putting aside the two fatal cases which were under my own care and which have already been mentioned, out of the thirty-five collected from the St. Bartholomew's records, thirty-one died (88·57 per cent.). The four survivors went through a long and tedious convalescence and submitted to repeated operations for the cure of fæcal fistulæ.

A brief epitome of their history may give an idea of the nature of these cases which, it is no exaggeration to say, were very extraordinary. For instance, at the end of 1869, a woman, aged thirty-nine years, and who was eight months pregnant, came under the care of Sir James Paget, with a left inguinal hernia which had been strangulated twenty-four hours. Twelve hours later the sac was opened; the intestine was gangrenous and was incised and stitched to the edges of the wound; the stricture, which was very tight, was freely divided. For the first twenty-four hours there was no relief; on the third day she was delivered of a living child. During the confinement intestines protruded through the wound, but were put back again, and in less than three months the wound was quite healed, and she was restored to perfect health.

Again, in a second case, a woman, aged fifty-three, was operated upon by Sir William Savory in 1884 for a strangulated femoral hernia of the right side. The intestine was gangrenous and was incised, but the stricture was not divided. The woman survived and a spur formed, for which the enterotome was twice used, and

¹ Loc. cit., p. 342.

afterwards a plastic operation was performed, and a year later the fistula had healed.

In the third case, the patient was a man, fifty-four years of age, who had had a strangulated inguinal hernia for some days but who was too collapsed to give any history. The intestine was gangrenous and was laid freely open, and the stricture dilated by the finger pushed into the interior of the intestine. The patient recovered from the operation, but eight months later there was still a fæcal fistula. I have been unable to learn whether this ever closed.

The last case was almost as extraordinary as the first. The patient was a woman, aged forty-four, who was under the care of Mr. Willett. In October, 1882, she came into hospital with a ventral hernia which had been strangulated four days. It contained two feet of gangrenous intestine, which was laid freely open with prompt relief. After the dead tissues had separated she progressed favourably, although her nutrition was defective, and at the site of the hernia two apertures were left; a large one which belonged to the upper end of the bowel, probably the upper part of the jejunum, and which discharged ill-digested food; and a smaller one which was discovered with difficulty, and was supposed to belong to the lower end of the bowel. An enterotome was applied (February 23, 1883) to the tissues between these openings, but without effect, and, therefore, an exploratory operation was performed (April 24th, 1883). The peritoneal cavity was opened, but only the upper end of the bowel could be found, and was left *in situ*, and the colon, which lay close at hand, was fastened in close proximity to it, with the view of their subsequent union. This was afterwards done (May 31st, 1883) by an operation by which the peritoneum was again opened. As this attempt did not succeed, yet another operation was done; the peritoneum was opened for the third time (September 26th, 1883) and the ileum and colon again sutured and covered with a flap of skin. She left the hospital on December

13th, 1883, with a small fæcal fistula, which afterwards quite closed. Mr. Willett (to whom I am deeply indebted for the kind and cordial way in which he explained the case to me) saw her a year after the operation, quite recovered.

I do not propose at present to comment upon these recoveries. They show very clearly the difficulties and dangers which await the small minority who survive the original operation.

We will, therefore, proceed with the analysis of the thirty-one fatal cases. In these the end was seldom long deferred. The brief abstracts of them, which are given at the end of this communication, show that no less than twelve died the day of the operation; five upon the next day; four on the third; one on the fourth; two on the fifth; two on the sixth; and one each on the seventh, eighth, tenth, fifteenth and thirty-sixth days respectively. The great mortality which followed closely upon the operation is easily accounted for by the desperate condition of many of the patients at the time of their admission, but after these have been deducted, a fair proportion is left of those who had sufficient strength to rally and survive for some time.

It may be remembered that there was no relief in the case in which I myself performed the usual operation of opening the gangrenous intestine. Nothing came from the bowel, although a finger could be thrust into its lumen in either direction. Let us turn to the records to see whether this want of relief is an unusual circumstance. It is obvious that the cases which died very soon after the operation can throw very little light upon the point. But in fourteen cases which lived beyond the third day there seems to have been no fæcal relief in two, and very imperfect or delayed relief in three others. In the case of a woman, operated upon by Mr. Willett (Case 11), it was ascertained that the gangrenous loop was still compressed by some omentum, which had been left in the ring; so that the bowel would not even transmit air. At the same

time the intestine above the obstruction was distended, the rest being empty. In a case (Case 9), operated upon by Sir William Savory, there was never any free discharge from the wound, and the patient died on the fifth day. It was afterwards found that the stricture had been freely divided, and a loop of jejunum stitched in the wound. The intestines above this loop were distended, whilst the rest were empty. There was no fæcal extravasation or peritonitis, and the opening into the bowel was quite free.

The notes of all the cases have been made with no particular object in view, yet it is the rule, rather than the exception, to find it stated that the intestines above the opening in the gangrenous gut were distended whilst the parts below were empty. The emptiness of the lower part is what we would expect, but the distension of the upper part is, to say the least, highly significant.

In another case it is said that there was no relief until the sixth day after the operation. It was then too late, for the patient soon died, exhausted by sickness (Case 6). In the case of a young man (Case 5), operated upon by Mr. Marrant Baker, no flatus passed from the wound for many hours, and nothing else until the fifth day; the patient dying on the seventh. And in another case under the same surgeon (Case 4), the relief seems from the notes to have been unsatisfactory. Another case operated upon by Mr. Langton (Case 19), the patient died on the second day without having had relief. There was, however, a slight general peritonitis, but no fæcal extravasation.

The impression left by these cases is, that the incision into the gangrenous intestine cannot be relied upon to relieve the fæcal obstruction; or that the relief may come too late to save the patient's life.

Sometimes the presence of peritonitis may account for the want of relief. This may have been so in the last-mentioned case of Mr. Langton's; or in that of a woman upon whom Mr. Willett operated (Case 18). This patient died the day after the operation, without relief, and with

vomiting and collapse, and it was ascertained that there was general peritonitis due to fæcal extravasation.

But in the other cases in which the obstruction continued after the intestine had been laid open, there was no peritonitis, and the absence of relief was due either to paralysis of the intestines or to the morbid condition of their damaged portion. Either of these may suffice to prevent relief quite apart from anything connected with the gangrenous loop having been left within the hernial orifice. If evidence be wanted to show that the damage done to the intestine is alone sufficient to prevent the passage of fæces through it, let us glance for a moment at the accounts of the post-mortem examination of cases of strangulated hernia which died unrelieved after the intestine had been returned into the abdomen. In a case of Mr. Willett's, which died upon the second day, it is said that a small portion of ileum was found very dark and congested, and did not look as if anything had passed through it since the strangulation; the gut above being dilated and that below constricted. It is also remarked that there was no peritonitis. In another case the knuckle of ileum, which had been strangulated, had ulcerated through, but fæcal extravasation had been prevented by an adhesion between it and the mesentery. "Above the place the gut was more distended than below, and it did not seem that anything had passed the seat of stricture since the operation." In a case operated upon by Sir William Savory, and which died without the obstruction or the sickness having been relieved, a small knuckle of intestine lay loosely in the femoral ring (which had been freely divided) and the intestine above was distended, but below it was empty.

It would be easy to multiply instances of this kind, but those which have just been given may suffice to show that, as most surgeons are already aware, the condition of the intestine itself, quite apart from any position which a loop of it may occupy, is quite enough to prolong the obstruction.

Without doubt the absence of relief is due in some

cases to the paralysis which follows the distension, and violent peristalsis. The late Dr. Brinton¹ laid stress upon this point and Mr. Treves² has more recently referred to it. But we have also to note that the morbid condition of the injured bowel may offer a mechanical obstacle to the onward passage of the fæces. In the case under my own care the swelling and œdema of the mucous membrane of the incised intestine was very obvious, and may have prevented the escape of the contents. In another case, in which the bowel was returned, it is said "that the congested gut felt quite solid, and on cutting it open the walls were found much thickened, and with scarcely any contents." And in another, that the loop which had been strangulated was "black and thickened." It seems reasonable to suppose that such conditions as these must offer a mechanical obstacle to the onward propulsion of the intestinal contents.

But besides being almost occluded by swelling of its coats, the injured loop of bowel may be in such a condition as to prevent the passage of fæces by stopping the onward progress of the peristaltic wave. Dr. Brinton³ has proved this quite clearly, and museum specimens and the post-mortem notes show that it is not unusual for the muscular and mucous coats of the intestine to have been divided by the stricture. Also, in addition, the mucous membrane may be inflamed, covered with lymph, ulcerated, sloughing, or, as in cases such as those which we are considering, in a state of gangrene.

In addition to the probability of its not relieving the obstruction the operation of opening the gangrenous bowel leaves the patient exposed to other dangers. The spread of the gangrene or of the ulceration is one of these dangers. A patient of Mr. Morratt Baker's (Case 4) died of collapse on the eighth day, and it was ascertained that there was diffuse peritonitis and fæcal extravasation

¹ 'Intestinal Obstruction,' by William Brinton, London, 1867, p. 4.

² 'Intestinal Obstruction,' London, 1884, p. 401.

³ Loc. cit., p. 4.

due to the intestine having ulcerated and given way at the seat of stricture; the notes also state that the gangrene had extended from the intestine, which had been left in the sac, to that within the abdomen. In another case under the care of Sir William Savory (Case 2) it is said that gangrenous ulceration had spread as in the last case, and permitted fæcal extravasation, with subsequent peritonitis. In another case, which died on the third day, the gangrene seems also to have spread, for it is stated (Case 14) that there was extensive sloughing of the small intestine; more than could be explained by the strangulation. Again, in a case of Mr. Willett's (Case 18) fæcal extravasation had been permitted by an ulcerated aperture in the constricted part of the intestine. In another case operated upon by Mr. Howard Marsh (Case 24) the gangrene did not spread, but "the intestine above the hernia was much distended and its peritoneum was ruptured in places and almost gangrenous." Lastly, and this is perhaps a less grave occurrence, the gangrene may spread to the edges of the wound, as it did in a case of Mr. Langton's (No. 19). Thus, I think, we may safely assert that the operation of incising the gut affords no security whatever against the local extension of the gangrene or ulceration, nor is it certain to relieve the distension which may be causing them elsewhere.

After the gangrenous intestine has been incised and left in the sac there also remains the danger of septic inflammation spreading backwards to the rest of the peritoneum. There was general peritonitis in fourteen of the thirty-one fatal cases given at the end of this communication; in seven others it is specifically stated that there was none; and in the remainder the subject is not mentioned. Although it is in accordance with our experience to find a focus of inflammation near the gangrenous bowel in these cases of general peritonitis, it is seldom referred to in the post-mortem notes. But in the case of a very old woman, who lived four days, it is stated that a focus of peritonitis was found in the vicinity of the opened and

gangrenous bowel; and that there was injection of the rest of the intestines, without extravasation of fæces (Case 10). In another instance the peritonitis seems to have been associated with, and perhaps caused by, extravasation of fæces from the hernial sac into the cellular tissue of the right iliac fossa outside the peritoneum (Case 15).

In a fair proportion of cases, however, there seems to have been no trace of peritonitis¹, and we may remark in passing, that this affection may sometimes be diagnosed when it does not exist, as, for instance, in one of the St. Bartholomew's cases (Case 17).

The fatal cases also show that sub-peritoneal fæcal extravasation must be reckoned as one of the dangers of incising the gangrenous intestine (Case 15).

Should the patient survive any length of time after the gangrenous bowel has been laid open, a danger of quite a different kind has to be encountered, and nutrition may prove a source of anxiety. In a case of the late Mr. Callender's (Case 1), which lived thirty-six days after the bowel had been opened, although plenty of food was taken and nutrient enemata administered, the patient did not thrive, and finally died of exhaustion. Perhaps the jejunum had been opened, but unfortunately a post-mortem was not allowed. In another case, which died on the fifteenth day (Case 2), the patient suffered from inanition and her food passed from the wound little changed, but on this occasion it was ascertained that a loop of ileum, two and a half feet from the ileo-cæcal valve, had been stitched to the wound. But in another case which died on the fifth day, the lower end of the jejunum had actually been stitched in the wound (Case 9); and in yet another, the beginning of the ileum had been opened (Case 27). Therefore it is evident that although, as is well-known and accepted, the lower end of the ileum is most commonly engaged in hernial sacs, yet we may have unwittingly to deal with a part very much nearer

¹ Mr. Bryant says that peritonitis exists in about 69 per cent. of fatal cases 'On Hernia with an Analysis of 126 Fatal Cases,' pp. 12 and 14.

the stomach. Sir William Lawrence¹ gives a number of instances of the same accident, and in which the patients died of inanition, and many other surgeons have done the same, so that the danger is evidently not one which can be ignored.

It follows from the above that should the surgeon elect to carry out the usual treatment and incise the gangrenous bowel, he leaves his patient exposed to the following imminent perils: 1. Non-relief of the intestinal obstruction. 2. Spread of the gangrene or ulceration, and fæcal extravasation (intra- and extra-peritoneal). 3. Spread of septic peritonitis from the hernial sac. 4. Death from inanition.

Instead of incising the gangrenous intestine, the following alternatives have been adopted: The gangrenous bowel has been removed at once and the ends of the healthy bowel united—immediate suture. Next, the gangrenous bowel has been removed and an artificial anus established, with a view of uniting the ends of the intestine by a subsequent operation—secondary suture. Or, after the artificial anus has been established, it has been cured and the continuity of the canal restored by destroying the spur with Dupuytren's enterotome, or with an electrolytic clamp. I have also to add that Mr. Bennett² has recently recommended that the damaged bowel be returned within the abdomen after free division of the stricture; also that a large-sized drainage-tube be introduced into the ring to provide for the impending fæcal extravasation. This plan seems to promise better than the usual one of leaving the damaged intestine in the sac, but it is clear that it leaves a great deal to chance.

Dr. W. Körte's³ recent exhaustive review of what he calls "the old and new methods of treating the gangrenous

¹ *Loc. cit.*, p. 349.

² "Some Points relating to the Management of the Damaged Bowel in Strangulated Hernia," William H. Bennett, 'Lancet,' October 18th, 1890, p. 806.

³ 'Deutsche Medicinische Wochenschrift,' 1888, p. 829, No. 41.

intestine," affords us an idea of the relative mortality of the various methods.

It is, of course, difficult to ascertain the exact mortality of the usual plan of treatment, by incising the gangrenous bowel, but it is right to say that the mortality of the Bartholomew's cases is higher than that given by some surgeons, Reichel's¹ statistics giving a mortality of 52 per cent. for all plans of treatment, and Hænel's² a mortality of 54·2 per cent. Kocher,³ on the other hand, lost seven cases, one after the other, and says that he has never seen one which has not eventually died on account of something connected with the artificial anus.

As regards the enterotome, we note that Körte, in his most recent writings, gives a list of 111 cases of anus pre-naturalis treated with the enterotome, and of these only 11 died. But it is to be remembered that those who submitted themselves to this treatment were the survivors out of a very large number of cases of gangrenous bowel. Many of the patients, however, were not cured, because it is said that in 30 a fæcal fistula remained.

According to Schmidt,⁴ the mortality after primary resection and sutures is 71 per cent., and after incision and artificial anus, 85·5 per cent., almost the same as in the St. Bartholomew's cases. McCosh, at the end of the excellent essay in which he records a successful case of primary resection and suture,⁵ tabulates 113 cases of the same kind, of which half were successful.⁶ Mr. Makins tabulates 55 cases with 29 deaths, a percentage of 52·7. Ferdinald Klaussner had 7 recoveries in 14 cases.⁷

¹ 'Deutsche Zeitschrift für Chirurgie,' Bd. xix, Heft 3, p. 230.

² Von Langenbeck's 'Arch.,' Bd. xxxvi, Heft 2.

³ 'Correspondenzblätter für Schweitzer Aertze,' March 1st, 1886.

⁴ Quoted by Körte.

⁵ 'New York Medical Journal,' 1889, p. 285.

⁶ A successful case is also described by Surgeon-Major W. R. Browne in the 'Indian Medical Gazette,' March, 1890, p. 89, *et seq.* Another by Mitchell Banks, 'Med. Soc. Proc.,' vol. viii, p. 279; also, K. A. Walter, 'Hygeia,' vol. xlviii, p. 263.

⁷ 'Münchener, med. Wochenschrift,' Nos. 5 and 6, 1889.

The mortality of secondary sutures is less than after primary resection and suture. Reichel puts it at 37·8 per cent., Hertzberg says recent experiences have brought it down to 27 per cent.; Makins puts it at 28·4 per cent.; McCosh¹ collected 120 cases with a mortality of 52 per cent. However, we must bear in mind that those upon whom secondary suture is performed are the rare and infrequent survivors of a most fatal class of cases. Indeed, it is almost to be wondered that so many could have been collected, but in the tables of secondary suture for fæcal fistula cases due to a variety of causes are all grouped together. For instance, in Mr. Makins' tables the causes of the fistulæ were gangrene after hernia, gunshot wounds, blows, and wounds of the intestine, and, besides, the same cases are used over and over again by the different authors.

Thus it appears that as regards mortality the plan of incising the gangrenous intestine is at present the most fatal procedure to adopt; primary resection and suture comes next; then secondary suture; and, finally, least fatal of all, the application of the enterotome. However, it may be again said that before either of the last two methods can be put into practice, the patient must have had the exceptional good fortune to escape from a number of most fatal accidents.

The removal of the gangrenous bowel, and subsequent suture as usually performed, takes a considerable time, and is attended with shock, and therefore is often debarred by the condition of the patient. But it is a question how far we ought to be deterred. Hagemann² operated successfully upon an ill-nourished boy of twelve years of age, who before the operation began had cold extremities, a scarcely perceptible and rapid pulse, and commencing collapse. After an operation, which lasted

¹ Loc. cit., p. 285.

² "Casuistischer Beitrag zur primären Darmresection und primären Darmnaht bei gangränösen Hernien," R. Hagemann, 'Deutsche medicinische Wochenschrift,' 1889, No. 31, p. 627. Another successful case is mentioned in this paper, p. 629.

an hour and a half, this boy was revived with warmth and subcutaneous injections of ether, and afterwards made a complete and rapid recovery.

I venture to submit that the arguments and statistics which have been brought forward are in favour of performing primary resection in cases of hernia in which the bowel is gangrenous or ulcerated. Without doubt a distinction ought to be made between the two classes of cases. Where there is ulceration the destruction is sometimes circumscribed, and may only involve a part of the circumference of the bowel.¹ In most of these the resection of a very small portion of bowel is required, whilst in some it may prove sufficient merely to invert and suture the margins of the aperture, and it is possible to accomplish this through the original wound. The mesentery is never so short as to prevent a sufficient extrusion of the bowel.²

When the intestine is gangrenous a more extensive procedure is required. I have only been called upon to perform resection of the intestine upon one occasion, and that was for intussusception. I have never as yet done it in a case of gangrene following strangulation, and, therefore, I do not propose to discuss the operation at length. There are, however, some obvious considerations which may be mentioned. As soon as it has been decided that the operation ought to be performed, the patient should be carefully surrounded with blankets and hot water bottles, and stimulants for hypodermic administration prepared. The resection should be done through the original wound, which is to be enlarged without disturbing the gangrenous bowel, beyond what may be necessary for its thorough disinfection with perchloride lotion (1 in 5000) discharged from an irrigator.

In doing this the operator learns the extent of the gan-

¹ In this class of cases the strangulation is not infrequently of recent date, whilst in the other it is often of long standing and due to neglect, the patient being much exhausted.

² 'Hunterian Lectures on Hernia,' by C. B. Lockwood, 1889, pp. 35 and 51, &c.

grene, the presence or absence of septic peritonitis, or of fæcal extravasation. When all this has been ascertained, the peritoneum ought to be packed with sponges, and both ends of the bowel properly controlled—a clip made out of a flexible pessary is convenient for this purpose—and the gangrenous portion of the bowel removed, together with any gangrenous mesentery or omentum. A margin of more than half an inch ought to be left between the healthy and diseased tissues, and the collapsed distal bowel should be divided first, as the gangrenous portion and the distended end may then be drawn from the wound, and used as a spout to carry off the fæcal accumulation. This unloading of the distended bowel greatly facilitates the operation, and has an influence upon the subsequent result. The removal of a wedge of mesentery is contra-indicated. Although desirable, perhaps, on theoretical grounds, it leads to so much hæmorrhage and loss of time that the advantages are outweighed by the disadvantages. The actual enterorrhaphy may be done by Czerny-Lembert's method,¹ but it is possible that experience may show that Senn's² modification of Jobert's method may give the same favourable results in man as it has in animals. The plan is as follows: "The upper end of the bowel which is to become the intussusceptum is lined with a soft, pliable, rubber ring, made of a rubber band transformed into a ring by fastening the ends together with catgut sutures. This ring must be the length of the intussusceptum, from one third to half an inch; the lower margin is stitched by a continuous catgut suture to the lower end of the bowel, which effectually prevents the

¹ Successes have been obtained by the operation of intestinal anastomosis by means of Senn's plates. This method seems to have been practised by Helferich, and is sometimes called "Helferich's operation," see Helferich, "Ueber die Ausführung der Herniotomie bei der Gangrän Verdächtigem Darm.," 'Cent. für Chirurgie,' vol. xvii, p. 56 (Kongress). Also "Ueber die Helferich'sche Operation bei der Gangrän Verdächtigten Hernien," L. Kredel, 'Cent. für Chir.,' vol. xvii, 1890. Also Arbuthnot Lane 'Clin. Soc. Trans.,' 1891.

² 'Intestinal Surgery,' Chicago, 1889, p. 168, *et seq.*

bulging of the mucous membrane, a condition which is always difficult to overcome in circular suturing. After the ring is fastened in its place, the end of the bowel presents a tapering appearance which materially facilitates the process of invagination. Two well prepared, fine juniper catgut sutures are threaded each with two needles. The needles are passed from within outwards, transfixing the upper portion of the rubber ring and the entire thickness of the wall of the bowel, and always equidistant from each other, the first suture being passed in such a manner that each needle is brought out a short distance from the mesenteric attachment, and the second suture on the opposite convex side of the bowel. During this time an assistant keeps the opposite end of the bowel compressed, to prevent contraction and bulging of the mucous membrane. The needles are next passed through the peritoneal, muscular, and connective-tissue coats at corresponding points about one third of an inch from the margins of the opposite end of the bowel, and when all the needles have been passed, an assistant makes equal traction on the four strings, and the operator assists the invagination by turning in the margins of the lower end evenly with a director, and by gently pushing the rubber ring completely into the intussusciens. The invagination accurately made, the two catgut sutures are tied only with sufficient firmness to prevent disinvagination, should violent peristalsis follow the operation." I am not aware that this method has been practised on human beings, but it seems worthy of a trial. After the bowel has been sutured and disinfected and dusted with iodoform, it is to be placed within the abdomen, and the hernial sac removed, and the ring closed in the usual way.

The after-treatment of these cases need not be discussed, and is to be carried out in accordance with established principles, except that the administration of opium is to be earnestly deprecated as conducing to further, and, perhaps, fatal, intestinal paralysis.

Postscript.—Since the foregoing was written I have been able, with the kind help of my friend Mr. Macgregor, to add the notes of the cases of strangulated hernia which were operated upon in St. Bartholomew's Hospital during the year 1890, and in which the intestine was gangrenous or ulcerated. They were five in number, which is rather beyond the average, and were all treated in the usual way, and all died. If we add them to the other 35 cases they bring the death rate up to 90 per cent. ; but this statement needs qualifying because one of the patients (Case 36) died as the operation was being completed. The others survived, three weeks, three days, thirty hours, and nine hours, respectively. They bear out the conclusions already arrived at, especially as regards the failure of the operation of incising the intestine to give relief. A woman aged sixty-five (under Mr. Willett) lived for three days after the operation. During that time there was no fæcal flow from the wound, and the vomiting continued. At the examination, the intestine above the hernia was found greatly distended and inflamed, below it was flaccid and empty (Case 33). The enterocele was partial (Richter's hernia), and the notes say that after the operation flatus was passed per anum and the bowels acted slightly. A very old woman (Case 35) was also operated on by Mr. Willett, and although she lived nine hours, there was no fæcal flow from the wound, and it was afterwards ascertained that the intestines above the gangrenous part were enormously distended with fæculent fluid. It is also said that the sac was thickened, and seemed gangrenous.

The third case was that of a woman æt. 54 (Case 34), who was operated upon by Mr. Long (Sir William Savory's House Surgeon) for a strangulated femoral hernia. The bowel proved to be ulcerated opposite Gimbernat's ligament, and it gave way after having been reduced. It was therefore drawn down, laid open, and stitched to the edges of the wound. The patient lived

for thirty hours, but had during that time no relief by the wound. She is said to have died from shock, but at the examination they found general purulent peritonitis, together with some fæcal extravasation.

The last case I have to mention (Case 32) was that of an infant, æt. 5 weeks, who was under the care of Mr. Langton. The rupture was a congenital inguinal hernia of the right side, containing a loop of gangrenous intestine. The latter was freely opened, and the constriction dilated with forceps. The infant did well for a few days, its bowels having relieved themselves by the wound, but it died at the end of three weeks of general peritonitis, without effusion of fluid, but with much lymph and many adhesions. It is said that the intestines above the artificial opening were distended.

Thus the cases for the year 1890 bear out the statement that the usual operation of incising gangrenous or ulcerated intestine, in cases of strangulated hernia, cannot be relied upon to give relief. They also show the dreadful mortality of that condition when treated in the usual way.

ABSTRACTS OF FATAL CASES.

CASE 1.—*Gangrene of intestine ; death from exhaustion on the thirty-sixth day.*—In 1875 a woman, æt. 50, was under Mr. Callender's care, having had a right femoral hernia strangulated for two days. The sac contained inflamed omentum and gangrenous intestine. The stricture was divided and the omentum cut off ; some of the intestine was returned, the rest opened and left in the wound. Although the patient afterwards took plenty of food, and had nutrient enema, she did not thrive, and died of exhaustion on the thirty-sixth day. No post-mortem examination was allowed.

CASE 2.—*Gangrene of intestine ; spread of gangrene ; fæcal extravasation ; general peritonitis ; inanition ; death*

on fifteenth day.—A woman, æt. 55, had had a right femoral hernia strangulated three days. The intestine was gangrenous, and Sir William Savory laid it open, and stitched its edges to those of the wound; the stricture was slightly divided. The patient suffered from inanition, her food passing out again from the wound little changed. She died on the fifteenth day, when it was ascertained that a part of the circumference of the ileum, two and a half feet from the ileo-cæcal valve, was engaged in the femoral ring, and was in a state of gangrenous ulceration, which, by its spreading, had permitted fæcal extravasation with subsequent general peritonitis.

CASE 3.—*Gangrene of intestine; death on tenth day from exhaustion.*—In 1873 Mr. Morratt Baker had under his care a woman, æt. 56, who had had a right femoral hernia strangulated for eight days. The sac contained omentum and intestine, the latter gangrenous and collapsed. The stricture was freely divided, and two days later there was an abundant flow of fæces from the wound. The patient died of exhaustion on the tenth day, and it was ascertained that there was no peritonitis or obvious cause for her death.

CASE 4.—*Gangrene of intestine; spread of gangrene; fæcal extravasation; death on eighth day.*—Last year Mr. Morratt Baker operated upon a man, æt. 58, who had reducible inguinal hernia on both right and left sides, and a strangulated femoral hernia on the right side of four or five days' standing. The latter contained gangrenous intestine, which was laid open without dividing the stricture or disturbing the adhesions about the neck of the sac. There was sickness on the second and third days after the operation, and relief seems to have been very imperfect. He died suddenly of collapse on the eighth day, the abdomen being much distended. It was ascertained that there was general peritonitis with extravasation of fæces into the peritoneum, due to the intestine having ulcerated and

given way at the seat of stricture. The notes also say that the gangrene had extended from the intestine within the hernial sac to that within the abdomen.

CASE 5.—*Gangrene of intestine ; death on seventh day ; tardy relief.*—A strong young man, æt. 21, had had a right congenital inguinal hernia strangulated for three days. The intestine was gangrenous and perforated, and Mr. Morratt Baker opened it and stitched its edges to those of the wound. The stricture was not divided. No flatus passed from the wound for some hours, and no fæces until the fifth day, and he died on the seventh. It was ascertained that the intestines above the hernia were distended with flatus, and red and hyperæmic from commencing inflammation, but there was no lymph or fluid. Only a part of the lumen of the intestine was engaged in the stricture, and not more than half an inch of its length.

CASE 6.—*Gangrene of intestine ; tardy relief ; death on the sixth day.*—A man, æt. 53, had had a right femoral hernia strangulated for twenty-four hours, but, owing to his refusal, no operation was done until twenty-four hours later. The stricture was divided and the intestine, which was gangrenous and ruptured, was stitched to the edges of the wound. The sickness continued, and there seems to have been no fæcal discharge until the sixth day, but the patient sank exhausted a few hours after. There was no fæcal extravasation or peritonitis, but the note says “that the intestine was completely cut through in its whole circumference, so that it would have been difficult to restore the continuity of the canal at any future period.”

CASE 7.—*Gangrene of intestine ; death on sixth day after operation ; general peritonitis.*—A man, æt. 41, was kicked by a horse in the right groin, four days after an old-standing right inguinal hernia became strangulated. At the operation the hernial sac was full of fæces and a longitudinal cut was made into the gut, and it was stitched to the edges

of the wound. The patient died six days later, having continued to vomit, and it was ascertained that the sutured gut was ileum and that there was general peritonitis.

CASE 8.—*Gangrenous intestine ; death on fifth day.*—A woman, æt. 57, who had had a right femoral hernia strangulated three days, was operated upon by Mr. Thomas Smith. The intestine was gangrenous and was laid freely open and the stricture divided. There was fæcal vomiting on the next day, and the obstruction seems to have been partially relieved by the operation, but the patient died on the fifth day after. At the examination it was ascertained that seven inches of gangrenous ileum, three feet from the ileo-cæcal valve, lay in the sac with recent adhesions about femoral ring. There was no fæcal extravasation or peritonitis, but the intestines were distended and swollen above the part which had been opened.

CASE 9.—*Gangrene of intestine ; death on fifth day ; imperfect relief.*—A woman, æt. 64, had suffered from strangulation of a right inguinal hernia for four days. When Sir William Savory opened the sac it was full of fæcal fluid, and the intestine was collapsed. The intestine was laid open and stitched to the wound, and the stricture was freely divided. There was never any free discharge from wound or relief *per anum*, and the patient died exhausted on the fifth day. No fæcal extravasation or peritonitis were discovered, and it was found that the lower part of the jejunum had been stitched in the wound. Above this point the intestines were distended, below they were empty.

CASE 10.—*Gangrene of intestine ; death on the fourth day.*—A woman, æt. 72, had had a left femoral hernia strangulated for some days. At the operation a line of grey slough was found in the bowel at the seat of stricture, and therefore it was laid open and stitched to the wound.

There was a great flow of fæces from wound, but on the fourth day she died with much abdominal distension. There was no fæcal extravasation, but local peritonitis with injection of the rest of the peritoneum.

CASE 11.—*Ulceration of intestine with gangrene of omentum ; death on third day unrelieved by the operation ; commencing peritonitis.*—Mr. Willett operated upon a woman, æt. 52, who had had a left femoral hernia strangulated for six days. The sac contained gangrenous omentum and small intestine, which latter was ulcerated through at Gimbernat's ligament. The gangrenous omentum was cut off, and the intestine united to edge of wound. The operation gave no relief and it was ascertained that it was still compressed by the adherent omentum, not even transmitting air. There was commencing peritonitis.

CASE 12.—*Gangrenous intestine ; death on third day.*—In 1878 Mr. Callender operated upon a woman, of uncertain age, who had had a femoral hernia of the left side strangulated for a week. The sac contained omentum, which was cut off, and intestine which was gangrenous and was left, the stricture having been divided. There was relief by the wound, but the patient died two days after the operation.

CASE 13.—*Gangrene of intestine ; death third day.*—A man, æt. 32, had had a right inguinal hernia strangulated for twenty-four hours. The operation was done by Mr. Willett, and the sac contained omentum, which was removed and the pedicle returned into the abdomen, and also intestine which was gangrenous, and was laid open and stitched to the edges of the wound, healthy intestine having been pulled down for the purpose. The patient died of weakness two days later, the bowels having been relieved. The examination showed no cause for the fatal ending.

CASE 14.—*Gangrenous intestine ; death on third day.*—A woman, æt. 44, who had had an umbilical hernia strangulated four days, was operated upon by Mr. Thomas Smith. There was extensive gangrene of the intestine which was laid open, the stricture having been previously divided. The patient died on the third day, and it was ascertained that there was fæcal extravasation into the peritoneal cavity. There was extensive sloughing of the small intestine, and this was greater than could be explained by the extent of the strangulation.

CASE 15.—*Ulceration of gut ; death the day after operation ; extra-peritoneal fæcal extravasation.*—A man, æt. 34, was operated upon by Mr. Morratt Baker for a femoral hernia of the right side, which had been strangulated some days. The skin over the hernia was œdematous and inflamed, and there was a gush of fæces as the stricture was relieved. The gut was left in the sac, together with some inflamed omentum. The patient died the next day with general peritonitis, and it was ascertained that the ileum, one foot from the ileo-cæcal valve, had been ulcerated through by Gimbernat's ligament, but that owing to adhesions, fæces had not entered the peritoneal cavity, although the sub-peritoneal tissues were widely infiltrated with them.

CASE 16.—*Gangrene of intestine ; death on second day.*—The patient was a woman, æt. 68, who had had a strangulated femoral hernia for six days. The sac and intestine were both gangrenous with fæcal extravasation. The ring was enlarged and the gut freely incised. The woman died on the second day and no examination was allowed.

CASE 17.—*Gangrene of intestine ; death on second day.*—A man, æt. 68, had had an inguinal hernia of the right side strangulated for five days—was operated upon by Mr. Willett. The intestine was gangrenous and had given way ; it was stitched to the edge of the wound and opened.

The stricture was not divided, but stretched by introducing the finger into the intestine. There was some fæcal discharge at once, and the bowels were afterwards open naturally. He died on the second day, it was thought, of peritonitis, but none was discovered at the examination.

CASE 18.—*Gangrene of intestine; death on second day.*—In 1888, Mr. Willett operated upon a woman, æt. 40, who had two femoral hernias, the right of which had been strangulated for three days. The sac contained omentum and intestine, which, being gangrenous, was laid open and stitched to the edges of the wound. She died the next day without having an action of the bowels, and with vomiting and collapse. It was ascertained that there was general peritonitis with fæcal extravasation into the peritoneum of the right iliac fossa. This had been permitted by an ulcerated aperture in the constricted part of the intestine.

CASE 19.—*Gangrene and ulceration of intestine; gangrene of edges of wound; no relief; death on second day.*—In 1885, Mr. Langton operated upon a woman, æt. 55, who had had a right femoral hernia, which had been strangulated for fifty-two hours. The gut was probably gangrenous, and there was an ulcerated hole in it opposite Gimbernat's ligament. The intestine was stitched to the edges of the wound. The patient died two days later unrelieved, and the edges of the wound were gangrenous. It was ascertained that there was slight general peritonitis without any fæcal extravasation, and that the intestines above the herniated intestine were distended.

CASE 20.—*Gangrene of intestine and omentum; death without relief the same day.*—A woman, æt. 33, had had a femoral hernia strangulated for three days. The sac contained eight ounces of fæculent fluid, gangrenous intestine and omentum, which was beginning to gangrene. The omentum was cut off and the wound left open, but the operation gave no relief.

CASE 21.—*Ulceration of intestine ; death the same day.*—A woman, æt. 59, had had a femoral hernia strangulated for two days. The operation was done by Mr. Willett, and the intestine burst as it was being returned. The incision was enlarged and the pelvis cleaned out, and an artificial anus established. The patient died soon after the operation.

CASE 22.—*Gangrene of intestine ; death the same day.*—A woman, æt. 60, had had a right femoral hernia strangulated for eight days. Was afterwards operated upon by Mr. Callender. The sac was full of "fœtid pus," and the gut gangrenous and ruptured. The stricture was freely incised, and the intestine, which was adherent, left to discharge. The patient died soon after the operation.

CASE 23.—*Gangrene of intestine ; spontaneous rupture ; operation ; death the same day.*—A woman, æt. 40, had some obscure trouble in a right femoral hernia of eight years' duration. Mr. Smith, under whose care she was, kept her under observation for a time, and when, at last, it was thought advisable to open the hernial sac, it was full of fæces, the gut having spontaneously ruptured. The wound was left open and the patient shortly died.

CASE 24.—*Gangrenous intestine ; death the same day.*—A man, æt. 42, who had congenital (infantile) inguinal herniæ on both sides, the right having been strangulated five days. The operation was done by Mr. Howard Marsh, and the intestine burst on handling, and was laid open and stitched to the wound. The patient never rallied. It was ascertained that the intestine above the hernia was much distended, and that its peritoneum was ruptured in places and almost gangrenous. There was no general peritonitis.

CASE 25.—*Gangrenous intestine ; death within an hour.*—A man, æt. 54, had a strangulated congenital (infantile) in-

guinal hernia of the right side. The scrotum was œdematous and discoloured, and the patient was collapsed. Mr. Morratt Baker found a foot of gangrenous intestine in the sac, and it was laid open. The patient never rallied, and died on his way back to bed.

CASE 26.—*Gangrene of intestine ; death same day.*—In 1886 Mr. Langton operated upon a man, æt. 62, who had an inguinal hernia of the right side strangulated for three days, and the skin over it was emphysematous. The sac contained gangrenous intestine (ileum) which was laid open and stitched to the edges of the wound. The patient shortly afterwards died, and it was ascertained that there was intra-peritoneal fæcal extravasation and peritonitis.

CASE 27.—*Gangrene of intestine ; death thirteen hours after the operation, apparently unrelieved ; peritonitis.*—A man, æt. 57, who had an enormous left scrotal hernia which contained large and small intestine ; the latter was gangrenous and was laid open and stitched to the edges of the wound. The patient died unrelieved thirteen hours after, and it was ascertained that the beginning of the ileum, twelve feet from the ileo-cæcal valve, had been stitched to the wound, and also that there was general peritonitis. The strangulation was caused by a fibrous adhesion, which crossed the fundus of the hernial sac.

CASE 28.—*Ulceration of intestine ; death same day ; general peritonitis.*—A man, æt. 48, had had a right femoral hernia strangulated for three days, was operated upon by Mr. Butlin. The sac was full of fæculent fluid, and the intestine, which was ulcerated, opposite Gimbernat's ligament and towards the convexity of the knuckle. The patient never rallied, and it was found that the stricture had been relieved, but that there was general peritonitis. No mention is made of fæcal extravasation.

CASE 29.—*Gangrene of intestine ; death the same day.*—A female, æt. 62, had a femoral hernia, which was supposed

to have been strangulated eight days. At the operation it was found that the knuckle of intestine had sloughed off. The wound was left open but the patient soon died. There was no examination and the notes are very meagre.

CASE 30.—*Gangrenous intestine ; death in seven hours.*—A woman, æt. 54, who had had a femoral hernia strangulated for eight days. The intestine was gangrenous and was laid open. The patient died in seven hours. There was no post-mortem examination.

CASE 31.—*Gangrene of intestine ; suppuration in great omentum ; death ; fæcal extravasation and general peritonitis.*—Mr. Thomas Smith operated upon a woman, æt. 72, who had had a right femoral hernia strangulated for four days. The intestine was left in the sac, and the patient having died it was ascertained the ileum was gangrenous and also perforated at the femoral ring by Gimbernat's ligament. There was general peritonitis and pus in the folds of the great omentum. It is noted that in this case the pain ceased at what was supposed to have been the onset of the gangrene.

CASE 32.¹—*Strangulated inguinal hernia in an infant ; gangrene of intestine ; death in third week.*—In July Mr. Langton operated upon an infant five weeks old, who had a strangulated inguinal hernia of the right side. The hernia, which was congenital, had been strangulated some days, and contained gangrenous intestine. The constriction was dilated with forceps and the bowel incised. There was afterwards a free flow of fæces from the wound, but chronic peritonitis supervened, and the child died at the end of three weeks. It was ascertained that the wound contained a loop of ileum, which was distant three inches from the ileo-cæcal valve. The peritoneal cavity contained no fluid, but there were general adhesions, and the intestines above the wound were distended.

¹ This and the remaining cases belong to the postscript.

CASE 33.—*Strangulated femoral hernia ; partial enterocele ; ulceration of intestine ; death after three days—unrelieved.*—A woman, æt. 65, came under the care of Mr. Willett with a femoral hernia of the right side which had been strangulated two days and a half. The gut was ulcerated through opposite Gimbernat's ligament, so the constriction was divided and the bowel left in place, the edges of the rent being stitched to the edges of the wound. There was no fæcal flow from the wound and the sickness continued, the abdomen being tender and tympanitic. Flatus, however, was passed per anum, and the bowels were slightly open. She died after living three days, and it was ascertained that only a part of the lumen of the bowel (twelve inches from the ileo-cæcal valve), was involved in the hernia, but that the intestines above it were distended and inflamed, whilst below they were flaccid and empty. There was no fluid or fæcal matter in the peritoneum.

CASE 34.—*Right femoral hernia ; ulceration of intestine ; rupture of intestine ; fæcal extravasation ; incision ; death without relief.*—A woman, æt. 54, had had a right femoral hernia strangulated for some days. The intestine ruptured after it had been reduced owing to ulceration at the line of constriction, opposite Gimbernat's ligament. It was drawn down, opened freely, and stitched to the edges of the wound by Mr. Long (Sir William Savory's House Surgeon). The stricture was divided at the early stages of the operation. The patient had no relief by the incision, and is said to have died of shock thirty hours after the operation, and it was ascertained that there was general purulent peritonitis with some fæcal extravasation. A loop of ileum three feet from the ileo-cæcal valve was adherent in the wound.

CASE 35.—*Strangulated femoral hernia ; partial enterocele ; gangrene of intestine ; death in a few hours—unrelieved.*—A woman, æt. 86, who had had a femoral hernia

strangulated for four days, was operated upon by Mr. Willett. The bowel was gangrenous, and was laid open and stitched to the edges of the wound. The patient survived some hours but had no relief. It was ascertained that only a part of the lumen of the intestine was involved in the hernia, but that there was enormous distension above the opening, but no extravasation of fæces. The peritoneum and intestines were considerably injected, and the sac seemed to be gangrenous.

CASE 36.—*Strangulated femoral hernia ; intestine and sac gangrenous ; death during operation.*—A woman, æt. 53, had had a right femoral hernia strangulated for three days. She was exhausted and collapsed on admission, and died as the operation was being completed by Mr. Holden (Mr. Willett's House-Surgeon). At the operation the sac was gangrenous, and the intestine ashen-grey and perforated in two places. This case has merely been referred to in the body of the paper.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' Third Series, vol. iii, p. 102.)