AN EXPERIMENTAL CONTRIBUTION TO INTESTINAL SURGERY WITH SPECIAL REFERENCE TO THE TREATMENT OF INTESTINAL OBSTRUCTION

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AN EXPERIMENTAL CONTRIBUTION TO INTESTINAL SURGERY WITH SPECIAL REFERENCE TO THE TREATMENT OF INTESTINAL OBSTRUCTION.[1]

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THE most important, and, at the same time, the most popular topic for discussion among surgeons of the present day is intestinal surgery. The current medical literature is teeming with reports of cases, and at the meetings of almost every medical and surgical society, large or small, this subject comes up for discussion and occupies a liberal space and conspicuous place in their printed transactions. The unusual activity which has been manifested in all parts of the civilized world in the development of this, one of the most modern and aggressive departments of abdominal surgery, is sufficient evidence that the subject is comparatively new, and as yet imperfectly understood. A study of the literature of intestinal surgery must convince every unprejudiced mind that here, as in many other difficult problems in surgery, the positive knowledge which we have acquired rests almost exclusively on the results obtained by experimental research. Gunshot wounds of the abdominal cavity have been made the object of careful and patient experimentation by a number of enthusiastic surgeons, and the results obtained have laid the foundation

[1]Read in the Surgical Section of the Ninth International Medical Congress, Washington, September 5, 1887.

for a rational method of treatment of these injuries, which has been eagerly accepted by all modern aggressive and progressive surgeons. The practical results which have been obtained thus far in the hands of a number of surgeons have been the means of saving a number of lives, which by the old conservative method of treatment would have been doomed to inevitable death from hæmorrhage or septic peritonitis. The numerous valuable practical suggestions for treatment of gunshot injuries of the intestines are the direct outcome of experiments on animals, and this, as well as the remarkable recoveries following gunshot wounds of the abdomen treated by laparotomy, have so firmly convinced the profession of the necessity of resorting to operative measures in such cases that few surgeons could be found at the present day who would be willing to trust to conservative treatment any case where positive, or only probable, evidences pointed towards the existence of a visceral injury of any portion of the intestine. While a decided advance has been made in the treatment of injuries of the intestinal tract, the operative treatment of intestinal obstruction still constitutes one of the darkest and most unsatisfactory chapters in the wide domain of intestinal surgery. The obscurity and uncertainty which cling to this subject are due to the difficulties which often surround an accurate diagnosis. At the same time we have every reason to believe that the appalling mortality which has so far attended the surgical treatment of intestinal obstruction is mainly due to late operations, and not infrequently to a faulty technique in the removal of the cause of the obstruction, and in the restoration of the continuity of the intestinal canal. An accurate anatomical or pathological diagnosis in such cases during life is often difficult, if not impossible, and when, as a *dernier ressort*, laparotomy is performed, and the surgeon is confronted by an unexpected condition of things, he is often in doubt as to what course to pursue, and frequently ends the operation by establishing an artificial anus. No one who has been forced to resort to this measure has left his patient with a feeling of satisfaction, as he must have been sadly impressed with the fact, that, at best, he has only been instrumental in relieving the urgent symptoms of the obstruction, while he has failed to re-

move its cause, and consequently also in restoring the continuity of the intestinal canal. A patient with an artificial anus is indeed an object of commiseration, as experience has sufficiently demonstrated how difficult it is in many instances to close the abnormal outlet, even after the cause of obstruction is subsequently removed or corrected spontaneously, without exposing him a second time to the risks of life incident to another abdominal section. If the causes which have led to the obstruction are of a permanent character, all attempts at closing the fistulous opening will, of course, prove worse than useless, and the patient is condemned to suffer from this loathsome condition the balance of his or her lifetime without a hope of ultimate relief. I believe I can safely make the statement without fear of contradiction that most of these unfortunate patients would prefer death itself to such a life of misery. The ideal of an operation for intestinal obstruction embraces the fulfilment of two principal indications:

1. The removal or rendering harmless of the cause of obstruction.

2. The immediate restoration of the continuity of the intestinal canal.

To meet the first indication the cause of obstruction must be found, its nature determined, and whenever advisable or practicable, it is removed, a step in the operation which may be very easy, or may demand a most formidable and serious undertaking, more especially in cases where the pathological conditions which have given rise to the obstruction are of such a nature as to constitute in themselves an imminent or remote source of danger, as, for instance, malignant disease or gangrene of the bowel from constriction. In all cases of inoperable conditions the cause of obstruction is rendered harmless as far as obstruction is concerned by establishing an anastomosis between the bowel above and below the obstruction by an operation which will be described further on.

Immediate restoration of the continuity of the intestinal canal should be secured in the operative treatment of all cases of intestinal obstruction, with the exception of inoperable cases of carcinoma of the rectum, but is most urgently indicated in cases of obstruction in the upper portion of the small

intestines and the colon, as the formation of an artificial anus in the former locality would prove a direct source of danger from marasmus by excluding too large a surface for intestinal digestion and absorption, while in the latter situation the cure of a fæcal fistula only too often proves an opprobrium of surgery. A careful perusal of the literature on the treatment of intestinal obstruction proves only too plainly the imperfection of this branch of surgery. The rules laid down in our text-books are often given with so much hesitation that it becomes impossible to apply them in practice. Opinions are so widely at variance that every surgeon finally acts upon the impulse of the moment and adopts a method which he deems appropriate for his case. It can be said that no uniformity of action exists, consequently the statistics which have been produced so far are of but little value from a practical standpoint. A rational and successful surgical treatment of intestinal obstruction, like other abdominal operations, can only be established upon a basis founded upon the results obtained by experimental investigation. In view of this fact it is astonishing that so little has been accomplished in this direction. I am convinced that accurate work of this kind will render essential information in the diagnosis of the obscure causes of obstruction, and will point out more clearly the indications for operative interference, while improved methods of operation will have to be studied exclusively in this manner. During the last 18 months I have made 150 operations on animals for the purpose of studying the effects of the principal varieties of intestinal obstruction, which were produced artificially; at the same time I have attempted to establish a number of new operations for the relief of certain forms of intestinal obstruction where it is impossible or inadvisable to remove the local conditions which gave rise to the obstruction. One of the greatest dangers in all operations for intestinal obstruction is the length of time required to perform the ordinary operations: hence it has been my object to simplify the operations, and thus by shortening the time diminish the danger from shock. All patients requiring an operation for intestinal obstruction are invariably in a condition not well adapted for prolonged operations, which necessitate the opening of the peritoneal

cavity and exposure of its contents to the cooling influences of the atmospheric air. An operation which can be completed in twenty minutes must certainly prove less disastrous to the patient than one requiring from one to two hours. A prolonged operation on the intestines is attended by two great risks: (1). Immediate, due to shock. (2). Remote, prolonged exposure to infection. Both of these dangers are diminished in proportion to the shortening of the time consumed in the operation, which is made possible by resorting to simpler measures, provided they are equally safe and efficient.

General Remarks on Experiments.

With few exceptions the experiments detailed in this paper were made at the Milwaukee County Hospital, located at Wauwatosa, six miles from Milwaukee. I wish on this occasion to return my thanks to Dr. M. E. Connel, superintendent of the hospital, and his assistants, as well as to Dr. William Mackie, of this city, for valuable services rendered in my experimental work. As the main object of these experiments was not to show favorable statistics, but more for the purpose of studying the effect of different forms of intestinal obstruction and to establish new principles of treatment, the animals were not submitted to any special treatment before or after the operation; the diet was not restricted and no internal medicines were given. I pursued this course in order to bring the intestinal canal in the most unfavorable conditions for operative interference, so as to expose the operations to the severest test. Ether was used exclusively as an anesthetic. The abdomen was shaved, thoroughly washed with soap and warm water, and disinfected with a 1-1000 solution of corrosive sublimate or a two and a half per cent solution of carbolic acid. For the sponges the same solution of carbolic acid or a weaker solution of corrosive sublimate were used. The abdomen was covered by several layers of aseptic gauze, with a slit in the centre. Whenever division or incision of the bowel was made fæcal extravasation was guarded against by compressing the bowel on each side by compressors made for this special purpose, or by constriction with an elastic rubber band. Experi-

ence showed that the latter method was preferable, as it proved less injurious to the tissues of the bowel, and afforded greater security against extravasation, while at the same time it proved less disastrous to the circulation between the points of compression. The rubber bands for this purpose should be about an eighth of an inch in width, rendered properly aseptic by prolonged immersion in a five per cent solution of carbolic acid, and can be readily applied by perforating the mesentery with an ordinary hæmostatic forceps at a point not supplied with visible blood vessels, and tied in a loop with sufficient firmness to obstruct the lumen of the bowel. Elastic constriction practiced in this manner prevents all possibility of extravasation, and does not interfere with the free manipulations of the operator, as is the case with clamps or the hands of an assistant, while the degree of compression that is necessary exerts no injurious effects on the vessels and tissues at the seat of constriction. Drainage was never resorted to, and the abdominal wound was always closed by deep interrupted sutures including the peritoneum. In all cases where partial or complete exventration was made necessary the bowels were kept covered with warm gauze compresses. In all cases where complete exventration became necessary, and where the bowels remained out of the abdomen for half an hour or more, a certain degree of shock was always noticed, and a number of animals died within a few hours after the operation, death being referable directly to this cause. For an external dressing we used iodoform ointment applied directly over the wound, and a compress of cotton, retained by a bandage, and a jacket, made of coarse cloth. As a rule the sutures were removed at the end of six days, when the wound was usually found healed by primary union.

I.—ARTIFICIAL INTESTINAL OBSTRUCTION.

In imitation of the more common forms of intestinal obstruction in the human subject, due to congenital malformation or pathological conditions, the following kinds of obstruction were produced on animals: (1) stenosis, (2) flexion, (3) volvulus, (4) invagination. It is a noteworthy fact that even in

cases where the obstruction was complete from the beginning, vomiting was moderate, and in some instances entirely absent. As vomiting constitutes one of the earliest and most conspicuous and persistent symptoms in most cases of intestinal obstruction in men, we can only explain its lesser intensity or complete absence in animals from the circumstance that animals suffering from this condition, as a rule, refuse all food and drink. As a rule, the tympanitis was also less marked than in the human subject.

1. Stenosis.

Circular narrowing of the lumen of the bowel was produced by excision of a semi-lunar piece of the intestinal wall and double suturing of the wound in a direction parallel to the intestine; and (2) circular constriction with bands of aseptic gauze.

A.—Partial Enterectomy.

Experiment 1.—Dog, weight 39 pounds. A semi-lunar portion embracing half the circumference of the bowel removed from the convex surface, two inches above the ileo-cæcal valve. Wound closed in a longitudinal direction by Czerny-Lembert suture. The first two weeks the discharges from the bowels were fluid and dark in color, subsequently normal in color and consistence. Animal killed 36 days after operation. Body well nourished; abdominal wound indicated by a firm linear cicatrix. Omentum adherent at point of operation; lumen of bowel at point of operation reduced one-half in size; lumen of bowel above and below the contraction equal in size, showing that the stenosis had not furnished an obstacle to the passage of intestinal contents. A few of the sutures remain attached, their free ends floating in the bowel.

Experiment 2.—Large, full-grown cat. The same operation was performed on the concave side of the bowel about the middle of the ileum, a semi-lunar piece of the wall of the intestine with the corresponding mesentery being removed and the wound closed in a similar manner, which diminished the diameter of the lumen of the bowel to about one-eighth of an inch. It was noticed during the operation that the convex surface of the bowel over an area corresponding to the partial excision presented a cyanosed appearance. The animal died