

ABSENCE OF MUSCULAR TONE AN IMPORTANT
ETIOLOGICAL FACTOR IN POSTOPERATIVE ILEUS.

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FOLLOWING intraperitoneal operations a certain amount of stasis in the intestinal canal occurs. It has been our custom to regard it as only a temporary paralysis, in the majority of instances caused by insult to the peritoneum incident to manipulation. The usual conception is that the paralysis, with the consequent distention, is due to a reflected action upon the intestines through the nerve cells in the plexuses of Auerbach and Meissner.

This discussion does not apply to cases where there is sepsis present. We all know how difficult it is to exclude the possibility of a peritonitis in some instances, but there can be no doubt that, occasionally, a case is observed where its absence is proven and yet the patient dies from paralytic ileus in spite of all known remedies. The unfortunate part about such an experience is that it may occur when least expected; that is, when the supposed active factors in its production have been absent. By this is meant severity of operation, necessitating an unusual amount of intraperitoneal trauma with the resultant shock of prolonged anesthesia. The comparative frequency with which it has occurred, as a complication of vaginal hysterectomy, is significant because there is perhaps less trauma and shock incident to the handling of intestines than in any other operation where the peritoneal cavity is invaded. We will have occasion to refer to the apparent association later.

The degree of intestinal distention following the ordinary elective abdominal operation depends somewhat upon certain factors incident to the methods of procedure. Careful preparation of the patient for operation, proper choice and method of anesthesia, gentleness and judicious postoperative care, render further discussion of this subject unnecessary in the average patient. Occasionally, however, in spite of these precautions, we are confronted by an ag-

gravated form of the above described condition when death ensues after the employment of every effort to relieve.

When the patient shows evidence of chronic fatigue with the poor tissue tone that follows chronic infection or long continued strain, there is always greater difficulty in dealing with this postoperative complication. It is the belief of the writer that in certain instances, where death occurs from so-called paralytic ileus, it is primarily due to lack of muscular strength in the walls of the stomach and intestine. This conclusion has been reached after careful observation of the various degrees of intestinal distention occurring in routine abdominal surgery. We find that the degree in the individual case depends largely upon the tissue tone of the individual previous to and the amount of exhaustion which occurs incident to the operative procedure. The amount of exhaustion or shock, as it is commonly called, also depends upon the extent of procedure and the character of anesthetic. In many instances it is an interesting index to the general tissue tone in an individual, but unfortunately its exhibition after operation has no value, except that it is a troublesome complication which causes no little alarm.

Keith(1) has recently called attention to the presence of nodal tissue in the bowel similar to that in which the heart beat takes its normal origin. This nodal tissue is in the shape of neuromuscular tissue and is interposed between the muscle fibers on the one hand and nerve fibers and nerve cells on the other. The relationship is so intimate that he finds it difficult to say often whether a certain intermediate branched cell is to be regarded as a muscle cell or as one of the cellular elements of the plexus. Keith regards the myenteric plexus as one of a composite texture composed of nerve cells, fine fibers and branching intermediate cells which appear to become continuous with processes of certain groups of muscle cells on one hand and ganglionic cells of the nerve fibers of the plexus on the other. He concludes that nodal tissue is located at various points along the course of the intestinal tract which acts as the pace-maker for that particular section. This is of interest because it suggests the very intimate relationship that exists between the muscular and nervous system, and the disturbance that may arise if either is below the normal in efficiency; as in the heart, a block may occur at any point where one rhythmical zone passes into the succeeding zone.

Bayliss and Starling(2) demonstrated the intrinsic beat of bowel muscle. The musculature of the whole intestinal tract has its pulse. There is no reason why it does not vary in tone and strength as does the heart and every other muscle.

Magnus demonstrated in a study of isolated pieces of intestine that the strips beat more actively when removed from a normally-fed animal than when removed from an animal that was not digesting. Experiments lead to the conclusion that the entire intestinal canal is supplied with extrinsic nerves which regulate the control of tone. It has also been proven that if the canal is entirely separated from the central nervous system, it will develop an independent tonic state and after a time resume its rhythmic movements, but it will regain its characteristic movements only as it recovers tone. Tonus is, therefore, fundamental. Tonic contraction and rhythmic peristalsis disappear where there is general bodily weakness and where the depleted central nervous system fails to deliver the necessary tonic impulses(3).

For some time we have been observing the muscular tone of the intestinal canal both during and following abdominal operations. This study has been made in connection with one of tissue tone in general, with particular attention to heart muscle, and has led to the conclusion that postoperative distention will vary in direct proportion to the strength and tone of the muscular system. When careful study shows marked absence of tone before operation, and when inspection reveals a large dilated colon with marked absence of muscular tissue, we know that the patient will suffer more or less discomfort from this complication after operation, the degree depending upon the amount of strength remaining when the stress and shock of the operative procedure become effective.

In the study of a patient presenting the evidence of chronic fatigue with the above-mentioned handicap, some consideration should be given to the possibility of this complication for, in many instances, while it may not prove serious, yet it undoubtedly adds much to the risk and is an additional worry to the surgeon in his postoperative care of the patient.

We have called attention in a previous paper to the significance that should be attached to careful study of the heart muscle in some cases of prolapse of the uterus. Careful observation will soon demonstrate to any operator that in this type of case abdominal distention is common and oftentimes quite troublesome. Study of our cases shows that it is not only failure of the cardiac muscle to withstand the stress, but in some instances there is exhaustion of the muscular structure of the stomach and intestines to such a degree that death ensues from what has been termed paralytic ileus. Reports in literature of death from this cause following simple procedures for the relief of uterine prolapse lead to the belief that it is due

rather to absence of muscular strength than to some obscure effect upon the sympathetic nerve centers.

It is our custom to look with suspicion upon every case of prolapse of the uterus which develops rather suddenly: that is, when the principal predisposing factors have been present for a long time. This means oftentimes the addition of another factor, viz., sudden weakening of the muscular and ligamentous supports dependent upon some constitutional change in which the tissue weakness is a general one. Careful analysis of this predisposing cause may reveal widespread weakness of all tissues, and unless this condition is recognized, the resistance of the patient may be greatly overestimated.

While no instrument of precision, which will enable us to measure muscular tone, has been discovered, we believe that much may be learned from a correct study of the pulse pressure, where there is widespread muscular weakness. It is necessarily present in the cardiovascular system, and while we have been slow to grasp it, there can be no doubt that the careful study of blood pressure enables us to measure the strength of the heart muscle with much greater accuracy than ever before. Observation along this line leads us to believe that the great majority of cases under discussion show the same relative weakness in the muscles of the intestinal tract that is found in the heart and blood-vessels. In all patients, careful investigation of the blood pressure is made upon admission to the hospital. Operation is either refused or deferred in every patient where there is a pronounced fall in the pulse pressure after exercise. We have learned that this is the best index to vital resistance, and if operation is undertaken in a patient showing a marked fall in the pulse pressure, after a brisk walk or vigorous use of the dumb bells, the greatest care is given to the selection of the anesthetic, extent and duration of the operation. A patient thus handicapped will stand but little stress and exhaustion soon follows a short drive under any form of anesthesia. Two years ago we met with an experience in a patient who showed plain evidence of the relative strength of the heart and intestinal musculature, had we been able to grasp it. The loss of the patient was a great shock, but it awakened a keener interest in this subject and has led to more careful observation and study of every patient where there is any evidence of such weakness. A brief report of the case may be of interest.

Mrs. L. B., aged forty-eight, admitted to St. Francis Hospital, November 6, 1914. Diagnosis: Laceration of the perineum, cystocele, chronic endocervicitis, and prolapse of the uterus. This patient, aside from an attack of typhoid fever at the age of twenty-five, gave a

history of perfect health until three months before admission. At this time she first noticed the uterus coming out of the vagina and since that time has not been feeling well in a general way. She has complained of being tired and unable to withstand fatigue. She has had some shortness of breath on exertion. Patient appears in perfect health, well nourished and color unusually good. Physical examination reveals slight irregularity of the pulse. For this reason, she was placed in bed and kept there for a number of days, at the end of which time the pulse seemed perfectly regular, and while the heart sounds seemed somewhat distant they were perfectly clear. On November 14, her condition seemed very good, and it was decided that there would be no unusual risk in operating. The operation consisted of the repair of the cervix, cystocele and rectocele, shortening of the round ligaments, a procedure unaccompanied, as a rule, by any great amount of shock. It was noted at the time of operation that the tissues were unusually soft and friable. Ether anesthesia. Patient was unable to void after operation, and there began on the following day persistent distention of the intestines, which was accompanied by vomiting. Gastric lavage afforded relief for a few hours, as did the use of pituitrin and the repetition of enemas. This condition persisted for three days when, owing to a possible doubt as to the presence of some mechanical obstruction due to the operation, the abdomen was again opened. No mechanical obstruction was found, nor was there any evidence of peritonitis. The intestines were distended throughout, and while an enterostomy was done 4 inches from the ileocecal valve, the distention continued without relief. The patient died two days later from paralysis of the entire intestinal tract.

There seemed no doubt in this patient that death was due to lack of horsepower, and that it was located not only in the cardiovascular system, but in the unstriated muscular fibers of the gastrointestinal tract. A case of this kind supports the arguments advanced, that the prolapse was an important index and was a danger signal, which, if properly appreciated, might have prevented a surgical death.

A keen appreciation of this phase of the subject, taken in connection with the general summary of the findings in a given patient, will lead to careful preparation of the patient for operation, and will influence in many ways the method of procedure at the time of operation. Fewer patients of this type will be operated upon without a long period of rest in bed preparatory to any severe operative procedure. Much greater care will be exercised in the type of anesthetic. Local or spinal anesthesia will be employed more frequently because by these methods energy will be conserved. The strength of the patient will serve as a gauge for the extent of the procedure. Multiple operations will be avoided unless absolutely necessary. In many instances, unless the tone of the individual can be raised to a point where the resistance is equal to the strain, operation will be withheld and the serious risk of a fatality avoided. Prolonged inhalation anesthesia will be given with respect for the kind and method of administration. If ether, it will be finally learned that

much better results will be obtained by giving ether vapor or by the closed method. Many of the advantages of nitrous oxide are due to rebreathing rather than to the virtue of the nitrous oxide itself. We find that by subjecting this type of case to prolonged rest, open air with general massage and good food, that operation is followed by almost no postoperative distention. It is our belief that when a patient is given ether he is subjected to the same test, and that the effect is similar to that of a Marathon race. At the end there is exhaustion, and in certain patients the reserve strength is not sufficient to withstand the test.

The writer has had two fatal results from paralytic ileus. A study of these cases and observations upon patients where there has been severe distention following abdominal operations, has led to the belief that the condition is due in some cases to the direct effect of exhaustion over weakened muscular tissue rather than to some reflected action through the sympathetic nervous system.

We are fully aware that there is nothing new in this conclusion, and that the individual resistance of patients is fully appreciated by surgeons at the present time. We desire to emphasize the point that the mortality rate in elective surgery in the practice of a given surgeon represents his ability to appreciate these principles. While experience may bring a perfected judgment which grasps these various danger signals almost intuitively, we must admit that occasionally a patient springs a painful surprise after operation due to some condition that should have been recognized long before.

REFERENCES.

1. *The Lancet*, Aug. 21, 1915.
2. *Jour. of Physiology*, 1899, vol. xxiv, p. 99.
3. Cannon. *Archives of Internal Medicine*, vol. viii, Oct., 1911.

DISCUSSION.

DR. GORDON K. DICKINSON, Jersey City.—I wrote a paper last year, but it did not have the dignified title Dr. Huggins has given to his. I called mine "Gas Pains" because that is the term which the interne and the young man commonly use, and I wanted my paper to go to them.

All those who have written on the scientific aspect of the subject and have reached into the cause of it and explained it have not given as good an opinion or explained it so well as Patterson, who advances the carbonic acid theory, or, better, the hypothesis that when you open the abdomen the carbonic acid is exhaled from the intestinal surface. Even if you put on moist gauze pads, it is exhaled in quantity and as the carbonic acid is a hormone unstriated muscle fiber you produce paresis of that part of the gut exposed;

consequently those who do not eviscerate and are instrumental surgeons, and those who avoid exposure of the intestines and manipulation, adding as little traumatism to evaporation as possible, are the ones who have less gas pains.

Working on that idea I carried it out after writing my paper, and as a result my internes are seldom called out at night to the bedside of patients to relieve gas pains. So I think the carbonic acid thought is a good one.