

student, unless he can come in contact with them and have competent instructors. Too often do we boast of the many hospital patients in Boston as a valuable asset to the medical school, forgetting how few of these are really accessible to our students. Not more patients, but more contact with patients is the present great need of our students.

If the Brigham Hospital is manned as the present Boston hospitals and be free of university control, to my mind its nearness will be its only advantage, and it may well serve as a perpetual preventive of what we need,—a university hospital. An improvised dwelling house with few patients would be better for us than a magnificent hospital, uncontrolled by the medical school, for in the former, at least, the medical school can determine the policy and appoint the best man capable of doing medical investigation and teaching, and in this wise lay the beginnings of a university hospital, which in due season will grow to be an institution that is a fit companion of our present laboratory buildings. But I have digressed from my main topic.

Notwithstanding the fact that at present the medical school cannot appoint to hospital positions the men regarded as most capable of teaching and investigation, yet the advantages of the training offered the young medical man by such an employment of his time as is afforded by teaching in the departments of medicine, are great, and these positions, I wish to emphasize, are for the young men and should be held for only a few years. Continuance in them is desirable neither for the man nor for the school. The personal pleasure in such work in itself would well recompense the man during these few years and the training gained would at least be no bar to hospital promotion. So, in those years, while awaiting an appointment in the out-patient department, medical teaching offers many attractions. If followed by the brighter men, at least, we will have soon in America a class of men from which to draw clinical professors, when freer interchange between our schools becomes possible, and who in the meantime can redeem us from the just criticism that in America rarely does a man continue clinical investigation beyond the first decade of his medical life, and that our medical leaders represent but little that was not embodied in our medical leaders of half a century ago.

For these reasons and others, I trust that the recent changes made in the teaching of medicine at Harvard will result in attracting the younger men to the positions which give them teaching experience and opportunity for clinical investigation. All effort possible on your part directed to this end will be a great boon to the medical school and a factor in the uplift of the standard of American medicine.

THE Croonian lectures of the Royal College of Physicians, London, have been delivered by Dr. W. J. R. Simpson on "The Plague."—*Science*.

## Original Articles.

### THE MEDICAL AND SURGICAL ASPECTS OF PERFORATING TYPHOID ULCERS.\*

BY RICHARD H. HARTE, M.D., PHILADELPHIA.

SINCE typhoid fever has become such a widespread disease, with its apparently unavoidable and fatal complication, namely, perforation, which has been estimated to amount to as many as 16,000 annually in the United States alone, it renders a discussion of the subject one of perennial interest, and, I think I may add, of considerable value. It is only by a discussion of the relative value of the various symptoms and modes of treatment at present known to us, that we can hope to save more of these cases from a fatal termination.

Although it may be somewhat of a presumption to call your attention to a subject which has already received such able treatment by many of the physicians and surgeons of Boston, yet I venture to present for your consideration some of the conclusions that I have myself reached, with the hope of carrying home with me, as the result of your kindly discussion and criticism, some ideas which will be of practical utility to my future patients.

I cannot but feel the importance, in the treatment of desperate cases of typhoid fever, of the surgeon and physician daily seeing the patient together, as it is impossible for a surgeon suddenly called in consultation, knowing nothing of the individual peculiarities of the patient, to positively diagnose perforation. Neither does it seem necessary that the surgeon should be called in consultation in every case, particularly before the physician feels that there is cause for alarm.

The physician is of the greatest help to the surgeon in deciding on the propriety of surgical intervention. An over-enthusiastic surgeon would many a time open a patient's abdomen were not the physician at hand to remind him that sudden pains in the course of typhoid fever are not unusual; that a leucocytosis of from 10,000 to 12,000 has occurred and the patient seemed none the worse; that the patient has vomited at times without appreciable cause; or, that in another instance, abdominal pain and fall of temperature was significant of intestinal hemorrhage and not of perforation. Of course, the surgeon must in the end assume the responsibility; he cannot and he should not regard himself merely as a machine in the hands of the physician. Therefore, to render himself competent to appreciate the changes produced in typhoid fever by perforation, he must familiarize himself with the normal aspects of the disease; he should be acquainted with the slow pulse, the disproportionate high fever; the distention of the abdomen, its normal resistance and susceptibility to pain; and he should pay particular attention to the facial expression of the patient. This facial expression and the change

\* Read at the meeting of the Surgical Section, Suffolk District Medical Society, in conjunction with Boston Medical Library, March 13, 1907.

which occurs in it after perforation is so characteristic, though difficult of description, that to one who is familiar with the patient's daily aspect, it becomes a surprising help in diagnosis. Hence, I think it well for every surgeon in hospital practice to keep himself fairly familiar with all the very ill typhoid patients in the wards. I have endeavored to carry out this plan with my colleagues as far as possible at the Pennsylvania Hospital, with the most gratifying results.

In the paper under consideration I wish to express as far as possible the results of our experience as obtained from the study of 80 cases of perforation, which have been operated upon by my colleagues and myself since 1901 at the Pennsylvania Hospital. I find that our experiences and the results obtained from them have already been presented in a paper by Dr. Ashhurst and myself (published in the Transactions of the American Surgical Association), based on 362 operative cases.

I wish here to express my appreciation of the very careful and accurate work which my colleague, Dr. J. A. Scott,<sup>1</sup> has done at the Pennsylvania Hospital. His reports have proved of great value, and for the statistics herein set forth I have largely depended on his figures. I find that Dr. Scott's studies corroborate the deductions which I have already arrived at in my previous papers on this subject<sup>2</sup>.

From January, 1903, to March 2, 1907, there have occurred in Philadelphia 34,725 cases of typhoid fever with 3,805 deaths. Considering that at least one third of these deaths are due to perforation, we have had 1,268 perforations to deal with in Philadelphia. Some of these cases should have recovered, and it remains for the attending physicians to determine how many are to be recognized and submitted early to surgical interference, with the hope that a fair percentage of recoveries may take place. The statistics thus far compiled give too low a mortality rate, I believe, as many fatal operative cases have never been reported.

There is no doubt that certain typhoid epidemics are more virulent than others, and the resulting ulcerations occurring in the bowel are deeper and greater in number, and where perforation has occurred and the patient has been operated upon in these serious cases, secondary perforation frequently occurs with a fatal result. In our series this has been experienced repeatedly.

In summing up our work at the Pennsylvania Hospital along this line, we have operated on 80 cases of typhoid perforation, of which 15 have recovered, giving a mortality of 81.25%.

Now permit me to take up, *seriatim*, the general subject of perforation.

**Predisposing causes.**—The causes of perforation are numerous; among them may be mentioned race, sex, age, stage of the disease, severity of the attack, severity of the epidemic, intestinal parasites, etc.

It would appear that the negro is less disposed

to perforation than the white. Out of 25 operations of my own, only one patient was colored, making 4%; and this seems to be the experience of other operators.

Males are more liable to suffer perforation than females.

As a rule typhoid fever is a disease of early life, and consequently most perforations occur between the ages of 15 and 30 years.

From a careful analysis of a large number of cases, the third week of the disease is the most usual time for perforation. It may, however, occur at any time during the height of the disease, or even before the patient feels particularly sick, as has been noted in a number of ambulatory cases.

There is no doubt, as before mentioned, that certain epidemics of typhoid fever are more virulent in character than others, the ulceration of the Peyer's patches in such instances being deeper and more extensive than in the milder cases, causing a greater tendency to perforation.

Virulent cocci or bacilli may cause a secondary infection resulting in extensive inflammation, necrosis and, later, perforation. Anything which sets up unusual peristaltic action in a previously diseased intestine—undue involuntary contraction of the abdominal muscles, straining at stool, urination, cough, sudden spasm or struggle incident to a cold bath, may be a factor in producing perforation. There is no doubt that irritating foods brought to patients by their friends should be classed as exciting causes. When perforation occurs during sleep, without any apparent exciting cause, it may rightfully be attributed to excessive necrosis.

Intestinal parasites have been mentioned as possible factors in perforation, but I do not consider them as such. I do believe, however, that they are a predisposing cause in appendicitis.

The *pathological lesion* in typhoid fever is confined largely to the last three feet of the ileum, although extensive involvement of the colon may be found, even down to the sigmoid. But it is in the last two feet of the ileum that perforations are most apt to be found, varying in number from one to six or more, and depending as to their size largely on the character and depth of the ulcers. Not infrequently at the time of the operation, when the intestine is exposed, one perforation may be found, while half a dozen ulcers can readily be detected through the peritoneum, both by the eye and by the sense of touch. These ulcers are favorable sites for future perforation. When the peritoneal coat does finally give way, the opening at first is very minute, even smaller than a pin head. It will usually be covered with a small mass of frothy mucus or liquid fecal matter. Around this area will also be found considerable masses of lymph, and in seeking for the point of perforation this lymph must be gently removed with gauze, after which the perforation will not infrequently be brought to light. Again, a large opening may exist, varying in size from the end of a pencil to the tip of the finger and permitting feces to escape. What will be noticed on the

<sup>1</sup> Univ. of Penn. Med. Bull., May and June, 1905. New York Med. Jour., Feb. 9, 1907.

<sup>2</sup> Ann. of Surg., Jan., 1904. Jour. Am. Med. Assn., Oct. 28, 1905.

operating table differs but little from what all have frequently seen in the laboratory. If cultures are made the typhoid bacillus will be found to be the infecting cause, with a low grade of peritonitis. If streptococci rather than staphylococci abound, the lymph is more abundant and the prognosis consequently more grave.

Time will not permit of a lengthy discussion of the many interesting points of this subject from a pathological standpoint, but the chief interest in doubtful cases is whether or not a perforation has taken place.

With our present knowledge of typhoid perforation there would appear to be little difficulty in making a positive *diagnosis*, but unfortunately typical cases are the exception. Not infrequently a case may present all the clinical evidences of perforation, submit to operation, and no signs of any peritoneal irritation be found. On the other hand, patients may die without any abdominal symptoms of importance and at autopsy a perforation may be found. Nevertheless, there are certain classical symptoms which must be borne in mind and which must be thoroughly analyzed in every suspected case, for otherwise errors will be made in diagnosis.

*Pain* is one of the most valuable symptoms in diagnosis, and the greatest attention should be paid to it. It varies in degree and in location and also in character, but it usually is more or less paroxysmal. Its severity may be so marked that the almost comatose patient may cry out with it, or, on the other hand, it may be very mild. It is usually of a stabbing character, situated most frequently in the lower right quadrant of the abdomen. It may be felt in the epigastrium and umbilical region, or in the bladder, and, in the male, at the end of the penis, or sometimes in the left iliac fossa. These facts should not be overlooked in patients who are apathetic, or are so far advanced in the toxemia of the disease that they do not appreciate pain. Thus it often happens that the first evidence of perforation is a distended abdomen with a movable dullness in the flank. I recall a case where the first sign of perforation was a violent attack of pain, causing the patient to scream out and draw up his legs in bed. This lasted but a short time, leaving only muscular rigidity upon which to base a diagnosis. On the other hand, it must be borne in mind that pain is a common thing during typhoid fever, due to the ingestion of improper food, flatulence, or a dozen different causes of irritation within the lumen of the gut. Therefore, it is imperative that this symptom be thoroughly guarded and carefully analyzed. In our experience at the Pennsylvania Hospital pain was a constant and reliable symptom in about 75% of the cases operated upon. The subject of pain is so important that I hastily run over a list of conditions which may be responsible for it. Among these may be mentioned hysteria, pleurisy, pneumonia, distended bladder, menstruation, appendicitis, peritonitis, cholecystitis, rupture of the gall bladder, liver abscess, phlebitis and thrombosis of the iliac vessels.

Manges<sup>3</sup> very aptly puts it when he says that the solution of some of the problems of the real significance of pain will be found when we know more about the exact relation of non-perforative peritonitis in typhoid fever.

There can be no question but that pain when present is a most valuable and important symptom and it would seem that it must always be present to more or less an extent after a perforation has taken place. But here the personal equation has always to be considered. What one patient will consider pain, another may express as only slight discomfort.

*Sweating*, either alone or accompanied by a fall of temperature, frequently accompanies the pain of perforation. The sweating may be profuse, involving the entire body, or only the head and neck. With it there is often a fall of temperature, and, in my experience, it is fairly consistent, varying from 2° to 4°. Where no fall of temperature occurs it may be due to the fact that the temperature had not been taken until the advent of peritonitis, which had restored it to the original range of fever. I consider it a good rule to have the temperature taken immediately and repeatedly after the occurrence of any abdominal pain, until all doubt is passed. A fall of temperature frequently accompanies intestinal hemorrhage during typhoid fever, but the hemorrhage is, as a rule, painless and usually evident in the stools in the course of an hour or so.

In considering the *temperature* it must be borne in mind that a sudden chill is a warning that must not be overlooked. In the last case I operated upon, a chill occurred some hours before a diagnosis of perforation was made. It does not often occur, but when present is significant of some sudden peritoneal irritation.

*Rigidity* of the abdominal muscles is one of the most valuable signs in the diagnosis of intestinal perforation, and I think its value is more generally appreciated by the surgeon than by the physician. This rigidity is *reflex* and hence is *involuntary*, depending for its production on the overflow of stimulus received in the lumbar cord from the inflamed peritoneum and is most noticeable in the right rectus and oblique muscles of the abdomen. Voluntary rigidity of the abdominal muscles is not uncommon in typhoid fever, as the patient tries in this way to protect his sore and swollen intestine from the useless pressure to which he is subjected at the hands of some physicians. I hope I may be pardoned if I say that I do not think all physicians realize what a surgeon means by abdominal rigidity. It is not elicited by trying to palpate the lumbar spine, but can be detected by the merest touch of the finger tips. The finger tips, however, must be as well trained in their work as is the skilled ear of the physician who frequently studies obscure heart lesions. It must be remembered that the sensorium in typhoid is so blunted that this symptom may not be so quickly recognized as in appendicitis.

*Tenderness* is not as valuable a sign as rigidity,

<sup>3</sup> Mt. Sinai Hospital Report, 1905.

since tenderness may exist where no perforation has occurred. It can be elicited to a more or less extent in almost every case of typhoid fever. However, when there is a definite spot of tenderness and it is accompanied by other significant symptoms, it must not be disregarded. In examining the abdomen for tenderness the rectum should never be overlooked, as a knuckle of the ileum may perforate and slip into the pelvis and thus for a time escape detection in a superficial examination of the abdomen. This was very noticeable in a case operated upon a short time ago by Dr. Stewart at the Pennsylvania Hospital. The case was suspicious, but nothing was positive until a rectal examination was made which revealed a spot of great tenderness, and when the abdomen was opened a perforated knuckle of gut covered with lymph was found lying alongside of the rectum and surrounded by exudate. The perforation was closed, the pelvis washed out and the patient recovered.

*Vomiting* is of so common occurrence in typhoid fever, without any apparent cause, that it cannot alone be considered as indicative of perforation, but when it occurs for the first time, and especially where it either precedes or follows pain, it should not be disregarded.

About the time of perforation a peculiar change takes place in the *facial expression*, which is most significant. It is difficult to describe, but once seen is never forgotten, being distinctly characteristic of the shock of perforation.

There is in the majority of cases an increase in the *pulse rate*. In typhoid fever the usual pulse rate is from 80 to 100 beats per minute, but after perforation it is apt to rise rapidly from 120 to 140 within ten or fifteen minutes following the onset of pain.

*Distention* of the abdomen is often present throughout the disease, and is not an important sign, although it becomes more pronounced after perforation. The important point to determine is whether the gas is within the bowel or free in the peritoneal cavity.

*Dullness* on percussion is a very fallacious sign, and palpation of the liver dullness, on which so much dependence was formerly placed, is even more elusive. Intestinal distention frequently precludes palpation of the hepatic dullness; even when air is free within the peritoneal cavity liver dullness may exist. Dullness in the flank is not always pathognomonic of fecal extravasation, as a freely movable colon with liquid feces within it may give rise to a similar condition.

It has been asserted by Crile and others that the blood *pressure* rises about the time of perforation and can be demonstrated by the use of the sphygmograph. I have not had any experience along these lines and am inclined to regard it as being of more interest to the laboratory observer than to the practical surgeon and physician.

The *examination of the blood* is now generally conceded to be of little value, or at least such has been our experience at the Pennsylvania Hospital. During typhoid fever the number of leucocytes

is physiologically diminished and it would seem as though the patient's exhausted condition prevented a leucocytosis. A high leucocytosis may render positive the diagnosis of perforation, whereas a low count should be interpreted as showing that a perforation does not exist, since the patient in the latter case may be entirely overwhelmed by the typhoid toxins and no leucocytic action be possible. Kast and Gutig have shown that in typhoid fever complicated by secondary infections the leucocytes are much lower than when such infections occur alone. In the observations made by Longcope, at the Pennsylvania Hospital, on the bone marrow in cases of typhoid fever, it is shown that when the disease is complicated by a severe secondary infection, there appears to be an actual inhibition of the formation of the polymorphonuclear leucocytes in the bone marrow. A wave of leucocytosis is here described as reaching its maximum just after perforation and then subsiding.

I am firmly of the opinion that a careful blood picture should be drawn wherever possible, but that the results should never be considered, except where they confirm existing clinical signs.

From what has thus far been considered, it would appear that in a typical case of typhoid perforation but little difficulty would be experienced in making an accurate diagnosis. But this point should never be lost sight of, — that it is one thing to operate on a case of typhoid perforation, and a decidedly different thing to operate on a case of septic peritonitis, the result of typhoid perforation, which has existed for some time and which has been evinced by milder and more localized symptoms which have not been recognized and properly interpreted. Any person who has seen many cases of perforation will be struck with the difficulty of estimating the exact time of the accident. This is emphasized in the elaborate and comprehensive report by Drs. Shattuck, Warren and Cobb, published in 1900.

It has been asserted that difficulty is experienced in making a diagnosis where the question of *hemorrhage* is concerned, as to whether the hemorrhage was responsible for many of the symptoms that present themselves or not. As before mentioned, the collapse is likely to be the same in either case, yet hemorrhage is usually unaccompanied by pain or rigidity. The escape of blood from the bowel soon tells its own tale. As a rule perforation cases are seldom accompanied by hemorrhage, probably not more than 10%. In one of my own cases both hemorrhage and perforation existed, as was proven by laparotomy. The bleeding point was ligated and the perforation in the bowel closed, after the establishment of an artificial anus. In appendicitis also it may be impossible to make a positive diagnosis, especially if the appendix is perforated. In non-perforated cases of appendicitis the pain is not so severe, the temperature does not show such a sudden drop and the facial expression is not so characteristic. Peritonitis, due to pelvic or ovarian disease, can usually be eliminated after a careful vaginal examination. Gall-bladder

affections are not uncommon during an attack of typhoid, owing to typhoid bacilli finding their way into the gall bladder, causing much disturbance and even rupture. This occurred in a case a short time ago at the Episcopal Hospital. Pain in the gall-bladder region, possibly jaundice, symptoms of shock, with rigidity, dullness and possibly a palpable mass, all aid in determining the character of the invasion. The perforation of gastric and duodenal ulcers during typhoid fever simulates very much the symptoms of an intestinal perforation in the ileum, and the local signs are our chief aid in making the diagnosis. Iliac thrombophlebitis, suppurating mesenteric glands, splenic infarcts, all may cause peritonitis during the course of typhoid, and are not so characteristic of perforation. Where pain exists the greatest care must be exercised in determining its origin.

I recall two cases, one where the pain, muscular rigidity, anxious expression, etc., pointed to perforation. The regular passage of a fair amount of urine and the inability to palpate the bladder led to a tentative diagnosis of perforation. After the introduction of the catheter, however, 188 oz. of urine were evacuated, and all symptoms immediately subsided. In the other case a diaphragmatic pleurisy caused a similar train of symptoms, which subsided on a thorough fixation of the side.

The *prognosis* in typhoid fever depends largely and almost entirely upon the promptness with which the condition has been recognized and the patient operated upon, provided that the area of ulceration in the bowel is not too extensive and the patient is not too toxemic, as the result of a prolonged illness.

Of nearly 600 cases which I analyzed 24.65% left the surgeon's hands well, there being a *mortality* of 75.35%. These figures, I am convinced, are too high, owing to the tendency to report only cases in which recovery has taken place. My own experience, based on 25 operative cases, gives a percentage of recoveries of 20%. Out of 39 operative cases, up to January, 1905, reported by Dr. Scott at the Pennsylvania Hospital, there were 12 recoveries, giving a *recovery* rate of 30+%. Since January, 1905, a heavy mortality has been experienced in all operative cases at the Pennsylvania Hospital, reducing the percentage of recoveries to 18.75%.

Vaughan,<sup>4</sup> of Washington, reports 10 cases of typhoid perforation operated upon by him, with a recovery rate of 40%.

I cannot help but feel that as time progresses the mortality rate in these cases will be diminished, as surgeons will segregate these cases, and only operate upon those where there is a possible chance for recovery.

The *operation* and *after-treatment* of intestinal perforation is probably so familiar to every one here, that it seems hardly necessary for me to discuss its technique to any great extent. Yet I feel convinced that there are some points which may be open to question. I am convinced of

the importance of operating as soon as possible after a diagnosis has been made and this should not, under ordinary circumstances, consume more than ten to twenty minutes. I never wait for the so-called reaction to take place before opening the abdomen. The valuable time that is often lost after the first suspicious symptoms manifest themselves, in making the diagnosis, in obtaining the consent of the patient or his family to operation and in the transportation of the patient from the typhoid ward to the operating room, is all too great. I look forward in all large hospitals to the time when the management will *insist* that when the patient is admitted to the medical ward the physician in charge shall have the consent of the patient and his friends to operate immediately, should the urgency of the case demand it. In cases in which there is an element of uncertainty in the diagnosis, and where the symptoms do not ameliorate, I think that an exploratory examination should be made. Experience has curiously demonstrated that where no perforation exists an exploratory examination is usually followed by improvement, and there is hardly a reported instance where operation can be said to have hastened death. In my own experience in 27 cases, two were found to be non-perforative, and they really seemed improved by their sojourn in the surgical ward and went on to a hasty convalescence.

I always employ general *anesthesia*, ether preceded by ethyl chloride (if not contra-indicated), and if this is intelligently administered the patient in a few moments drops into a peaceful sleep without a struggle. The unconsciousness thus gained on the patient's part is much more valuable in the rapid completion of the operation than are any of the advantages, imaginary at best, which can be claimed for local anesthesia. It must be remembered that ether is a heart stimulant and doubtful cases not infrequently improve so much under its administration as to render an operation justifiable.

There are few surgeons to-day who advocate anything but the right-sided incision. Those who adhere to the median incision must have had a limited experience. Seventy-three per cent of the perforations are situated within 12 inches of the cecum and 94% are in the last two feet of the small intestine. In addition to this it is very difficult, when the abdomen is opened, to determine in which direction the presenting loops of bowel run, no matter how proficient one may be with Monks' method of intestinal localization, invaluable as it is for other intestinal investigations. If the cecum is first located it is easy to trace the ileum upwards until the perforation is found. This is materially aided by having your assistant examine one side of the intestine while you are watching the other side during its rapid removal from the abdominal cavity. In this way much time is saved and there is less likelihood of the perforation being overlooked. If in searching for a perforation it is noticed that when the color of the ileum begins to fade quickly from its dark, congested shade to the normal pink,

Wash. Med. Ann., March, 1906.

you may be positive that you have run beyond the perforation limit, and doubtless have overlooked a small pin-point perforation, probably covered with a few flakes of lymph.

As soon as the perforation is found it should be sutured, thus preventing undue soiling of the peritoneum. In about one out of every 8 cases more than one perforation will be found. Hence diligent search should be made for all inflamed areas and every spot, even threatening perforation, should be *inverted*. The inversion of the perforation with Lambert sutures of silk is usually best done in the long axis of the bowel, as transverse sutures are more prone to tear out as the intestine resumes its normal convexity. However, under certain conditions a transverse suture may be most applicable, especially if the opening is large.

Excision of the ulcer is not only useless but harmful, as it is a waste of time and may cause hemorrhage. If the opening should be too large to preclude suturing an omental flap may be adjusted over it, or if the conditions do not readily admit of closure, an artificial anus should be established. Excision of the bowel with an end-to-end anastomosis is too severe and slow an operation, as proven by its failure in every reported case. In desperate cases, where an extensive area of the ileum is studded with large, deep ulcers, all of which are on the point of perforating and where inversion is out of the question, an artificial anus may be quickly established and the efferent loop of bowel washed out with salt solution, so as to remove all irritating substances from the surface of the ulcer, thus reducing the tendency to fresh perforation. My last case, upon which I operated about two weeks ago, was of this type.

The *toilet of the peritoneum* has been a subject much in dispute in cases of peritonitis from any cause. It depends, however, almost entirely upon the amount of soiling and extravasation that has taken place within the peritoneal cavity, as to what method shall be employed for the removal of all infectious material. If the operation has been early and little or no soiling or extravasation has taken place, all the cleansing can be accomplished by the judicious use of dry gauze.

But if, on the other hand, which is usually the case, the pelvis is partly filled with fluid, stained with fecal matter and pus, the coils of intestine smeared with escaping fecal matter, and all the area in the region of the perforation in a state of surgical filth, then I cannot see that there is any other alternative but thorough irrigation of the abdominal cavity with hot saline solution. In my opinion this is the most efficacious method of cleansing the abdominal cavity, and I am sure, if rightly done, offers the patient the best chance of recovery. I cannot see that infection is much diffused, or that the patient is much shocked by this procedure. It often occurs that the infectious material is widely diffused, but has not yet been absorbed. If adhesions have not yet formed, and if the infective material can be re-

moved quickly, absorption will be diminished, or effectually prevented. On the other hand, the time required and the traumatism frequently inflicted in the sponging process must condemn this method to the conscientious surgeon. The only other cause open is to leave fecal matter, and perhaps pus, free in the abdominal cavity, compelling the patient to take his chance to fight off the probability of infection, with no other help than that afforded by a drain.

To satisfactorily cleanse the abdomen by *irrigation* does not mean pouring a few pitcherfuls of solution into the abdomen and then mopping it out in an aimless manner. The surgeon should be provided with a large, hard rubber tube, having a lumen of  $\frac{3}{4}$  of an inch, with multiple perforations, and with a rubber tube and a funnel attached to the other end. Through this funnel should be poured gallons of hot salt solution, at a temperature not less than 110° F. The tube should be inserted first down to the pelvis, then between the coils of intestine, while the surgeon separates them with his left hand while manipulating the tube with his right. During the irrigation the pulse will, as a rule, improve, partly due to the heat of the solution and the refilling of the vascular channels by absorption. To combat shock it has been suggested that adrenalin be added to the solution. I have used this, however, in only one case and with a negative result.

*Drainage* is best maintained by large rolls of gauze placed in those regions of the abdomen where fluid is wont to accumulate, namely, the pelvis, each loin and between the folds of intestine, along the sutured bowel. Intravenous injection of salt solution is of great aid, preventing shock and sustaining the patient during the first few hours following operation.

No little discussion has arisen as to what position patients should be placed in on their return to the ward. Some advise the extreme Fowler position, that is placing the patient in the Sims's sitting posture, in order to facilitate drainage towards the pelvis. There is no question that this is all right, in perforated gastric or duodenal ulcer, gall-bladder infections, etc., but it must be borne in mind that typhoid patients are usually exhausted by a long illness and are frequently so toxic and delirious that it is not only unwise, but almost impossible, to keep them in a sitting posture. I have seen it, to my mind, do decided harm to toxic patients, although the patient's condition after operation was fairly good. I am strongly of the opinion that the majority of cases after operation will do better in the horizontal position, and that drainage can be perfectly maintained without any undue tax on the strength of the patient.

As a rule no *food* should be given by the mouth until the third or fourth day. During this interval nourishment should be maintained by nutritive enemata, and when food is finally given, it should be of the blandest kind, for the surgeon must remember that the patient has typhoid fever as well as a sutured intestine.

Finally, I would say that I have no reason to

change the conclusions at which I arrived some time ago, and which were published in my previous paper.<sup>5</sup>

1. Perforation of the bowel in typhoid fever is a much more common condition than is generally supposed, being responsible for about one death in every three cases.

2. The most common time of perforation is between the fourteenth and twenty-first days of the disease and occurs in all grades of severity, from the ambulatory to the hemorrhagic type, and does not seem to be any more common in the hemorrhagic than in the milder types of the disease.

3. The ileum is the most frequent site of perforation, in the majority of instances the perforation occurring within 12 to 18 inches of the ileocecal valve. The next most frequent sites of perforation are the appendix and the cecum.

4. Pain of some kind is present in 75% of all cases. In 50% of the cases the onset is sudden and severe and of increasing intensity, localizing itself to a special zone. In 20% of the cases the pain is of slow onset, not localized, with general distribution. In some cases no pain is complained of and the usual symptoms of perforation are absent.<sup>6</sup>

5. Tenderness and rigidity are present to a certain extent in all cases. The latter symptom I regard as a most valuable sign, and it is rarely wanting, except in patients with unusually large and pendulous abdomens.

6. When perforation is suspected the temperature should be taken every hour, as it is only in this way that definite conclusions can be drawn with regard to any marked variation in this symptom.

7. Distention is a late symptom of perforation, usually not making its appearance until some hours after the perforation has occurred. The obliteration of the liver dullness is not regarded as a reliable sign of perforation.

8. The study of the leucocytes is of little aid, although occasionally their increase may make you more positive of the diagnosis. The differential count is of no practical value.

9. Before a positive diagnosis is made, pain caused by a pleurisy, pneumonia, cholecystitis, acute gastro-intestinal indigestion, iliac thrombosis, appendicitis, peritonitis, the passage of a renal calculus, distended urinary bladder, or even a hemorrhagic exudate into the abdominal muscles, must be carefully considered. Any of these conditions may cause symptoms similar to those caused by intestinal perforation.

10. Nature may occasionally close one or more perforations, but the only rational procedure where perforation occurs is surgical intervention. No case is too desperate for an attempt, as it has not infrequently been noted that the mild cases succumb and the more desperate ones recover.

11. In cases of doubt, where the symptoms point to perforation, the safest procedure is to operate. As a rule, cases operated on and no perforation found seem rather to be benefited than otherwise by the operation.

12. When the diagnosis has been made, I know of no condition, except possibly that of hemorrhage, where speed in operating is so important a factor in securing success, as it is in intestinal perforation. Everything should be carefully prepared beforehand and all conditions considered, so that when the operation is once begun things should move with rapidity and without any interruption.

#### PERFORATING TYPHOID ULCERS.\*

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WE are under obligations to Dr. Harte for his comprehensive and interesting paper. The closer association of work which he suggests between the physician and the surgeon would be of great value in other affections as well as in typhoid, and profitable to the patients as well as to the medical men. There are, however, practical difficulties in carrying it out. Each man has his own patients to look after, and when he has got through with those inside the hospital he usually has not too much time for those outside.

His other suggestion, that an understanding should be reached that every case of typhoid admitted to the hospital may be operated on without delay, if deemed necessary, seems to involve no serious difficulties, and should, it seems to me, be generally adopted.

It is interesting to learn that those patients operated upon without any perforation being found did so well. I find it hard to believe that their improvement was due to the operation, which was presumably done well on in the third week at about the time when the disease naturally abates. I am sure that Dr. Harte does not mean to recommend anesthesia and laparotomy as a routine remedial measure for typhoid fever.

Not knowing what Dr. Harte was going to say or exactly how he was going to treat the subject, I put down in writing what I have to say, especially from the point of view of the physician.

Perforation is the gravest complication of typhoid fever. Fortunately it is rare. Of 2,047 cases of typhoid treated in the Massachusetts General Hospital in the past ten years, it has been known to have occurred in 30, or in 1.4% of the cases. I have had no case of perforation, myself, since 1899.

It is most liable to occur in the third week, but may occur at any time after the middle of the second. It may occur in the first or second relapse, the primary attack or attacks having run a favorable course. There is no relation between the severity of the case and the liability to perforation.

The duties of the physician with regard to perforation in typhoid are four-fold: (1) He must know the symptoms suggestive of its occurrence; (2) he must be on the watch for them; (3) he must see that the nurse or attendant knows and is alive to them, in order that he be sent for at the earliest

\* Read at the meeting of the Surgical Section, Suffolk District Medical Society, in conjunction with Boston Medical Library, March 13, 1907.

<sup>5</sup> Jour. Am. Med. Asso., Oct. 28, 1905.

<sup>6</sup> Scott.