THE DIAGNOSIS OF INTESTINAL PERFORATION IN TYPHOID FEVER

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Without doubt the greatest bugbear to physician and surgeon alike in the management of typhoid fever is the ever-present liability of intestinal perforation.

This complication occurs in from 2.5 to 3 per cent. of all cases of typhoid. Furthermore, according to Osler, one-third of all the deaths in typhoid are due to intestinal perforation; and when we come to consider that, from statistics collected by Taylor, in the United States alone there are estimated to be 500,000 cases of typhoid annually, with 75,000 deaths, we are confronted by the astounding fact that about 25,000 persons die annually from intestinal perforation due to typhoid fever. It therefore seems that anything which may add to the knowledge of this condition is acceptable.

Twenty-four years ago Leyden advocated the surgical treatment of typhoid perforation and Mikulicz performed the first successful operation for the condition, and for the first time a ray of hope appeared in a condition which up to that time had appeared practically hopeless. But, in spite of the fact that the operative treatment is now and has been well known for some years, Harte and Ashurst were able to collect only 362 published reports of operations up to January, 1903. These cases gave a mortality of 74.3 per cent., thus showing that something had been done toward checking the death rate. At the Atlantic City session of the American Medical Association in June, 1907, J. E. Allaben reported 162 operations as all that he could find reported from January, 1903, to January, 1907, and these gave a mortality of 62.34 per cent., a decrease of 11.69 per cent., evidently due to improved surgical technic and earlier diagnosis. Doubtless many cases have not been reported; but when we consider that in twenty-three years only 524 cases have been reported, we can not deny that many cases among the thousands that have occurred must have gone unrecognized and that consequently the point in which we are lacking most is diagnosis, and more than that the early diagnosis, for it is an easy and simple matter to make a diagnosis of the peritonitis following a perforation, but it is far more difficult and by no means easy to make a diagnosis of the perforation itself.

TWO NEW SIGNS OF PERFORATION IN TYPHOID

It has been my privilege to follow seven cases of typhoid perforation. While following and studying these cases I observed two signs which seem to me to be important in the early diagnosis of perforation and to which, so far as I know, attention has not been called.

The first sign, for want of a better description, I have designated as the "dipping crackle" and is exemplified by the following case:

CASE 1.—History.—A. L., female, aged 30, came under observation on the twentieth day of her disease. The onset and course of the disease had been typical but severe, and for three days before coming under observation she had had wild delirium, which had almost disappeared at the time I first saw her. On the evening of the twenty-first day of the disease she complained of a sudden severe knife-like pain in the right iliac fossa which was made worse by coughing. Her pulse became rapid, finally reaching 130 and changed in character, becoming smaller and showing increased tension to the finger. Respirations became rapid and labored but dia-

phragmatic respiration was maintained. The abdomen was distended, the area of liver dullness was gradually replaced by abdominal tympany and the heart became pushed to the left. The temperature gradually rose and about four hours after the onset of the symptoms she had a chill lasting ten minutes, and following this the temperature suddenly rose to 106 F. There was no change in the leucocyte count. There was well-marked tenderness and rigidity in the lower half of the abdomen and especially in the right iliac fossa. There were no signs in the lungs except a little more dullness in the right axilla and at the right base. There was no vomiting or restlessness.

The "Dipping Crackle" Sign.—At the first examination, which took place a few minutes after the perforation, on placing the bell of the stethoscope over the right iliac fossa and dipping suddenly with it as in dipping palpation, a very fine crackle was heard which sounded much like a fine crepitant rle, or as if two sticky surfaces were being drawn apart. This sign was present in three of the seven cases and appears to me to be a rather valuable confirmatory sign, as it seems to be due to the fact that in dipping suddenly the parietal and visceral layers of the peritoneum come in contact for an instant and, apparently, the inflamed surfaces stick together for a moment and then pull apart. I have never found the sign present over an area of more than two inches in diameter and never later than four hours after the initial symptom, presumably because the accumulated gas prevents the surfaces from coming in contact.

The second sign to which I desire to call attention is shown in the following case:

CASE 2.—History.—W. C., male, aged 17, was taken ill suddenly and had been in bed only two days when he came under observation. The initial attack lasted only thirteen days, and during this he had an enlarged spleen, rose spots, and typhoid tongue, but no Widal reaction. After being normal for twenty days the temperature rose suddenly and he entered on a relapse. The spleen again became palpable and rose spots appeared but the Widal reaction did not become positive until the eighteenth day of the relapse. In the meantime two blood cultures had been taken and were negative. On the fifteenth day of the relapse he had a small hemorrhage and following this his fever remained fairly typical of the disease but rather long drawn out, until finally on the thirty-fourth day of the relapse he suddenly complained of a sharp, excruciating pain in the end of the penis on micturition. There was no change in temperature, respiration or leucocytes.

Second Sign of Perforation.—The patient was examined immediately and a small area of tenderness found low down in the right iliac fossa. He was turned on his left side and in half an hour the area of tenderness had moved toward that side about two inches.

Operation.—He was immediately prepared for operation, but owing to the fact that permission could not be obtained until his parents could be consulted, operation was delayed for four hours. The temperature meanwhile had been taken hourly, and it was not till five hours after perforation that it showed any change and then there was an abrupt rise to 105.4 from 101 F., with a corresponding rise in pulse to 118 from 86 and in respiration to 28 from 20. There was no vomiting, no loss of liver dullness, nor was there dullness in the flanks. He was operated on, the perforation found and sutured, and he eventually recovered.

The sign to which I desire to call attention, and the one in this case which practically clinched the diagnosis, was the fact that when the patient was turned over on his left side the pain and tenderness, so to speak, followed the turn and that fairly rapidly. Since seeing this case it seems to me that on the occurrence of a sudden pain in a case of typhoid the patient should immediately be turned on the side opposite the pain, and if the pain and tenderness follow the turn in from fifteen minutes to half an hour the diagnosis may be considered confirmed.

The explanation of the sign is simple. At the time of perforation there is a greater or lesser amount of the contents of the intestine extruded into the peritoneal cavity, and this extravasation tends to flow in the direction of least resistance, that is, downward, and its extension is marked by the indications of local peritonitis, pain, tenderness and rigidity. By turning the patient over on the unaffected side that side is made the lowermost, and if there be a perforation with extravasation the signs of the extension of the local peritonitis will pass to that side which is lowermost.

THE SIGNS AND SYMPTOMS OF PERFORATION IN GENERAL

In looking over the series of seven patients whom I attended I find that all the cases were rather peculiar. Two were practically ambulatory cases, two occurred in long drawn-out relapses, one—a severe case—was complicated by tertian malaria, and one was unusually severe and complicated by mental symptoms throughout. Of the seven patients four were women and three men; usually this proportion is reversed.

Two of the patients had had hemorrhages before perforation. In only one had there been any marked distention of the abdomen.

Perforation occurs as a rule at some time between the end of the second week and the fourth week of the disease and is more apt to occur in ambulatory cases or in cases with distention or hemorrhage.

Of all the symptoms, pain is the most marked and important one. This as a rule is sudden in its onset, sharp and severe and of a cutting or boring character. At first the pain is localized and later spreads, and this method of its spreading according to the position in which the patient lies I wish to emphasize, as it seems to me to be about the most pathognomonic symptom of typhoid perforation that we possess.

Pain may be present in other conditions in typhoid, notably in thrombosis of the iliac or femoral vein, but the differentiation is not difficult, as both the character and localization of the pain are different. The pain in the right iliac fossa occurring early in the disease may be mistaken for appendicitis, but usually occurs too early in the disease to be mistaken for perforation.

Pain may be absent, but only in those cases in which the sensorium is so blunted by the disease that the patient does not complain of it. One such case occurred in my series and in this case the diagnosis was made by the restlessness of the patient. I believe thoroughly that in all other cases pain is the one early, definite and constant symptom.

Tenderness usually follows or accompanies the pain, and in somnolent and delirious patients may be present when pain is not complained of. After a movement of the bowels (as in two cases in my series) the pain and tenderness may disappear, and this must be borne in mind or it may prove misleading. Even if they disappear it will only be for a short time and then there will be a recurrence.

Rigidity, if following or accompanying a sudden pain in the abdomen during the third or fourth week of typhoid, completes the chain of symptoms and to my mind makes the diagnosis positive. That it may not always be present was shown by one case in my series in which operation was delayed because of the lack of this sign, consequently I differ from Harte, who states that rigidity is never wanting except in patients with unusually large and pendulous abdomens.

The other signs and symptoms usually cited—chill, nausea, vomiting, rise of temperature and pulse, loss of liver dulness, shifting dulness and loss of abdominal respiration—are to be taken simply as confirmatory symptoms which may or may not be present. The “dipping crackle,” as I have called it, seems to me to be a valuable confirmatory sign if present. All these symptoms should be considered as due more to the peritonitis following the perforation than to the perforation itself, and should on no account be waited for in order to establish the diagnosis.

I believe that the increase in leucocytes is absolutely valueless except as a confirmatory sign. It is so often absent until hours and, in some cases, days after the perforation. As Cushing states, “an individual observation at such a critical time may be misleading; in the first place, a condition of hypoleucocytosis is often characteristic of the fever, and a count apparently within the normal limits of 8,000 to 10,000 may actually represent a double increase in the number, and secondly, because by a single count the ‘transient wave of leucocytosis’ may entirely escape notice.” In my series of cases in which the leucocyte count was followed closely throughout the disease, being taken every one or two days as a routine, it proved of little or no value as a diagnostic aid. Consequently I believe that, in private practice, the leucocyte count, except as a matter of scientific interest, can well be dispensed with and on no account should operation be delayed in order to wait for the result of a count.

There is one sign concerning which much has been written of late that I am sorry was not observed in all the cases in my series, and that is the variation in blood pressure. It has been stated that a transitory rise of from 20 to 30 mm. of mercury occurs immediately after the perforation. In my series, although the sphygmomanometer was not used, there was in several patients a change in the tension of the pulse which was perceptible to the examining finger, the pulse becoming distinctly smaller and more wiry. In one case that I observed the sphygmomanometer was used and showed a rise from 96 mm. of mercury to 132 mm., the reading being taken with the Janeway instrument. A diagnosis of perforation was made and the patient operated on, but it proved to be a case in the pre-perforative stage.

TREATMENT

There is only one treatment; that is operation, and that immediate. I have reported two patients operated on in whom perforation, although suspected, was not found. In neither of the cases did operation in any way militate against the patient's chance of recovery; it rather seemed to be beneficial, for in one case it caused the temperature to fall to normal in addition to relieving the pain, and in the other it relieved the pain. After seeing these two cases I should unhesitatingly recommend operation even if the diagnosis were supported only by a strong suspicion.

CONCLUSION

1. Perforation occurs as a rule in the latter part of the second, in the third, or in the fourth week of typhoid, especially in ambulant or atypical cases.

2. The initial symptoms are sudden severe lancinating pain in the lower part of the abdomen and generally in the right iliac fossa, and usually tenderness, there may or may not be rigidity. The other symptoms usually described are merely confirmatory if present, and

the majority of them are due to the peritonitis following the perforation and not to the perforation itself.

3. Two signs, hitherto undescribed, appear to me to be valuable as confirmatory evidence, namely, the one that I have designated as the dipping crackle, and the tendency of the pain and tenderness to approach the side that is lowermost if the patient be turned on the side.

4. In the management of a case of typhoid the attending physician should uncover the abdomen at least once a day and carefully and thoroughly examine it. In the light of recent work, blood pressure should be taken daily if possible. Nurses should be impressed with the extreme importance of pain in this disease.

5. On the occurrence of a severe sharp pain in the lower part of the abdomen, and especially in the right iliac fossa, accompanied by tenderness, with or without rigidity, the abdomen should be carefully examined and the limits of the tenderness mapped out. The patient should then be turned on the unaffected side, and if in from fifteen minutes to half an hour the tenderness has moved one or two inches, or if at any time the tenderness and rigidity become marked, immediate operation is indicated.

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Clinical Notes

APPARATUS FOR ADMINISTERING NITROUS OXID AND OXYGEN OR ETHER VAPOR AND AIR IN ANY DEFINITE MIXTURE

THE EXACT PERCENTAGES OF THE TWO GASES BEING UNDER THE IMMEDIATE CONTROL OF THE ANESTHETIST *

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Hewitt, in the latest edition of his treatise on anesthetics published in 1907, says: "There is no form of anesthesia at present known which is so devoid of danger as that which results from nitrous oxid when administered with a sufficient percentage of oxygen to prevent all asphyxial complications." He came to this conclusion after employing this anesthesia himself 17,000 times without having cause for anxiety in more than two or three cases, "in which, owing to the percentage of oxygen having been insufficient, transient respiratory embarrassment arose, and in one case in which transient syncope, probably of reflex origin, took place." In the same chapter he also says: "The chief objection to the use of definite mixtures of nitrous oxid and oxygen are: (1) that they are difficult to prepare accurately and in sufficient quantities; (2) that different subjects require different percentages, and (3) that the proportion of oxygen can not be increased or decreased to meet the special conditions arising during the administration."

It was this statement which stimulated me to devise an apparatus which will not only provide a sufficient quantity of these gases for a reasonably long anesthesia, but which will also deliver the gases in any desired definite mixture, the percentages of which will at all times be conveniently under the control of the anesthetist.

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Hewitt and others have endeavored to accomplish this by employing two rubber bags as reservoirs for the two gases and securing a mixture of the gases by a regulating stop-cock at the outlets of the two bags. The objection to this method is that the two rubber bags must be kept approximately under the same tension of gas, and hence inflated to the same degree; otherwise the gases do not mix accurately.

In place of two rubber bags I employ a pair of small gasometers exactly alike in all dimensions. The gases are conducted from these two gasometers by two flexible tubes of equal dimensions, to the mask, in which there is a regulating stop-cock which delivers the two gases accurately mixed in any required proportion into the mask. The accuracy of this regulating device may

Fig. 1.—Apparatus for administering nitrous oxid and ether or ether and air in definite percentages.

be tested by noting the relative amount of fall of the two tanks during a given time. The apparatus shown in Figure 1 is adapted not only for administering nitrous oxid and oxygen in definite mixtures, but also for administering ether vapor and air in definite percentages.

The two anesthetics may at any time be conveniently changed, the one for the other, without an interruption in the anesthesia. A very convenient procedure, which is also agreeable to the patient, is to start with pure nitrous oxid under which the patient loses consciousness within thirty seconds on the average. As soon as cyanosis makes its appearance a small percentage of oxygen,