Any new project involving more expense to those of limited means, even though it may bring better service, is bound to be a losing business. Those interested already recognize this feature and are making preparations to appeal to the community, especially to the women of the community, for at least partial support. The plan is not to give such service free, but to urge all patients to pay the cost, probably from \$10 to \$15 for complete nursing and medical care, or perhaps \$5 where the patient has her own private physician. The obstetrician's time at the clinic will be given free by the committee of the Women's Municipal League. Our experience in East Boston during the first year of that clinic, where patients were asked to pay \$10.00, was that we received an average of a little over \$7.00. This is probably a greater proportion of the worth of such service than is paid by the students at Harvard College toward their educational advantages. Thus we do not consider that we are in any way pauperizing the community.

I began by saying that I wished to speak to you doctors tonight in your capacity of public health officers, and I believe that this project will appeal to the medical profession in this special capacity. It is easy to prove that the occupation of being an infant in Boston is more dangerous today than that of being a soldier in the European War. It has also been shown that 42% of this infant mortality takes place within the first month of life, which represents the large factor that prenatal and birth conditions play in this high infant mortality.

Two views of meeting the problem of reducing this early infant mortality are being put on trial throughout the country. First, the education, licensing, supervision, control, and re-education of the midwife to handle normal obstetrics. The other, to improve the teaching of obstetrics in the medical schools and to develop the maternity service to the community, *i.e.* lying-in hospitals, out-patient and pregnancy clinics. This scheme preserves to the medical profession the care of women at this critical period of their lives. The midwife program is probably the cheaper. The pregnancy clinic, working through the doctors and nurses, retains for the medical profession the care of such cases. In backing such a scheme as has been outlined here, you thereby help to preserve to the medical profession its privilege of rendering intelligent aid to civilized woman at her most critical time of life. I have complete confidence that neither time, effort, nor money will induce you to give up such a privilege.

REFERENCES.

- ¹ Williams, J. W.: The Midwife Problem and Medical Education. J. A. M. A., Jan. 6, 1912, Vol. lviii, pp. 1-7.
- ² DeLee, J. B.: Transactions of Am. Assn. Study and Prevention of Infant Mortality, 1911, pp. 195-197.
- ³ Baker, S. Josephine: Transactions Am. Assn. Study and Prevention of Infant Mortality, 1911, p. 241.
- ⁴ New Zealand Society for the Health of Women and Children, U. S. Dept. of Labor, Children's Bureau, 1914.
- ⁵ Seventh Annual Report, New York Milk Committee, 1913, pp. 36-47.
- ⁶ BOSTON MEDICAL AND SURGICAL JOURNAL, Aug. 13, 1914, p. 277.

Original Articles.

PERFORATION OF THE STOMACH AND INTESTINE BY FOREIGN BODIES THAT HAVE BEEN SWALLOWED.*

By F. S. WATSON, M.D., BOSTON.

I HAVE selected the subject of this communication to present to you this evening, partly because I happen to have had six cases of the condition in my care, partly because some of their features interested me, and partly because I did not recall its having been brought before any of our medical associations here for discussion.

In order to bring the communication within the limits appropriate for the occasion, I have not attempted to treat the subject exhaustively and have confined my exposition of it to a sketch and to the mention of some of its more essential features. I have also restricted it to perforations of the stomach and the intestine, omitting cases of perforation of the appendix or Meckel's diverticulum, of which all of us have doubtless had a good many. I will briefly refer to my own series of six cases first, and will conclude by calling attention to some of the features of the subject in general.

The perforating bodies in my own series of cases were as follows: 1. A wooden toothpick. 2. A needle such as is used in sewing canvas. 3. A fish bone. 4. A bristle. 5. A flat, thin bit of bone with sharp edges. 6. A body of unknown nature, having the shape of a bit of lead pencil, and about an inch and a half in length.

Four of these bodies I have brought with me to show to you; the other two, I regret, were lost.

Sites of Perforation. The sites of the perforations were located in three of the cases. In these they were: In the upper part of the jejunum, in the small intestine near the ileo-cecal valve, in the transverse colon midway in its course. In two of the remaining three they were presumably high up in the intestinal tract or in the stomach, and in one of them in the small intestine near the ileo-cecal valve.

Pathological Processes Produced by the Perforations and Foreign Bodies. In all but one of the cases the pathological conditions discovered were those that are seen in circumscribed peritoneal infection and inflammation.

In three of them intra-abdominal abscesses had been formed. In one of these the abscess had approached the surface of the abdomen, and would doubtless have been spontaneously evacuated there had not the operation been done.

In the second example of intra-abdominal abscess, that in which the jejunum was perforated, the conditions were of a more acute and severe grade of local peritoneal infection. The perforation in the bowel was large enough to admit the tip of the little finger, and fecal extravasation

* Read at the meeting of The Boston Surgical Society, March 1, 1915.

was taking place from it into the cavity of the abscess. The process was but five days old in this instance.

In the two cases in which the perforations were in the small intestine near the ileo-cecal valve, the areas around the sites of the perforations were well walled off from the peritoneal cavity by adhesive processes. An illustration of the condition seen in a good many of these cases was afforded by the toothpick case. Here the foreign body had evidently but very recently perforated the bowel, nevertheless, the immediately adjacent area was walled off by adhesions that had been formed before the perforation actually took place.

In the transverse colon perforation and in that caused by the bristle the conditions presented were somewhat unusual. In the former there was a tumor about the size of the palm of my hand, projecting above the surface of the abdomen somewhat, at the level of the umbilicus and extending downward toward the upper margin of the symphysis pubis in less conspicuous form.

This tumor represented an enormously thickened portion of the left rectus abdominalis muscle which at its thickest part must have measured two inches in depth. Immediately beneath this was a mass formed by the thickened omentum which was intimately attached to the parietal peritoneum overlying it, and which extended upward and downward. Beneath and below this mass was a second one, the lower border of which reached the level of the brim of the pelvis and extended toward the spine posteriorly. This mass was an intra-abdominal abscess containing about twelve ounces of pus and the foreign body. The three parts just described were welded into one mass which gave the impression of a large intra-abdominal solid tumor.

The perforation was not seen at the time of the operation, but was revealed by the autopsy, at which it was found to be in the transverse colon. Fecal extravasation had been prevented by the firm glueing down, above and around it, of the omentum.

In the bristle case the condition was seen in the form of a tumor upon the external surface of the left upper quadrant of the abdomen, having the size of my closed fist and composed of chronic inflammatory tissue. The base was intimately united with the left rectus abdominalis muscle.

Symptoms and Diagnosis. One of the most interesting points connected with these cases for me personally, in so far as the diagnosis was concerned, was my failure to make a correct diagnosis in any of the cases; at least this was true with regard to the etiological factor in them. The reason for these errors was that no information was vouchsafed by any of the patients of their having swallowed a foreign body. In two of the cases I knew, it is true, that I had to deal with intra-abdominal abscesses, but their origin was entirely obscure. In two in which the small intestine was perforated near the ileo-cecal valve, the symptoms were absolutely typical of attacks

of subacute appendicitis, and I believed them to be such. In the perforation of the jejunum, the picture presented was that of an acute and severe peritonitis, and despite the absence of previous symptoms I was inclined to believe it to be a case of perforating ulcer of the duodenum. In the fish bone perforation with the large intra-abdominal abscess, there had been but very moderate intra-abdominal or constitutional symptoms and the gastro-intestinal function was but slightly disturbed. Here I knew that there was an intra-abdominal abscess, but whence it came I did not know. In the patient with the transverse colon perforation the symptoms had been mild for the first fortnight, but had increased in gravity during the ten or twelve days preceding his entrance to the hospital. He had lost strength rapidly during that period and was very critically ill when I first saw him. Constipation had been present for four days. His complexion was of grayish color. Tongue heavily coated. Pulse weak and rapid. Abdomen distended, and muscular rigidity was evident. Leucocytosis of 7000. Temperature, 99.8° F. The physical abdominal conditions found have already been described.

In the bristle case there was an entire absence of intra-abdominal and of constitutional conditions. The patient had noted merely the presence of a tumor in the upper left quadrant of the abdomen which had painlessly increased in size until it was as large as my closed fist. This tumor was closely attached at its base to the left rectus abdominalis muscle and had the feel and general history of a sarcoma of the abdominal wall. It was thus diagnosticated by two of my colleagues at the Massachusetts General Hospital, by one of them at the Boston City Hospital and by myself.

Its duration was two months.

Treatment. The treatment in three of the cases consisted in opening, cleansing the intra-abdominal abscesses and removing the foreign bodies. In the jejunal perforation the opening in the gut was closed by suture.

In the two cases simulating appendicitis, the foreign bodies were removed. In the one in which the toothpick had made a perforation of the gut the opening was closed with one suture. The appendices were taken out as a matter of routine. The abdominal wounds were closed tight without drainage.

In the bristle case I made an incision into the tumor in order to remove a small bit to send to the pathologist for a rapid diagnosis, and by good chance exposed in so doing the tip of the bristle you have seen tonight. Enlarging the incision I traced it to and through the abdominal wall. It was removed, the mass of chronic inflammatory tissue was cut off at the base and the wound closed.

Remarks. It is impossible to determine the proportion of cases in which perforation by foreign bodies that have been swallowed occurs, relative to the whole number of those persons who

have taken them into the stomach and intestine. This, because the number of those through whose gastro-intestinal tract they pass without injury and whose cases, therefore, are not published, is doubtless far in excess of those whose cases have been reported. In the reported cases of foreign bodies ingested, perforation has occurred in about 8.0%.

Foreign bodies remain, as a rule, longer in the stomach than in the intestine, so too is the stomach more often the seat in which foreign bodies are found to be present than the intestine.

The longer the foreign body is, the more likely it is to be detained in the stomach. The shorter ones usually pass into the intestine.

The character and the number of foreign bodies that have been passed through the whole length of the gastro-intestinal tract without inflicting serious injury upon it, is extraordinary. Among them are recorded the following: Pocket knives, hairpins, safety pins (open and closed), nails of different sizes, bits of glass, table knives, spoons and forks, fish hooks, and a large variety of substances such as bones, bits of lead solder and of enamel from tin and other sorts of vegetable cans.

Per contra, far less formidable foreign bodies have caused perforations of the stomach or intestine some of which have resulted fatally.

One point worthy of being noted is: that perforation has taken place in the bowel in a few instances after the foreign body has passed through and out of the gastro-intestinal tract, seemingly without having inflicted any injury. In these cases the subsequent perforations have been produced as the result of an ulcerative process set up by the foreign body during its stay in the bowel, some point in which has thereby become weakened and finally given way.

One of the factors determining the detention of foreign bodies in the intestine and, in a certain number of cases, perforation, is the existence of narrowings, or constrictions in it. The more frequent causes of these are the results of tuberculous disease, syphilis, and kinks of the bowel.

The most frequent sites of perforation of the intestine are in or near the right iliac fossa. We have all had a greater or less number of cases in which foreign bodies have perforated the appendix, of course. In a considerable number perforations take place in the cecum and in the small intestine near the ileo-cecal valve. Another favorite site of lodgment and sometimes of perforation, is near the anus. In a few instances of this character fatal phlegmon around the rectum has been produced following perforation at this point. I do not know the relative number of perforations of the stomach as compared with those of the intestine, but it is my impression that they are fewer in the former and that the larger number of these have been made by knives and other sharp bodies that have been ingested.

Sometimes the foreign body has made its way through the intestine and into the vagina or bladder. One interesting example of the latter condition is reported by the English surgeon Mr. Reginald Harrison.

The patient came to the hospital in this instance because of a stone in the bladder. On doing a lithotomy operation Mr. Harrison withdrew a calculus of unusual shape. It was of long oval form. Its nucleus was found to be the stem of a pipe. The patient on being questioned declared that he had swallowed the mouthpiece of his pipe during a drunken sleep. He had experienced no trouble from it and did not associate his vesical symptoms with the incident. In this case the communicating opening between the bowel and the bladder had closed spontaneously. In other examples of this condition and of the cases in which the foreign body has been spontaneously discharged on the surface of the abdomen, fecal fistula has resulted and required operation in order to close it.

An interesting and important feature of the cases of perforation of the stomach or intestine by foreign bodies that have been swallowed, is that in a large number of them the area of the peritoneum immediately about the site of the perforation is already walled off by an adhesive process before the foreign body actually penetrates the wall of the intestine. It is because of this fact that the number of fatal results from perforations of this sort is so small. It may be estimated from a series of 82 cases collected by Wölfler in which but eight deaths occurred.

The course observed in the majority of cases is that which is seen in my own series; that is to say, the clinical picture is presented of a circumscribed peritonitis of varying degrees of intensity.

In a considerable number of the cases there is formed an intra-abdominal abscess, and a good many of these make their way to the surface of the abdomen and are spontaneously evacuated there. The foreign body is usually evacuated with the contents of the abscess. In some instances it is retained and an operation is required for its removal.

In many of the cases the opening of the perforation has closed spontaneously before the abscess arrives at the surface. In a smaller number it remains open and a fecal fistula forms, as has been said.

The time occupied by such abscesses in reaching the surface is sometimes very long; weeks, and even months, have been noted in some of the cases.

In a few examples the abscess has pointed at a spot remote from the site of the perforation. Wölfler mentions one case in which it was found over the trochanter of one of the femurs.

In a few instances the conditions that were seen in the case of the bristle perforation in my series, have been met with: that is to say, the formation of a solid tumor, external to the abdominal wall, and having the appearance of a

sarcoma. In these cases the foreign body has usually been of small caliber and the mass of chronic inflammatory tissue is produced by long continued irritation.

The length of time during which foreign bodies that have been swallowed remain in the gastro-intestinal tract varies greatly. The shortest time that I have found recorded in any case was five hours. The average time is from three to six days. Months may elapse before they are passed out, and in a few cases the body has remained without its presence being suspected throughout life.

The most interesting examples of the taking of foreign bodies into the gastro-intestinal tract are to be found in that class of talented persons who have elevated the art of swallowing all manner of objects to the dignity of a profession.

I may briefly refer to two examples of these people. My attention was directed to the first of them when passing the portals of a dime museum by seeing a placard which bore the following legend "The World's Wonder—The Great Australian Glass Eater." Beneath the placard stood a barrel filled with bits of glass of varied shapes and sizes, and upon the barrel were painted the words "His Diet."

I entered and watched this gentleman eat his noonday meal. It consisted in a goodly number of bits of glass. This he swallowed seemingly without discomfort. I was informed that he had been engaged in this nutritious occupation for no less than five years. He presented the appearance of excellent health.

In the stomach of the second person of this fraternity the presence of the following objects was revealed by a radiograph: Two watch chains, three door keys, eight horse-shoe nails, some bits of glass, a breastpin, six safety pins—two of them open, a pocket knife, and some other articles the nature of which I do not now remember. These represented the residue of this person's diet during the previous six months. He ultimately became afflicted with symptoms of dyspepsia and sought medical advice. A gastrotomy operation was done and the articles named above were restored to him, and after a short convalescence he resumed his former professional vocation.

Some of the professional "swallowers" have had a less fortunate fate, however. Wölfler reports two instances in which, the stomach having been perforated by knives that had been swallowed, death resulted as a consequence.

The two points which have especially interested me in connection with this subject have been: The difficulties that may be offered to making a correct diagnosis which is due to the absence of information of a foreign body having been swallowed, and, the seeming injustice displayed by the unequal distribution of the immunity to injury that is exhibited by certain persons who are privileged to swallow without harm almost anything they can take into their mouths; while others cannot swallow even so

innocent looking a body as the bristle that I have showed you tonight without having a perforation of the stomach or intestine result, and being forced to live in constant anticipation of impending death because of the presence of a tumor on the abdomen which was of a character such as to involve in an error of diagnosis four of Boston's distinguished surgeons, one of whom has just had the pleasure of addressing you.

VARIETIES OF THE GOLD SOL TEST (LANGE) IN SEVERAL LOCI OF THE CEREBROSPINAL FLUID SYSTEM: A STUDY OF TWENTY- EIGHT AUTOPSIED CASES.*

By H. C. SOLOMON, BOSTON,

*Assistant in Neuropathology, Harvard Medical School;
Junior Assistant Physician, Psychopathic Department,
Boston State Hospital;*

AND

E. S. WELLES, BOSTON,

*Interne, Psychopathic Department, Boston State
Hospital.*

THE present communication offers evidence that the cerebrospinal fluid in different loci varies in its chemical composition. The method of examination used is the gold sol reaction of Lange. The test was performed on fluids obtained post mortem in a series of twenty-eight cases. The attempt was made to obtain fluids from the several cisternae and spaces, namely:—

1. Cerebral subarachnoid space.
2. Epicerebral space.
3. Lateral ventricles.
4. Third ventricle.
5. Cisterna at base of brain.
6. Spinal subarachnoid space.

Obviously it is quite difficult, if not impossible, to obtain a clear (bloodless) fluid on all occasions; consequently fluid was available from many less than the possible 168 loci. From fifty autopsies, clear fluid was obtained from at least one locus, in twenty-eight from two or more loci, and in several others no clear fluid was obtained.

The gold sol reaction is now being used extensively in clinical laboratories for the examination of cerebrospinal fluids. It is an application of the reaction of albuminous substances with colloidal gold. It has been shown and especially worked out by Zsigmondy¹ that albumins may be

* Being Contributions of the State Board of Insanity, Number 40, (1915.6). This communication was presented at a meeting of the Boston Society of Medical Sciences, January, 1915. This work was made possible through the courtesy of the Pathological Service of the Massachusetts State Board of Insanity, to whom our sincere thanks are given. (*Bibliographical Note.*—The previous contribution was Number 39 (1915.5), by H. C. Solomon and E. S. Welles, entitled, "On the Value of the Gold Sol Test (Lange) with Spinal Fluids Obtained Post-Mortem," published in the BOSTON MEDICAL AND SURGICAL JOURNAL, Vol. clxxii, No. 11, March 18, 1915.)