

concerning words. It is natural that the needs of language are such that new words are inevitable, but the facts for which the words stand are antecedent, and a prevalent fault of all is to ascribe too much of an entity to word symbols, forgetting that they are purely abstract representations. Insanity is not an entity; it has no relation to an entity. Psychoneuroses as a word means nothing. Insane patients have series of symptoms. These symptoms are capable of description, of analysis, of synthesis, etc., and individual cases may be grouped, and generalized ideas made therefrom, but the abstraction should be clearly separated from the realities, especially in speech. It is imperative, Dr. Jelliffe believes, to discard the old metaphysical categories of the mental faculties. They are not separate nor separated by dividing walls—will, emotions, memory, are not separate in the mind. The entire mental life is continuous. There may be some anatomic groupings of elements that render Wernicke's ideas concerning pathologic psychology comparatively sound, but the old terminology of metaphysical psychology still encrusts and encumbers the psychiatry of today to the discomfort of students. Dr. Jelliffe is not in favor of the complex word used by Dr. Punton, as it creates an air of definiteness about conditions which are extremely hazy and which, he thinks, are only beginning to be understood. The simple term, psychoneuroses, including neurasthenia, hysteria and states of mild psychical depression or exaltation, is a better one to use. He agreed with Dr. Punton that the word insanity carries with it a stigma which, if applied to patients who are suffering from the varieties of psychoneuroses mentioned, works a great injustice. To say to the world that a person who has a psychoneurosis is insane, although he may be sufficiently ill mentally to be treated as a pronounced case of mental imbalance, serves no useful object and is often an imprudence which brings about a complete mental breakdown, which the physician should try to avoid.

DR. H. T. PERSHING, Denver, Col., said that when a physician is asked to determine whether a patient is or is not insane he must first ascertain whether the mind is changed by disease or defective by reason of imperfect development. He must then find the degree of defect. There are many mental defects which do not constitute insanity, but if the mind is so imperfectly developed that the individual is unfitted thereby for the ordinary relations of life then he is insane. Dr. Pershing thinks that if neurologists were to keep these two points in mind they would be saved a great deal of trouble, especially in medicolegal cases.

DR. J. H. McBRIDE, Pasadena, Cal., said that if Dr. Punton intends to be understood as saying that hysteria always precedes insanity he should certainly differ from him. Hysteria may precede insanity, but there are many insane who are never hysterical. Not all emotional display in insanity can be called hysteria. There is certainly a prejudice against the person who is known to have been insane, and it must be admitted that there is some reason for it. In most cases of recovered insanity it is not difficult to see that the insanity has left a scar; there is some loss of mental vigor and balance. Insanity is not a highly recoverable disorder. Out of ten insane patients possibly two or three recover and stay well. There are many cases of insanity in which the disorder is due to causes that might be called incidental, acute infections, traumatisms, etc. In these cases hereditary tendency must play a very subordinate part. In the great majority of cases, however, the insanity is essentially due to conditions of brain structure that are inborn. These people have brains that are made of crumbly material that breaks down under adverse conditions of life, and in these individuals there is a very low rate of recovery.

Here the insanity is the final stage in a degenerative tendency that has been in operation for one or more generations. It is inevitable, therefore, that only a minority of cases of insanity should be curable. Nature is attempting to eliminate the unfit and, though she may adopt cruel methods and proceed in a bungling fashion and often fail, yet in the long run the object is accomplished.

The Physician's Holiday.—The reorganization of the medical profession makes it possible for one physician to leave his patients temporarily in the hands of another and fare forth into the world for a period of change and rest.—*Western Medical Review.*

INTESTINAL PERFORATION IN TYPHOID FEVER.

WITH REPORT OF CASES.

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In the general consideration of intestinal perforation in typhoid fever, it may not be amiss to compare it with appendicitis, relative to the surgical history of both. Without going into the earlier history of these pathologic conditions, it will be sufficient to consider them from the time they were prominently brought to the notice of the medical profession. The epoch-making contribution on appendicitis, by Fitz of Boston, appeared in 1886. What ought, equally, to have been the awakening call in regard to typhoid perforation was made by Leyden of Berlin, in 1884, and again in 1886 by Wilson of Philadelphia. What has happened meanwhile? An enthusiastic and glorious achievement for the surgery of appendicitis and only faltering and apathetic efforts in the direction of typhoid perforation; thousands of successful operations annually for the former, and, the world's record in 1904, 362 reported operations on the latter.

Why have we been so intensely active in regard to appendicitis and so hesitant concerning typhoid perforation, when such statisticians as Taylor and Brooks inform us that from 16,000 to 20,000 persons die annually in the United States alone from the latter cause? The answering explanation is not immediately obvious, particularly when we recall that the earlier consideration given to appendicitis was essentially for perforation, abscess and peritonitis. The difference is one of the anomalies of surgical progress.

Of all the explanations that might be advanced, the one that seems most reasonable is the poor results that followed early surgical efforts, in general peritonitis, from whatever cause, and the infrequent and fortuitous contact of the general practitioner with typhoid perforation.

The frequency of perforation in typhoid fever has been variously given by different authorities. Liebermeister found it in 26 of 2,000 cases (1.3 per cent.); Murchison in 48 of 1,580 cases (3.03 per cent.); Curschmann in 22 of 829 cases (2.7 per cent.); Armstrong (Montreal General Hospital) in 34 of 932 cases (3.66 per cent.). In my work it was present in 11 instances in 576 cases (1.9 per cent.).

Curschmann,¹ in his admirable work, says: "I believe that under the most unfavorable circumstances perforation occurs in not more than 3 per cent. of all cases of typhoid fever."

Children, it has been stated, are less liable to perforation than adults. My work offers no assistance on this point, since all the cases were in adults.

As regards sex, there seems to be but little difference, although perforation is said by some writers to occur more often in males. (As my own cases were almost wholly in the male sex, I have no basis for an opinion.)

Season seems to have but little influence. Curschmann states: "The frequency of perforation of the bowel, precisely like that of intestinal hemorrhage, may be extremely variable at different times." This I have particularly noticed in my own cases—the first 3 cases, of 11 perforations, occurred in the late months of 1890 and the early months of 1891; the last 3 cases have

1. "Typhoid Fever and Typhus Fever," edited by Oster. Nothnagel's Encyclopedia.

occurred within the last six months—prior to March 15, 1905.

That perforation is more likely to occur in cases accompanied by diarrhea would seem to be indicated by the fact that in 30 cases of perforation at Johns Hopkins Hospital, 20 patients had diarrhea, 16 of them at the time of perforation. My 11 cases of perforation showed marked diarrheal tendencies in only 4.

The relationship of tympany to perforation does not seem to be very marked. When there is deep ulceration and accompanying tympany, perforation may be more readily brought about by mechanical causes, such as straining at stool, turning in bed, etc. Curschmann is inclined to believe that tympany is not so much a sign of severe intestinal lesions as it is a symptom of severe general infection, which gives rise to paralysis of the muscular layer of the intestine and consequent gaseous distension. My own experience tends strongly to confirm this view.

Hemorrhage in typhoid fever occurs in varying frequency, in anywhere from 4 to 8 per cent., in the larger collection of reported cases. In 829 cases at Johns Hopkins Hospital it occurred in 6 per cent. In my 576 cases it occurred in 43 (7.4 per cent.), counting all evacuations of blood sufficient in amount to be termed hemorrhage; it was the cause of death in 11 cases. The average number of hemorrhages per case was 3.3. The average number of hemorrhages to each patient who died was 5.1. Hemorrhage occurred in 3 of the 11 cases of perforation.

Like perforation, I have found hemorrhage to vary considerably at different times, but with no well-marked relationship between the two. In my hemorrhagic cases the intestinal loss of blood occurred in nearly all during the primary attack of the fever, and seldom during a relapse.

In dealing with the subject of intestinal perforation, Keen² summarized the 83 operative cases that had been reported. The result showed 19.36 per cent. of cures and 80.64 per cent. of deaths. The first three operations ever performed for typhoid perforation were by Mikulicz, Kussmaul and Bontecou, in the order named.

Finney³ gives a brief history of the 112 operative cases he was able to collect. Of these 23 patients recovered (20.05 per cent.).

Harte and Ashurst⁴ summarize the 362 operative cases that they collected with the following results: Recovered, 94 patients (25.97 per cent.); died, 268 (mortality, 74.03 per cent.). Their analysis by lust-rums gave:

1834-1888,	10 cases,	mortality	90	per cent.
1889-1893,	16 cases,	mortality	87.5	per cent.
1894-1898,	100 cases,	mortality	72	per cent.
1899-1903,	166 cases,	mortality	69.2	per cent.

This readily gives an idea of the progress in operative work.

Of my 11 perforation cases, 5 patients were operated on, with one recovery and four deaths—recovery, 20 per cent.; mortality, 80 per cent. All the patients not operated on died.

The status of perforations not operated on does not seem to change. Various writers place the mortality in these cases at 95 per cent., and this opinion is confirmed by Curschmann.

One can not comprehensively discuss the subject of intestinal perforation of typhoid apart from typhoid fever

itself. A long list of cases from any institution, or practitioner's records, when carefully studied, can scarcely fail to be of value. The accurate and painstaking work on typhoid fever, performed under Osler, at Johns Hopkins Hospital, throughout a number of years, has been of incalculable benefit in the study of every feature of the disease. Similar work elsewhere, of course, is entitled to its proper share of credit.

Simply to review cases of perforation, I believe, would not be of the same value as if all typhoid cases were given, even brief, consideration. This report is intended to cover a period of fifteen years, from March 15, 1890, to March 15, 1905. The work was all performed within the Northern Pacific Railway Hospital, at Brainerd, and does not include cases among our employes and others treated at their homes. There is a peculiarity about the work that does not often exist outside of railway hospitals, and that is the extent of territory which the work covers. The patients came from along the railway lines in Minnesota, Northern Wisconsin, Manitoba, North Dakota, and as far west as the middle of Montana.

In view of the fact that more than 90 per cent. of the patients came from abroad, frequently with little or no previous observation or treatment, often in the second week of the disease, sometimes in the third, with mental hebetude, and occasionally delirium, already established, it will be appreciated how difficult it is to be exact concerning early clinical features in many of these cases.

During the fifteen years (1890-1905) we admitted and treated 576 patients with typhoid fever. Of these 534 recovered (92.7 per cent.), and 42 died (a mortality rate of 7.3 per cent.). The causes of death were as follows: Toxemia, with severe nervous manifestations, 12 (28.5 per cent. of the total mortality); hemorrhage, 11 (25.9 per cent. of the total mortality); intestinal perforation, 10 (28.8 per cent. of the total mortality); pulmonary complications, 5 (11.9 per cent. of the total mortality); acute heart failure, with sudden death, 4 (9.5 per cent. of the total mortality).

Exactly 75 per cent. of the 576 patients were admitted during the last six months of the year, from July 1 to December 31; the remaining 25 per cent. were admitted from January 1 to June 30, while over one-third (35.76 per cent.) of the total cases were admitted during the months of September and October.

In this series of 576 cases, 291 patients, over 50 per cent., were admitted and treated during the last five years, during which time there was a total of 16 deaths, from all causes, or a mortality rate of 5.5 per cent.

The total mortality rate in 829 cases of typhoid fever treated at Johns Hopkins Hospital during the years 1889-1899 was 7.5 per cent. Comparison tends to show that typhoid fever patients' chances for recovery are not necessarily minimized by being transported long distances on railway trains.

In the hospital we used Widal's method of serum diagnosis in a considerable proportion of the cases, particularly the doubtful ones. I wish incidentally to call attention to an objective symptom of typhoid fever, namely, tremor of the tongue. I have found it almost universally in all grades of cases, and from the earliest stage to convalescence. In character it may vary from complete loss of muscular control to a mere vibrating tremor movement, noticeable only near the tip. Associated with other of the usual clinical symptoms I have found it of value before Widal's reaction test could be elicited.

2. "Surgical Complications and Sequels of Typhoid Fever," 1898.

3. "Surgical Treatment of Perforating Typhoid Ulcer," Johns Hopkins Hosp. Rep., vol. viii, 1900.

4. "Intestinal Perforation of Typhoid Fever," *Annals of Surgery*, January, 1904.

Case.	Age.	General Course of Disease.	Bowels.	Hemorrhage.	Tympanites.	Day of Perforation.	Mode of Onset.	First Symptoms.	Abdominal Pain.	Chill.	Sweating.	Vomiting.	Collapse.
1	26	Moderately severe.	Diarrhea not severe.	None.	Not marked.	14th.	Sudden.	Severe pain in abdomen.	Yes.	No.	Profuse cold sweat.	Yes, a dark green material.	No.
2	30	Mild.	Constipation.	Two hemor's from nose on day of perforat'n.	Not marked.	16th.	Sudden.	Severe pain in abdomen.	Yes.	No.	No.	Yes.	No.
3	3	Mild.	No diarrhea.	None.	Not marked.	11th.	Sudden.	Ch.	Yes, very severe.	Yes.	Yes.	Yes.	No.
4	28	Severe, with mental apathy and delirium.	Slight diarrhea.	None.	Yes.	17th.	With marked typhoid state; abdomen distended and involuntary bowel movement of small watery stools.	Distention of abdomen; irregular breathing; subjective symptoms concealed.	No, comatose.	No.	No.	Yes, before onset of perforation.	Yes.
5	25	Mild.	No diarrhea.	From bowels 7 days before perforation; temp. fell 3 degrees.	Not marked.	30th.	During bowel movement sudden severe diffuse pain in abdomen.	Severe cramp-like pain lasting only a few minutes.	Yes, very severe; diffuse at first; later localized in right iliac fossa.	No.	No.	Yes.	No.
6	37	Mild, early conval., relapse, complicated with phlebitis.	No diarrhea.	None.	Yes.	31st; 8th day of relapse.	Sudden severe abdominal pain; patient cried out in agony; face and extremities cold and clammy; pain in genitals.	Severe pain in abdomen.	Yes, diffuse; referred also to penis and scrotum.	No.	Yes.	Yes.	Yes.
7	24	Severe.	No diarrhea.	One on day of perforation.	Not marked.	19th.	Gradually increasing distension and tenderness; hemorrhage from bowels.	Rigid abdomen, tender on pressure; rapid pulse.	None.	No.	No.	Yes, late.	No.
8	20	Severe. Marked mental apathy.	No diarrhea.	Yes, 5 on different days preceding perforat'n.	Yes, marked.	48th.	Sudden.	Severe pain near McBurney's point; chill.	Yes, severe in right iliac fossa.	Yes.	No.	Yes, late.	No.
9	30	Severe; high temp. and delirium.	No diarrhea.	None.	None, until late in disease.	17th.	Sudden; severe abdominal pain; lips pallid; very restless; skin cold and clammy.	Paroxysmal pains in abdomen.	Yes, severe in right iliac fossa.	No.	Yes, on extremities.	No.	Yes, very marked.
10	24	Mild, rapid conval., relapse severe.	No diarrhea.	None.	Not marked.	52nd, 10th day of relapse.	Sudden; severe colicky pain; lips pallid; face drawn and expression anxious.	Severe paroxysmal pain; most marked in right iliac fossa.	Yes, severe and diffuse at first; later localized on right side.	No.	Yes, slightly.	No.	No.
11	43	Mild; mental condition rather dull.	No diarrhea.	None.	Yes, marked.	15th.	Sudden; severe pain in abdomen with signs of collapse.	Severe abdominal pain; chill.	Yes, diffuse at first; later more on right side.	Yes.	Profuse cold sweat.	No.	Yes.

As regards the general treatment of the cases, I would say that in this hospital for more than sixteen years we have relied mainly on the tub bath.

The detailed histories and a table of our perforation cases will be given after the treatment.

PATHOLOGY OF INTESTINAL ULCERATION AND PERFORATION.

The lesions of the intestine in typhoid fever consist mainly of changes in the lymphoid tissue and these may be divided into four stages: First, the stage of hyperemia; second, that of medullary infiltration; third, that of necrotic destruction and ulceration, and, fourth, that of cicatrization. "In general these anatomic stages correspond with the clinical course of the disease. It is to

be borne in mind that the intestinal lesion does not develop and extend simultaneously and uniformly, but rather in stages, often distributed over a considerable period of time, and it likewise undergoes involution in a corresponding manner" (Curschmann). This, in a measure, will account for the appearance of perforation at varying times in a long list of perforation cases. For a more extended description of the minute anatomic changes of typhoid fever, such authorities as Curschmann, Osler, Mallory and others may be referred to.

The so-called medullary infiltration and consequent coagulation necrosis may only extend to the muscular coat, which would form the base of the ulcer. This is most frequently the case. Or the ulcerative destruction

Temper-ature.	Pulse.	Respira-tion.	Condition of Abdomen.	Liver Dull-ness.	Leuco-cytes.	Opera-tion.	No. Hrs. Att. Perf.	Result.	Autopsy with Findings.	Condition of Appendix at Operation or Autopsy.	Number and Loca-tion of Perforations at Autopsy or Operation.
Fell from 102.2 to 97.2; then rose to 104.4.	Rose from 92 to 140.	Somewhat quickened.	Tender on right side.	No one noted.	No count	No	..	Death in from 48 to 50 hrs.	No autopsy.....	.....	.....
Rose to 103 then fell to 102.	Rose from 98 to 112.	Not noted.	Extremely tender in right iliac region.	Not mentioned.	No count	Yes	6	Death in 12 hours.	Partial autopsy..	Not reported	Two in ileum 15 and 21 in. above cecum.
Rose to 104.6 then fell to 100.	Rose from 98 to 124.	Rapid violent hic-cough.	Noticeable tenderness in right iliac area.	Not mentioned.	No count	No	..	Death in 55 hours.	No autopsy.....	.....	.....
By axilla; rose 101-104; later fell to 103.2.	Rose from 120 to 144.	Rose from 24 to 44.	Distended...	Abolish-ed.	No count	No	..	Death in about 56 hours.	Partial autopsy showed typical typhoid ulcers; intestines matted together with many adhesions. (One perfora'n found in ileum 12 in. from cecum.	Very adherent and inflamed.	One in ileum 12 in. above cecum junction.
Fell at first to 99.8; then rose 102.2.	Rose from 84 to 106.	Very rapid and shallow; hic-cough.	Distended and extremely tender.	Obliter-ated.	No count	Yes	19	Death in 75 hours after perforation & 56 hrs. after operation.	Partial autopsy; bowels covered with deposit of lymph; perforation closed and stitches holding; appendix adherent.	Much inflamed and adherent; not removed at operation. (Patient in bad shape)	One was located in ileum 6 in. from colon. Wound admitted end of finger; only one perforation found; free fecal matter in cavity at operation.
High at first 104; fell quite rapidly to 95.6 before death.	Rose from 106 to 122; very weak.	Shallow and very rapid.	Distended; very rigid.	Obliter-ated.	No count	No	..	Death in 25 hours.	Partial autopsy; abd. cavity contained free fecal matter and a large amount of turbid fluid; many ulcers with softened bases; one perforating; clot in femoral vein.	Thickened and adherent.	One found at autopsy; located 18 in. from ileocecal valve, large size.
No change . .	Rose from 100 to 150.	Rapid. . .	Board-like; very tender.	Obliter-ated.	7,894 im-med-ly after onset of sympts.	No	..	Death in 30 hours.	No autopsy.....	.....	.....
Rose, then fell; after operation fell to 97, then rose to 105.	Rose slightly before operation; markedly after, to 150.	No change..	Partly dis-tended; hard.	No mark-ed change.	1 2, 2 2 3 made just after onset of sympts.	Yes	2	Death in 10 days and 4 hrs. after per- foration.	Complete autop-sy; negative ex-cept in abdo-men; purulent exudate; catgut suture given way with opening in-to bowel free. No attempt at repair.	Very adherent, much thickened; removed at operation.	One very small one found 2 in. from ileocecal valve.
Fell from 102 to 98.4.	Almost imper-ceptible; rose from 90 to 134.	Rapid and shallow; rose to 0.	Very rigid and tender.	Nearly obliter-ated.	No count	No	..	Death in 55 minutes after per- foration (approx- imately).	No autopsy.....	.....	.....
No marked change.	Rose after operation from 84 to 116; no change before.	Rapid and shallow; thoracic.	Very rigid; moderately distended.	Not ob-literat-ed.	No count after perforation.	Yes	2 3/4	Recovery..	.....	Very much inflamed; removed at operation.	Two small pin-point perforations found in ileum close to colon, 1 other large one (1/2 in. in diam.) 12 in. from colon.
No change before operation; after operation it rose to 101.4 then fell to 97; then vacillated.	No change before operation; after operation it varied between 130 & 148; was between 82 and 90 before perforation,	Rose in fre-quency; very shallow.	Moderately distended; very rigid; painful on pressure.	Partial obliteration.	No count	Yes	3 3/4	Death in 75 hrs. after perforation and 71 1/2 hrs. after operation.	No autopsy.....	Much con-gested and inflamed; removed at operation.	Two perforations found in ileum within 8 in. of colon; and one pin-hole perforation 15 in. above cecum, closed by plastic lymph and adherent omentum and surrounded by old peritonitis. Free pus in peritoneal cavity.

may include the muscular layer and subserous tissue and leave only the peritoneal coat, through which infection may pass and cause a local peritonitis. Again, it may involve the whole thickness of the intestinal wall, and when the slough separates a complete perforation results, varying in size from a pin hole to an opening including a third or more of the circumference of the bowel. The escape of intestinal contents and infective germs may vary from a minute quantity to a sufficient amount to flood a great portion of the peritoneal cavity, depending usually on the size of the perforating ulcer. When the amount of leakage is great, general peritonitis is almost certain to appear in a very short time. When the opening is extremely small and the leakage slight,

this may be only a localized peritonitis. In Case 11 of this series it was disclosed at operation that there had been an early pin-hole perforation with localized peritonitis to the extent of eroding the bowel of its glossy appearance throughout the affected area, and later two large ulcers in other locations had perforated, causing the symptoms which called for operation. The primary perforation had been closed by plastic matter and the adhesion of the neighboring omentum.

In certain cases in which the peritonitis is limited and limiting adhesions and walling off has occurred, abscesses may appear and require to be dealt with weeks and may be months afterward.

In form the perforation may be large and irregular,

large and circular, small and cribriform, or it may be slit-like or oblong. The large circular ulcers are thought to be due to sloughing, the cribriform to ulceration, and the slit-like to mechanical traumatism. They are usually opposite the mesenteric attachment, though rarely they may open between the folds of the mesentery and cause a retroperitoneal abscess.

The perforation, as a rule, is single. In the five patients operated on, however, it was single in only two; in two of the cases there were two perforations, and in one three.

The site of perforations is usually found in the lower end of the ileum within from 12 to 18 inches of the cecum. Infrequently it may occur at any point along the digestive tract. It is not infrequently seen in the cecal region of the colon, including the appendix. Typhoid ulceration (rarely with perforation) may be found widely scattered along the digestive tract. A number of well-authenticated cases of typhoid ulceration of the esophagus and consequent stricture have been reported. Mitchell⁵ reports eight cases. I have seen two cases of esophageal stricture following well-authenticated typhoid fever. In neither case could the stricture be charged to traumatism occurring in the course of the disease. In both cases it supervened before convalescence was established. The first case was in a young girl of 20, seen in consultation with Dr. F. J. Campbell of Fargo, N. D., about ten years ago. The stricture was located about the junction of the middle and upper thirds of the esophagus. Soon afterward the patient developed an empyema which so reduced her strength that she could not undergo an operation for the stricture, which still persisted, and she died a few weeks later. The second case, also in a young girl of about 20, was seen in consultation with Dr. John H. Dunn, of St. Cloud, about three years ago. The stricture was located at the junction of the middle and lower thirds. Later it was found necessary to do a gastrostomy to assist in overcoming the stricture. The patient, I am informed, made an excellent recovery.

SYMPTOMS.

Perforation in typhoid fever rarely occurs during the first week of the disease; the majority of cases are seen during the second and third weeks; it may occur, however, at any time during the latter part of the disease and convalescence. It is not infrequently seen during a relapse. The so-called preperforative symptoms are usually too vague and indefinite to be of much practical value to the average practitioner doing his work outside of hospitals.

Pain.—The earliest reliable symptom of perforation is pain, which usually is complained of in the cecal region; it may be referred, however, to the epigastric or pelvic regions. Occasionally pain is complained of in the genitals. The character of the pain may vary from a severe stabbing nature to more or less of a dull ache. Often its severity will cause the patient to cry out from his suffering. Patients who are irrational may fail to complain of pain. Occasionally with pin-hole perforations and limited peritonitis there may be no complaint of pain (Case 11).

Rigidity.—The next most important symptom is rigidity of the abdominal muscles, following quickly after the appearance of pain. This rigidity may be confined to the right internal and external obliques and the recti muscles, or the whole abdomen may be rigid.

Tenderness.—This is the next symptom of marked importance and is usually found in the cecal region, though it may also be adduced by pressure toward the epigastric or pelvic regions. All other symptoms are of varying importance.

Vomiting.—This is a symptom which may occur coincidentally with, or soon after, the appearance of pain. In some cases of typhoid fever, however, vomiting is a symptom that appears early and frequently throughout the acute stage of the disease. In such a case its value as a symptom of perforation would not be of marked importance.

Temperature.—In quite a number of cases of perforation there is often a remarkable drop of temperature, sometimes to near the normal point; with the advent of peritonitis the temperature again rises.

Pulse and Circulation.—The shock of perforation and peritonitis usually lowers the force of the pulse, while the rate is greatly increased, often from the usual rate of 90 to the unusual one of 130 or more. The skin of the face and hands may appear pallid and even somewhat cyanosed, and is frequently covered with profuse perspiration.

Respiration.—The respiration may be somewhat quickened, but is not likely to become costal in character until peritonitis is established.

Facial Expression.—In perforation the expression of the face is often marked by anxiety, suffering and general distress to an extent which might be called characteristic, almost Hippocratic in type.

Liver and Movable Dullness.—Liver dullness must have been carefully noted, from time to time, prior to perforation, to be a symptom of important value. Pre-existing tympany may have reduced the area of liver dullness almost to the vanishing point before the admission of free gas into the peritoneal cavity. Movable dullness in the flanks is not likely to be present until peritonitis with effusion has appeared; hence it could only be a symptom of late value.

Blood.—Leucocytosis may be mentioned as a symptom of possible value. To be of practical utility, however, a leucocyte count would necessarily have to be made hourly as it (leucocytosis) would not appear until peritonitis had supervened, and to wait for this might be a waste of valuable time.

Summary of Symptoms.—Given a case of typhoid fever with clinical symptoms, pathognomonic of the disease, backed up by Widal's serodiagnosis, if possible, and presenting, after the first week, the three cardinal symptoms, pain, rigidity and tenderness in the cecal region, supplemented by some of the less valuable symptoms, and it will not only be expedient, but reasonable to diagnose intestinal perforation.

Osler's schema¹ for the observation of perforation symptoms should always be at hand for the observance of internes and nurses.

DIFFERENTIAL DIAGNOSIS.

It may be necessary frequently to differentiate between intestinal perforation of typhoid fever and acute appendicitis, with or without perforation; from intestinal hemorrhage of typhoid; from typhoidal peritonitis without perforation; from peritonitis due to tubal disease; from gangrene or perforation of the gall bladder; from perforating gastric and duodenal ulcers; and from suppurating mesenteric glands.

Time will not permit me to consider the symptoms, conditions and features that might be adduced in differ-

5. Johns Hopkins Hosp. Rep., vol. viii.

entiating each of the above. Cumston,⁶ of Boston, in an extended review, terminates his article by saying: "In closing, I think I can sum up in a word all that has been said in this paper, namely, that every time an appendicitis exists, either alone or associated with typhoid fever, an operation is indicated." I believe the same conclusion, namely, operation, would hold good for all the other conditions, with the possible exception of intestinal hemorrhage, and even this has been surgically treated with reported success.

PROGNOSIS.

The prognosis in intestinal perforation of typhoid, without operation, is almost hopeless. The chances for recovery do not exceed 5 per cent., under the most sanguine expectations. With operation, the prognosis will depend, in a large measure, on early surgical interference, the extent of the peritonitis, the physical condition of the patient, and the absence of secondary perforation and intestinal hemorrhage. Some writers claim that there should be 50 per cent. of recoveries if the operation is undertaken within the first three hours. With the marked improvements in the treatment of peritonitis, these hopes would not seem to be too sanguine. At Johns Hopkins Hospital 30 per cent. of recoveries were obtained from all operations. In my fatal operative cases, one patient who was operated on 19 hours after symptoms of perforation lived for 55 hours and succumbed to general peritonitis; another lived ten days.

TREATMENT.

All patients with typhoid fever who have suffered intestinal perforation, immediately on diagnosis, should be treated by laparotomy, and the only deterrent to operation should be a moribund condition of the patient. Wilson has well said: "The courage to perform it (operation) will come of the knowledge that the only alternative is the patient's death."

Anesthetic.—I have used local anesthesia, from cocaine, and general anesthesia, with ether, and my preference is decidedly for the latter.

The Incision.—The incision that I have found the most useful and satisfactory is the one made through the right rectus muscle and opposite the cecal region. After gaining entrance to the peritoneal cavity the appendix and cecum—even the ascending colon—should be thoroughly examined; next, the lower portion of the ileum, beginning at the cecum. When the perforation is found, it is best to close it with a suture of linen or silk; if small, it can be readily closed with a purse-string suture; if large, Lembert's, Halstead's mattress, or Cushing's right-angled sutures may be used; in some instances, it will be well to strengthen with a second tier. There is a difference of opinion among writers as to whether the opening should be closed in the longitudinal or transverse direction of the bowel. Probably this is a matter of no particular moment, unless the opening is so large that the necessary suturing may diminish the lumen of the bowel to dangerously narrow proportions, in which case the question of resection may have to be considered. If there are other ulcers presenting a perforating appearance, it would be wise to place reinforcing sutures to prevent future accidents.

If the appendix is inflamed, as it frequently is, it should be removed, even though perforation is not present. In the last three cases it was found decidedly inflamed and in each instance it was removed.

The toilet of the peritoneum is important and probably would be the next step in the progress of the operation. If there has been a considerable escape of fecal matter, irrigation with normal salt solution would be of value. If fecal matter is not present (and the peritonitis is confined to the region of perforation) or has gravitated to the pelvis, the effusion fluid may be withdrawn by a suction syringe or removed by careful sponging. Tubular drainage should be introduced to the bottom of the pelvis, probably through a stab wound on the left, as well as through the operation wound on the right. This should be supplemented with the necessary amount of Penrose and gauze drainage. At this time the sutured portion of the bowel should be brought opposite the operation wound and maintained there by gauze or by a few stitches of ten-day catgut. This position of the bowel will be of decided advantage in case the suturing should yield and leakage result. Such portion of the wound unoccupied by drainage may be closed with through-and-through sutures. After the application of a voluminous dressing and the return of the patient to bed, he should at once, or as quickly as possible, be placed in Fowler's position to allow gravitation of effusion fluid into the pelvis, where the drainage has been placed. The after-treatment will consist of the necessary surgical attention and such general typhoid treatment as may be applicable.

If positive symptoms of postoperative perforation occur, one should not hesitate, if the patient's condition will permit, to reopen the wound or to perform a new laparotomy and deal with the conditions found. Cushing⁷ reports a case with recovery in a boy of 9 years, in whom laparotomy was performed three different times: First, for perforation; second, for supposed perforation, and, third, for acute intestinal obstruction, when a new perforation was also found.

I am greatly indebted to Dr. W. H. Buskirk for his valuable and painstaking assistance in the examination and selection of data from our hospital and clinical records for the purposes of this article.

CASE 1.—Male, aged 26, was admitted to the hospital July 29, 1890; diagnosis typhoid fever. Temperature, 102.8; pulse, 80. No history is recorded of condition prior to admission. The course of the disease was moderately severe throughout, temperature running from 101.2 to 102 in the morning and from 103 to 104.8 in the evening; pulse averaging 85 and never going above 98. There was some diarrhea. The patient perspired freely at times.

August 9: At 7:15 a. m. temperature was 102.2; pulse, 92. Patient was suffering severe pain in abdomen. At 10 p. m. temperature was 101; pulse, 104. There was persistent vomiting of dark green material, with undigested milk.

August 10: At 7 a. m. temperature was 97.2; pulse, 100; patient still in great pain. At 4 p. m. temperature was 104; pulse, 130; patient covered with cold sweat. At 6:30 p. m. temperature was 101.4; pulse, 140; still in cold sweat.

August 11: Patient gradually sank and died at 8:45 p. m. Perforation occurred on the fourteenth day after admission, and death in from 48 to 50 hours after perforation. No autopsy.

CASE 2.—Male, aged 30, was admitted to hospital Feb. 4, 1891, having been sick one week; diagnosis typhoid fever. He had a moderate run of fever, with temperature running from 100.8 to 103.2, pulse averaging about 90. There was no diarrhea or hemorrhage; his general condition was good.

March 4: At 8 a. m. there was some pain in the abdomen; two hemorrhages occurred from the nose; there was vomiting during the late afternoon. Temperature was 100 in morning, rising to 103 at 1 p. m. and dropping to 102 at 4 p. m. Pulse was 98 at 8 a. m., 100 at 1 p. m., and 112 at 4 p. m. The symp-

6. "The Clinical Aspect and Differential Diagnosis of Appendicitis and Typhoid Fever," Amer. Jour. of the Med. Sciences, May, 1905.

7. Johns Hopkins Hosp. Rep., vol. viii.

toms grew rapidly worse and perforation was diagnosed. At 9 p. m. laparotomy was performed; median incision was made. Fecal matter was found scattered throughout the peritoneal cavity. A perforation, irregular in shape and nearly three-quarters of an inch in diameter, was found in the ileum about 15 inches from the cecum; an attempt at suturing followed, but was unsuccessful because of the friable and softened condition of the intestinal walls. Patient being in collapse, only drainage was inserted in wound.

He was returned to bed. His condition grew steadily worse and he died at 4 a. m. March 5, 12 hours (estimated) after perforation; on the sixteenth day of the disease. Partial autopsy revealed general peritonitis and a second perforation of the bowel 6 inches above the one found at operation.

CASE 3.—Male, aged 43, was admitted to hospital Oct. 17, 1891. He had been sick 10 days; diagnosis, typhoid fever. His condition was not bad; temperature varied from 101 to 102, and pulse from 80 to 92 on day of admission.

October 18: At 2:15 a. m. he had a chill; temperature, 103.2. At 3 a. m. there was severe pain in the abdomen, continuing during day. At 4 a. m. temperature was 104.6, and pulse 98. At 8 p. m. temperature was 104, and pulse 106.

October 19: At 4 a. m. temperature was 102.4, and pulse 104. At 8 p. m. temperature was 100, and pulse 112. The patient was feeble; he vomited several times during the day and sweated profusely; he had violent hiccough. The pain continued severe during day.

October 20: His condition grew worse during the early part of the night. At 4 p. m. temperature was 100.2, and pulse 124, and was growing more feeble and rapid. At 9:30 a. m. there was vomiting. At 9:38 a. m. death occurred. Perforation occurred on the eleventh day of the disease; death, 55 hours later. There was no operation. No autopsy.

CASE 4.—Male, aged 28, was admitted to the hospital Aug. 23, 1896. He had been sick seven days; diagnosis, typhoid fever. He had a severe run of fever, with temperature from 102 in the morning to 104.8 and 105 in the evening. Pulse from 106 to 126. There was slight diarrhea, some vomiting, and mental apathy with some delirium.

September 2: Patient had been in marked typhoid state and delirious; the abdomen was distended. At 7:30 p. m. respiration was very irregular, and there were involuntary bowel movements. Temperature was 101.2; pulse, 120, and respiration 24. At midnight the axillary temperature was 104; pulse, 132, and respiration, 32.

September 3: Temperature varied from 103 at 4 a. m. to 104 at 4 p. m., pulse ranged from 120 to 130, and respiration from 26 to 30. The patient was delirious, and the abdomen was distended.

September 4: At 4 a. m. the temperature was 102, pulse 120, and respiration 34. At 4 p. m. temperature was 103.2, pulse 144, and respiration 44. Symptoms of previous day were more marked.

September 5: All symptoms were increased in severity, and the patient died at 3:35 a. m. There was no operation. A partial autopsy showed abdominal ulcers, one of which had perforated. There was also considerable peritonitis.

CASE 5.—Male, aged 25, was admitted to hospital Oct. 14, 1897. He had been sick two weeks; diagnosis, typhoid fever. The fever ran a light course, the temperature averaging 103.6 in the evening and pulse not over 80.

October 23: There was hemorrhage from the bowel, but no symptoms of collapse; temperature fell from 101.8 to 98.8, and pulse from 76 to 60. The patient did well for several days after the hemorrhage, temperature and pulse running as before.

October 30: At 5:30 p. m. there was a sharp pain in the abdomen during passage of stool; respiration increased; face became pinched in appearance. The patient lay in bed with his knees drawn up. The temperature fell at first and then rose. Perforation was thought of, but the surgeon was not warned until next morning.

October 31: Operation was performed at 11 a. m., 19 hours after first symptoms of perforation. A median incision was made below the umbilicus. On opening the abdomen a large amount of gas and fecal matter escaped through the wound.

The intestine was covered with lymph deposit, and there were numerous adhesions. In the ileum, about 6 inches from the colon, a large perforation was found, which would admit the end of the fingers; the edges were well defined. Other unperforated ulcers were apparent through the bowel wall. The peritoneal cavity was sponged dry and flushed with normal salt solution; tubal drainage was inserted and the wound partly closed.

November 1: The condition became critical, and there was some vomiting. At 4 a. m. the temperature was 101, pulse 134. At 4 p. m. temperature was 101, pulse 130 and weak.

November 2: At 4 a. m. the temperature was 101, and pulse 144. At 4 p. m. temperature was 104.2, and pulse 160. The patient grew rapidly worse and died at 8:30 p. m.

Autopsy showed very severe general peritonitis, with extensive adhesions. Suturing in the bowel was intact. Perforation occurred on the thirtieth day of the disease; death occurred 75 hours after perforation and 56 hours after operation.

CASE 6.—Male, aged 37, was admitted to hospital Oct. 22, 1898. He had been sick ten days; diagnosis, typhoid fever. At the time of admission there was tympanites and some vomiting; rose spots were also present. The case ran a light course after admission to hospital until convalescence began. The man had a relapse, beginning November 4, but it was not severe. On November 9 he developed a phlebitis.

November 12: During the day the temperature ran high and the pulse increased. At 4 a. m. the temperature was 103.6 and pulse 106. At 4 p. m. the temperature was 104, pulse 108. At 9:30 p. m. there was sudden acute abdominal pain; the patient cried out in agony; the abdomen became rigid; extremities and face were cold and clammy; pulse was rapid, feeble and fluttering. Pain was referred to genitals.

November 13: At 4 a. m. the temperature was 102 and pulse 122. At 4 p. m. temperature was 97, pulse 122. There was severe pain throughout the day, with vomiting, delirium and cold sweat. Temperature was subnormal all day, running as low as 95.6. The condition grew worse, and the patient died at 10:30 p. m.

No operation was performed, because of the severe phlebitis and the low condition of the patient. Autopsy showed perforation of ileum 18 inches from the ileocecal valve, with free fecal matter and turbid fluid in the abdominal cavity. There were numerous ulcers with softened bases, one black and almost perforated, and a clot in the femoral vein extending into the pelvis.

CASE 7.—Male, aged 24, was admitted to the hospital Sept. 23, 1902. He had been sick two weeks; diagnosis, typhoid fever. Rose spots were present on admission. The case ran a severe course after admission, temperature running from 102.6, with pulse 96, in the morning to temperature of 105 and pulse 116 in the evening.

September 29: At 7 a. m. temperature was 102 and pulse 100. At 8 p. m. temperature was 103.2 and pulse 120. The condition of the patient was the same as on former days until 8 p. m., when there was hemorrhage from bowels.

September 30: At 4 a. m. the temperature was 101 and pulse 100. At 3 p. m. temperature was 101 and pulse 144. Blood count showed 7,894 leucocytes. The condition was serious; pulse was rapid and weak. He did not complain of pain; abdomen was rather rigid and somewhat tender on pressure; liver dullness was diminished.

October 1: At 8 a. m. the axillary temperature was 98 and pulse 120. At 8 p. m. the axillary temperature was 101.4 and pulse 150. He vomited during the day. Death occurred at 11:30 p. m. Perforation occurred on the nineteenth day of the disease. No operation (no reason given in clinical history). Death occurred in about 30 hours after perforation. No autopsy.

CASE 8.—Male, aged 20, was admitted to the hospital Jan. 23, 1903. He had been sick one week with prodromal symptoms of typhoid; diagnosis, typhoid fever. The general condition on admission was rather bad; the abdomen was distended and there was pronounced typhoid mental condition. At 7 a. m. the temperature was 103 and pulse 72. At 8 p. m. the temperature was 104 and pulse 94. The patient had two hemorrhages on January 24, one on January 25, another on

January 26; also a slight chill, and another hemorrhage on January 27. During this time the temperature continued high, and pulse ran from 78 to 84. There was no diarrhea.

January 31: The general condition was about the same. At 8:30 p. m. he was taken with sudden severe pain in the abdomen in the right iliac region. He had a chill at 9 p. m. The abdomen became distended and there was general abdominal tenderness more marked at McBurney's point. The pulse was rapid and weak, and the facial expression anxious and drawn. At 10:30 p. m. (diagnosis of perforation having been made) operation was performed under cocain until bowels were exposed; then ether was given. The incision was made through the right rectus. The bowels were much distended, and there were numerous adhesions around the appendix, which was somewhat thickened and congested. The appendix was ligated and the stump turned in by means of formalized catgut suture. A small pinhole perforation was found in the colon within one inch of the appendix; it was closed with Lambert sutures of silk. An ulcer, with gangrenous look and threatening perforation, was found 4 inches from the ileocecal valve; it was reinforced with suture of silk. There were no signs of peritonitis and no increased amount of fluid in the peritoneal cavity. Only local drainage was used, and the wound was closed up to drain. For several days after operation the patient's condition was quite good.

February 3: At 4 a. m. the axillary temperature was 98.8 and pulse 80. At 8 p. m. the axillary temperature was 98.6 and pulse 92. Some distension was present and there was considerable vomiting on this day.

February 7: The patient's condition was serious. At 4 a. m. the temperature was 100.8 and pulse 120. At 8 p. m. the axillary temperature was 104.6 and pulse 128 and weak. The abdomen was distended and tender; there was no infection of the abdominal wound.

February 8: Condition was still serious. Temperature and pulse were about the same as day before. He had blood in stools twice on this day; there was not much reaction of temperature and pulse. At 4 a. m. temperature was 103.8 and pulse 130. At 8 p. m. temperature was 104 and pulse 130.

February 9: Patient's condition was much worse, temperature being uniformly high and pulse rapid and weak.

February 10: Temperature reached 105 and axillary pulse 150. Patient died at 12:20 a. m. February 11.

Complete autopsy: Examination was negative, except in the abdomen. The bowels were found covered with purulent exudate, but not distended; the catgut suture which had closed the stump of the appendix had been absorbed, and, as there were no attempts at repair, the stump was open. The perforation and ulcer, which had been reinforced with silk sutures, had held firmly. The peritoneal exudate was much more marked in the right iliac fossa than elsewhere. There were no fresh perforations. Perforation occurred on the forty-eighth day of the disease and death in ten days and four hours after operation. A mistake was made in this case in using catgut instead of silk for closing the appendiceal stump, and later in not reopening the wound for exploration.

CASE 9.—Male, aged 30, was admitted to the hospital Oct. 28, 1904. He had been sick ten days; diagnosis, typhoid fever. He had nose bleed, headache and other characteristic symptoms of the disease, which ran a severe course, the temperature ranging from 102, with a pulse of 96 in the morning to 104, with pulse of 104, in the evening. There was slight vomiting, with some delirium. There was no tympanites until November 1.

November 24: Axillary temperature was 98.4 and pulse 132 at 7 a. m.; respirations, 40. Patient was sweating. At 8:45 a. m. there was sudden severe abdominal pain, occurring in paroxysms; the expression was anxious. The patient was very restless; his lips were pallid; his extremities cold and covered with cold sweat. The abdomen was rigid and extremely tender, the tenderness being most marked in the right iliac fossa. The pulse was rapid, thready and almost imperceptible. At 9:40 a. m. death occurred.

Perforation occurred on the seventeenth day of the disease; death after perforation (estimated) in 55 minutes. No operation. No autopsy.

CASE 10.—Male, aged 24, was admitted to hospital Dec. 6,

1904. He was admitted primarily for injury, but complained of having been sick for two or three days. He developed a light run of typhoid; rose spots were present; temperature ran from 100 to 102 and pulse was practically normal; he complained early in the disease of some pain in the right fossa. Blood count, December 9, leucocytes were 10,186, and on December 15, 11,457. He had a typical convalescence, beginning December 24. Temperature was normal all day December 25. Diet was gradually extended. The patient was up and about.

January 17: He had a well-marked relapse, with all symptoms much more severe than during previous illness.

January 19: Temperature was 100.8, with pulse 104 in the morning. Temperature was 100.8, with pulse 110, in the evening. The condition was about the same on January 25.

January 26: Respirations ranged from 20 to 24 and were shallow; there was no delirium, no chills, no diarrhea. This condition continued without change until January 27.

January 27: At 7:30 a. m. the patient was taken with severe abdominal pain, paroxysmal in type and of a colicky nature. His face was drawn and his expression anxious; the lips were slightly pallid; the abdomen was board-like, and there was general diffuse tenderness, most marked in the right iliac fossa. Liver dullness was not obliterated. Perforation was diagnosed, and at 10:15 the patient was taken to the operating room.

Operation.—A lateral incision was made through the right rectus. The appendix was very much inflamed and was removed; the stump was closed with a purse-string suture of silk. The appendix was not gangrenous or perforated. The ileum was examined; two small pin-point perforations were found close to the cecum and were closed with purse-string sutures of silk. Two ulcers were found near the same area with their bases much inflamed; they were reinforced with continuous sutures of silk. About 12 inches from the colon a large perforation was found with well-marked borders and a punched out appearance; it was one-eighth of an inch in diameter. It was turned in with purse-string suture of silk. General peritonitis present; the abdominal cavity was filled with a seropurulent fluid. A tube and three Penrose drains were inserted to the bottom of the pelvis. The upper angle of the wound was closed with three interrupted sutures of silkworm gut. The patient stood the anesthetic well and was placed in bed in Fowler's position. During the evening he received a hypodermoclysis of physiologic salt solution and heart stimulants.

January 28: His condition was fairly good; temperature was 99.2 and pulse 98 in the morning; in the evening the temperature was 101.2 and pulse 116. There was profuse serous drainage from the wound; the abdomen was slightly distended. There was a small bowel movement.

January 29: His condition was fairly good; temperature was 98 and pulse 88 in the morning. Temperature was 99.8 and pulse 100 in the evening. The Penrose drains were removed and glass drains inserted. The discharge became more purulent; there was some tympanites and some flatus was expelled.

From now on improvement continued; there was some infection of the wound, which promptly cleared up. He did not have much temperature after the operation. Diet was extended on February 18. He was sitting up in bed on February 22, and was up and about on February 28. He had a slight relapse, not severe, on February 28, which only lasted eight days. Improvement in all respects followed. He was discharged, cured, on April 12, 1905. Perforation occurred on the fifty-second day of the disease and the tenth day of the relapse. He was operated on 2 hours and 45 minutes after perforation occurred.

CASE 11.—Male, aged 43, was admitted to the hospital Feb. 16, 1905, on the tenth day of the disease. He had a light run of typhoid; there was enlarged spleen, and rose spots were present. Temperature ranged from 100.8 in the morning to 101.6 in the evening; the pulse varied from 80 in the morning to 88 in the evening. There was considerable tympanites, but no diarrhea. There was no delirium, but the mental condition was dull throughout.

February 21: His condition in the morning was similar to

that of the last few days, but at noon he was taken with severe abdominal pain; there were symptoms of collapse; the pulse became more rapid and weak; the patient was covered with profuse cold sweat; face was pinched; lips were pallid; abdomen was rigid and very painful on pressure; there was partial obliteration of the liver dullness. At 12:30 he had a chill; at 3:15 he was operated on. A lateral incision was made through the right rectus. On opening the abdomen a large amount of pus was found between coils of intestine; the appendix was inflamed and congested and was removed. Two perforations were found within 8 inches of the colon; they were closed with a purse-string suture of linen. About seven inches above this was found a small pin-hole perforation which had been closed by plastic matter and adhesion of the neighboring omentum. All the bowel in this area showed signs of old peritonitis, which must have existed for some days, as the surface of the intestine was eroded and roughened. Pus and other effusions were wiped out carefully with moist gauze, and the peritoneal cavity made apparently clean. One rubber tube drain was inserted to the bottom of the pelvis and five Penrose drains were inserted in various directions. The upper angle of the wound was closed with through-and-through sutures of silkworm gut. The patient was placed in Fowler's position after return to bed. During the afternoon his condition was very critical. At 7 p. m. his temperature was 101.4, pulse 130 and weak. Stimulants were administered, such as enemata of coffee, whisky and normal salt solution, by hypodermoclysis. The wound was dressed in the evening; there was profuse drainage.

February 22: The condition was not so good; at 7 a. m. the temperature was 98 and pulse 134; at 7 p. m. temperature was 98.6 and pulse 140. Some gas was expelled following an enema of turpentine and asafetida. There was profuse seropurulent discharge from drains.

February 23: The condition was worse. At 7 a. m. the temperature by axilla was 102 and pulse 148; at 7 p. m. the temperature by axilla was 100 and pulse 134. He gradually grew weaker. Some gas was expelled following an enema; at 6 p. m. a large amount of blood was passed in the stool.

February 24: Condition was still very bad. At 12:45 a. m. there was more blood in stools; at 2:15 a. m. there was an extensive hemorrhage from bowels; at 7 a. m., axillary temperature was 102, pulse 148 and almost imperceptible. Death at 2:45 p. m.

Perforation occurred on the fifteenth day of the disease; death occurred 74 hours and 45 minutes after perforation and 71 hours and 30 minutes after operation. No autopsy.

THE IMPORTANCE OF THE FIRST STEPS IN ARTIFICIAL FEEDING OF INFANTS, WITH PRACTICAL POINTS ON THE USE OF TOP MILK MIXTURES.

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There is probably no cause of chronic digestive disturbances in infancy which can be more easily avoided than improper methods of artificial feeding during the first few months of the infant's life, for this is the time when the average infant receives little, if any, of the physician's attention. Most of the ills of this period are ascribed to immaturity or to innate depravity, and the newborn one is left to work out his salvation with the aid of the attendant nurse and family.

Holt has repeatedly affirmed that under favorable conditions, when he can have entire charge of the infant's feeding from the start, it is exceptional for him to encounter any real difficulty in carrying out the infant's nutrition. This, he thinks, is due as much to the first steps as to his constant subsequent management of the case. Even a brief survey of the subject will reveal cer-

tain undeniable facts. The nutrition of the infant, as Chapin points out, should be divided into the preplacental, the placental and the mammary stages, during all of which the infant should be regarded as attached to the mother. At the beginning of the mammary stage the infant's stomach is only rudimentary. The newborn infant is undoubtedly best adapted to its own mother's milk. The nearest approach to this is the milk of another woman, but when we attempt to make use of cow's milk we are at once dealing with a foreign substance, and no amount of modification will make it anything else. This can be well demonstrated by reference to a table published by Heubner.¹

Time by which Weight is doubled.	Analyses of Milk.			
	Days.	Proteid.	Ash.	Phosphoric Acid.
Human.....	180	1.0	0.2	0.032
Horse.....	60	2.0	0.4	0.124
Calf.....	47	3.5	0.7	0.160
Goat.....	19	4.2	0.8	0.210
Pig.....	18	5.9	..	..
Sheep.....	10	6.5	0.9	0.272
Cat.....	9.0	7.0	1.0	..
Dog.....	8.0	7.3	1.3	0.43
Rabbit.....	7	10.4	2.4	0.891

It would seem that the rapidity of growth is in direct proportion to the amount of proteid in the milk, and that the natural process of growth in the human species is very slow. The coincidence of a low proteid and a slow growth can mean only that the infant's powers of digestion are unsuited to a stronger, tougher nutriment, and are but slowly developed. Additional proof that growth in the infant is intended to be slow is found in the fact that the proteid of the mother's milk, low as it is, is yet sufficient for the needs of the infant, not only during the whole of the period, during which the weight is doubled—a period varying from four to seven months—but also for a longer time until weaning may be demanded.

The physical characteristics of human milk and cow's milk, when they are introduced into the infant's stomach, have been so often stated as to make repetition unnecessary. No one can overlook the fact that the mechanical action of the curd of cow's milk, apart from the complicated question of its chemical properties, is fundamentally different from the action of the curd of human milk, and, as Chapin well expresses it, this points strongly to the fact that the stomach of each species depends largely for its development on the stimulus afforded by the proteid content of its own proper milk. An absolute liquid diet offers no such stimulus, but in the case of the infant the soft flocculent curd is evidently sufficient for the purpose, which, in the case of the calf, demands coarser excitation for its accomplishment. Of the so-called "vital characteristics" of milk by which we understand that each milk shall be best suited to the young for which Nature intended it, too little is definitely known to make discussion profitable. Statistics are so overwhelming in proof of the fact that the breast-fed infant far surpasses the artificially fed infant in expectancy of life that further comment is unnecessary. The causes for the high mortality of artificially fed infants are undoubtedly the disturbances which may properly be classified as gastrointestinal, originating in the inability of the infant to digest its food. It is impossible to compute the part

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1. Zlet. für Diät. u. Physik. Therapie, vol. iii, p. 1, 1899. Abst. from Archives of Pediatrics.