minutes after they have been noted. Dr. Osler also emphasized the need for the prompt co-operation of the surgeon. In general hospital cases there is not time to call the attending surgeon and, therefore, when the case has been carefully studied and diagnosis of perforation made, the house surgeon should immediately operate. The last case at the Johns Hopkins Hospital, he said, illustrates the importance of this. A strong, robust German, in the tenth or eleventh day of the disease, at 12 o'clock was suddenly seized with pain in the abdomen. He was seen by Dr. McCrae and was also carefully watched by the resident surgeon. He was operated on at 3 o'clock. The interesting thing was that the operation seemed to make no difference in the progress of the case. The perforation was found, was fixed and the patient made an uneventful recovery from a very severe attack of typhoid fever. The records of 19 cases with perforation that were operated on show that 7 recovered, which is an average of 33 per cent. and is as good as can be expected in a general hospital where the very severe cases are received, sometimes even with perforative peritonitis.

Dr. J. C. WILSON, Philadelphia, said that one of the rules that he gives the resident physicians, particularly in the German and Pennsylvania hospitals, is to ascertain the conditions as regards rigidity as a matter of routine at every visit. The mere suspicion of rigidity of the right side, at the right lower quadrant of the rectus muscle, requires a report at once to the general physician. Pain, particularly if with rigidity, should make the physician notify the surgeon to come prepared to operate, and the patient should be made ready to go to the operating room without waiting for the coming of the surgeon. That is one of the most important points regarding the routine management of enteric fever from the standpoint of early diagnosis of perforation. On the other hand, said Dr. Wilson, in several cases sudden intense pain occurred on the right side of the abdomen, in the iliac region, with rigidity of muscles, but with very little constitutional disturbance; in a few hours these symptoms passed away and the patient was left apparently as well as previously. There was no perforation and he was at a loss to account for it. Dr. Wilson is strongly of the opinion that hemorrhage and perforation very rarely occur at the same time, but he thinks that hemorrhage is not rarely a precursor of perforation and, therefore, that a vigilant watching is very necessary. The time has come for the profession seriously to consider opening the abdomen to stop the bleeding.

Dr. MORRIS MANGES, New York, agreed with Dr. Osler's points and said that the whole trouble of diagnosis in typhoid perforation in the early stages is that the general practitioner wants too much for diagnosis.

EARLY DIAGNOSIS AND OPERATIVE TREATMENT OF GASTRIC CANCER.

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The hopelessness of pyloric cancer, or, indeed, of any form of gastric cancer when the diagnosis has become so plain that "he who runs may read," and the possibility of affording prolonged or even permanent relief if timely surgical interference could be advised, makes its early diagnosis of paramount importance. Unfortunately, it is one of the most difficult chapters in internal medicine, and it must be confessed that we are to-day without a single pathognomonic sign of early pyloric or other gastric cancer. The fact is that in most cases of gastric cancer, as in many other chronic diseases, the initial stages are practically symptomless. Symptoms, however, usually supervene at a comparatively early stage, and many of these cases would have a possible chance for more or less successful surgical treatment if these symptoms were given proper consideration and

the patient placed under the care and treatment of a physician skilled in gastric disorders. In general, it may be said that any case of progressive and intractable stomach disease, especially if developing in an otherwise healthy patient, or even in a patient who has had a very prolonged but comparatively slight digestive disorder, should not be allowed to continue more than five or six weeks without an accurate diagnosis being made by a competent physician. It is possible that at such an early stage the only thing that can be determined is an existing gastritis; but the character of the secretion and the motility of the stomach muscle can be determined and noted as a starting point for further observation of the case. Later, if the patient does not improve with favorable environment and proper local and general treatment, but instead grows progressively worse, there comes a time when an exploratory laparotomy should be advised for the two-fold purpose of determining the presence or absence of a neoplasm and its removal if present. Just when this point arrives can not be decided by any fixed rule, but is a matter of clinical judgment in the individual case under consideration. It must be decided on the basis of all available facts concerning the chemistry of digestion, the debris of the fasting stomach, general nutrition, metabolism, etc., no one of which will be sufficient to make out a very strongly probable case, but which taken together may create a suspicion so strong as to warrant, or even to demand, that the patient be offered an exploratory procedure.

It may be said that the results of pylorotomy for cancer have not been sufficiently good to justify the procedure. If this is true, and it is easily debatable, it is because the diagnosis has not been made sufficiently early. Physicians have not been willing to take the responsibility of advising an exploratory laparotomy while the case remains in doubt, and this procedure is necessary if therapeutic results are to be obtained. There is no doubt whatever that cancer is primarily a local disease, and that if it can be sufficiently early recognized and eradicated by free incision, a permanent cure may reasonably be expected. It seems to me that it is our duty, therefore, to be on the alert and to advise operation at what seems to be the proper moment. It is simply a question of clinical judgment as to when such a procedure is justifiable, and if any serious attempt is made to meet these questions in the manner indicated, it must now and then happen that a mistaken exploration will be made. This, however, with the perfect technic of present abdominal surgery and the practically complete absence of mortality in simple exploratory procedures, is not a matter to be dreaded so much as the possibility of permitting a case of incipient cancer to pass the operative period.

The following case, as the history will show, was operated on too late, although the operation was advised immediately after my examination. It was postponed about two weeks by circumstances connected with the patient, but this, of course, did not substantially change the conditions, which were obviously far beyond radical operative relief.

Patient.—Mr. B., aged 40, laborer, was referred to me by Dr. R. E. Brokaw, Portland, Ind., Sept. 1, 1904.

History.—The patient complained of indigestion beginning seven months previously, although for several years there had been a slight disturbance of gastric digestion. The first symptom referable to his present condition was a pain occurring in the region of the stomach with occasional vomiting coming on without reference to meals. This had grown progressively

worse with, however, periods of exacerbation and of amelioration. The bowels were constipated and there was considerable flatulence, mostly referable to the region of the stomach, which was the cause of more or less pain. He said that at times there was a large transient swelling in the left epigastrium which was very painful, and on manipulation gave rise to gurgling sounds and finally would disappear with a sound of a splashing or gushing character.

Examination.—The general nutrition had been somewhat impaired. His weight in health was from 135 to 140 pounds, and at the time of my examination was 119 pounds. Physical examination was negative except that I thought I could distinguish, in the pyloric region, a small, hard nodule, tender on pressure, but quite movable, but this was not very distinct. Analysis of a test meal (Ewald test breakfast) showed 50 degrees of free HCl, total acidity of 150 degrees, strong biuret reaction, with very little unchanged starch. No lactic acid. The fasting stomach contained a dirty brownish fluid with large quantities of mucus, leucocytes and broken-down red blood corpuscles. There was a slight, even doubtful, trace of lactic acid and numerous Oppler-Boas bacilli. The blood examination showed 50 per cent. of hemoglobin, 3,000,000 red cells and 7,000 leucocytes. Analysis of the urine revealed nothing unusual except fibrinuria. Examination with the cardiometer showed the distance from incisors to stomach to be sixteen inches and revealed a moderate dilatation of the esophagus for from four to five inches above the cardiac. A subsequent test meal showed 30 degrees of free HCl.

Diagnosis.—On the basis of the clinical history, physical examination and stomach analysis, a probable diagnosis of pyloric cancer was made and operation advised. Pyloric stenosis was positively diagnosed, the only question being as to its malignant or non-malignant character.

Operation.—The operation was performed two weeks later by Dr. Miles F. Porter, and a pyloric cancer of considerable size was found. There were secondary deposits in the gastro-hepatic omentum as high as examination could be made, and it was decided to be too late for resection and a gastroenterostomy was made.

Result.—The patient made a good recovery, but, of course, will succumb within a few months.

The probabilities are that in such a case as this the symptoms began sufficiently early to make a radical procedure possible if we are only willing to act on a strong suspicion corroborated by careful and somewhat prolonged study of the case.

In another case, seen only two weeks before death, too late for any operative procedure, the symptoms had been pronounced for months, and yet, so far as could be determined, the disease was limited absolutely to the pylorus without any secondary deposits whatever, and in this case also there would have been an excellent opportunity for a radical extirpation of the tumor with a fair chance of permanent cure if action had been taken early.

What now are the clinical manifestations which will justify or demand an exploratory procedure in the interest of these cases in the future? From what has already been said, it is plain that any categorical answer can not be given to this question. In some cases, the disease is latent to so late a period that it is manifestly impossible even to suspect the existence of the disease during its early stage. In one of my cases, for instance, an elderly man consulted me on account of a slight indigestion of a few weeks' duration. I urged him to permit me to make a physical examination which he declined to do on that occasion, but insisted on my prescribing something for temporary relief, saying that he would permit me to make the examination later. He really appeared in fairly good health, and from his appearance I had not the slightest suspicion of malignant disease.

About two weeks later, I was asked to call at his residence, and found that he had been vomiting typical coffee-ground material, and on placing my hand over the stomach found a tumor half as large as an orange. He died two or three weeks later. This man apparently was in his usual health until within five or six weeks of the time of his death. He had retired from business and his habits were not active, and this, perhaps, masked the debility which must have been present to a greater degree than was suspected.

In cases of gastric cancer occurring in stomachs previously normal, and in which the symptoms manifest themselves with more or less suddenness, a strong suspicion of malignancy should be entertained at once, and only sufficient time taken in the study and observation of the case to establish its progressive character. It must be remembered that in such a case the onset of symptoms is not contemporaneous with the inception of the disease, but simply marks the point of development at which gastric function and perhaps general nutrition become impaired. The latent stage may be brief or long, according to the location, rapidity of development, and nervous organization of the individual case, and it is always possible that the first obtrusive symptom may not be very early. My own observation in regard to nutrition is certainly contrary to that of Krönlein, who mentions emaciation as the earliest symptom. Nutrition is likely to suffer slowly, soon after the development of positive symptoms, but in a large majority of my cases other symptoms, such as pain, vomiting, etc., have distinctly preceded emaciation. This, for instance, was true in the case reported in this paper. The patient was in his ordinary health seven months before, being referred to me without any perceptible diminution of weight or strength, and yet the symptoms arising at that time undoubtedly marked a more or less advanced stage of the pyloric cancer. This appears to me to be an important question, as too much stress is commonly laid on the state of general nutrition. There is no reason why a purely local disease involving the pyloric end of the stomach should impair nutrition and cause emaciation until it produces obstructive phenomena of some sort. There may even be improvement of nutrition after the development of symptoms referable to the local lesion, and more or less improvement of general health, but this, of course, will be transient in character. In the two weeks, for instance, which elapsed between my examination of the case recorded and his return for operation, he gained three pounds in weight, both weighings having been made either by myself or by my assistants in my own office, and careful reference being made to clothing, etc. It is undoubtedly true that in many cases emaciation is an early conspicuous symptom, but it should be fully recognized that there are many exceptions to this rule, if, indeed, it is the rule at all.

Stomach analysis, as a rule, will give only corroborative evidence. In fact, in the early stage which we are now considering, there are no exceptions to this rule, and the corroborative evidence itself may be slight or lacking. The absence of free HCl or the presence of lactic acid can not be assigned a high value in the diagnosis of gastric cancer, except as they corroborate other findings. Many cases are on record, like the one already reported, in which free HCl is present in normal quantities, and it is well known that it may disappear in simple gastric catarrh. The same remark applies to lactic acid which was really absent from the test meal

in this case, and is frequently present, as is well known, in certain forms of non-malignant disease. The Oppler-Boas bacillus is very frequently associated with gastric cancer, but it simply means a certain type of lactic-acid fermentation, and while I attach more importance to it than I do to the HCl and lactic-acid phenomena, it is only strongly corroborative, as I have found it in several cases which were undoubtedly benign in character, as proved by subsequent history, as have other observers also. Atypical mitosis, which was thought by Hemmeter and others to have considerable diagnostic value, is not distinctive. It is somewhat characteristic of rapid neoplastic formation, and if found with great frequency is entitled to some consideration in summing up the total findings.

The pain and vomiting of gastric cancer are in no sense distinctive, and may be duplicated in non-malignant disease. The anemia which is so marked in some cases is purely a secondary phenomenon, and the leucocyte count is not significant. Even absence of digestion leucocytosis only means that the products of digestion are entering the blood slowly, or that the reactionary power of the phagocytic mechanism is greatly impaired, and this could only be a late phenomenon and without value for our present purposes.

The prolonged retention of stomach contents, or as Einhorn calls it, isochochymia is a symptom of considerable value, and occurs rather early. It is simply an expression of gastric myasthenia, with possible pyloric obstruction, and may occur in other cases, and, moreover, it is not likely to be marked at a stage when diagnosis is most important and most desirable. Like the other symptoms, therefore, it is only corroborative, and it is undoubtedly true that many a stomach with fully developed cancer may have practically unimpaired motility and empty itself perfectly.

We can omit from our present consideration such phenomena as coffee-ground vomit and a well-defined tumor, cancerous fragments in washwater, etc., as they do not belong to the stage of the disease under discussion.

In summing up the diagnostic data, we are admittedly unable to place our fingers on a single symptom or analytical finding, the presence of which can be relied on to establish the diagnosis of early gastric cancer, and the absence of which can exclude it. This, perhaps, may be said to be true of any combination of several symptoms. This is unfortunate because of the impossibility of establishing a general diagnostic formula, but it does not justly express the possibility of the experienced and skilled diagnostician of establishing a probable diagnosis strong enough to justify surgical intervention. In fact, it is very largely a question of the individual case and the individual diagnostician. A few general propositions, however, may be set down even at the risk of repetition.

The earliest symptoms of gastric cancer are simply the manifestation of disturbed gastric function and may present almost any type of disturbance influenced, of course, by the location of the neoplasm, the rapidity of its growth, and the vulnerability of the muscular and secretory apparatus and the nerve centers, the original vigor of the digestive apparatus and the virility of the organism as a whole. As an initial symptom there may be pain in one case, vomiting in another, impaired secretion in another, and emaciation in still others. When a patient, therefore, presents himself with some form of gastric dis-

turbance, the first information to obtain is an accurate history of its development, its duration, its progressive or unprogressive character, the state of the general nutrition, etc. The characteristic thing about the nutritional disturbance in gastric cancer is its slow development; it may, of course, be rapid, but this is probably exceptional. It is to be presumed that the external physical examination will be negative, although Mayo Robson says it is still not too late to attempt relief even if a palpable tumor is present. The next step is to secure the contents of the fasting stomach in the morning before breakfast; if there is no fluid, any detritus that is present should be secured by irrigation. A careful chemical and microscopic examination may throw some light on the diagnosis. The presence of lactic acid, of the Oppler-Boas bacillus, of the evidences of an associated gastric catarrh, and of broken-down blood cells are all more or less significant. An Ewald test breakfast should then be given, and the character of the digestive processes critically studied. The presence or absence of HCl, its amount if present, the intensity of the biuret reaction, or its absence, the presence or absence of the various enzymes are salient points here. The motor function, in some measure, will be determined at the same time, but should be studied further by an examination of the stomach contents at varying intervals after larger meals.

The summing up of all the data thus obtained will rarely, if ever, justify a prompt positive diagnosis of gastric cancer in the early stage. However, it usually will strengthen or dispel the suspicion, and will serve as a starting point for such further clinical study and observation of the case as the importance, obscurity and difficulty of the questions involved imperatively demand. This means that the patient should be continuously under critical study¹ and treatment, the therapeutic tests being of the utmost importance, although, as already indicated, they may prove temporarily misleading.

It is not my purpose to enter into an extended discussion of the operative treatment of gastric cancer, as this is entirely outside of my province, except as an observer of the work of others. One of the most discouraging points which makes the internist hesitate to advise radical procedures is the very large mortality attending gastrectomies. About one-third of all the patients die from the effects of the operation. This is a frightful mortality, and one which ought to be reduced if cases are taken to the surgeon earlier. Haberkant says that with extensive adhesions the mortality is 70 per cent., and without them, 27 per cent. We thus see that even without adhesions more than one-fourth of all the patients die from the effects of the operation. When we can be assured of a mortality of not over 10 or 12 per cent. in the absence of adhesions, and with a fairly good general condition, the operation can be urged on a patient with better grace.

It appears to me that gastroenterostomy should be the operation of choice, as gastroenterostomy is admittedly only palliative in character, and does not by any means offer the same degree of relief as a radical gastrectomy does. This is shown by the average duration of life after the two operations for gastric cancer. Patients live, on an average, after gastroenterostomy from three to four

1. The amount of time varies widely. In some cases three or four days is sufficient. In others three or four weeks or even longer. These latter cases are the ones in which suspicious tendencies occur and in which the influence of treatment on the stomach function is important. Ordinarily one or two weeks' time is ample.

months, after gastrectomy, more than a year. The reasons for this are sufficiently plain. When recurrence takes place after a gastrectomy, it is presumably from the secondary deposits which could not be removed, or because of an insufficiently wide excursion of the knife in removing the segment of the stomach. It is quite natural that these deposits should not develop so rapidly as the original active focus of the disease, probably in a state of disintegration on the mucous surfaces. Beside this, the hemorrhages and septic secretions from the ulcerating surfaces debilitate and poison the patient when a gastroenterostomy has been done, as no change whatever has been made in the local morbid process, and such benefit as does accrue is simply the result of better drainage of the contents of the stomach.

The question as to whether the presence of a palpable tumor makes it too late for surgical intervention is a most intensely interesting and practical one. It is probably true, in a vast majority of cases, that when the growth has reached a stage when it can be palpated through the abdominal wall sufficient metastases have occurred to make a complete removal impossible. In exceptional cases, however, this may not be true, and I have seen at least one case in which a somewhat doubtful palpable growth was apparently strictly limited to the pylorus without secondary deposits. Even if a radical cure can not be anticipated, the relief of from one to two years which should follow a gastrectomy would be worth while as a simple palliative procedure, could it be shorn of its terrible mortality. In conclusion, I wish to affirm with all the emphasis possible the fact which Riegel so forcibly points out, that if we are ever to get better results in dealing with gastric cancer, it will be when the internist acquires the diagnostic acumen necessary to enable him to strongly suspect malignancy, and possesses in addition the courage necessary to enable him to act on that suspicion before it becomes a certainty. In order that this may fairly be demanded of him, however, ample opportunity must be offered for study and observation of the case; and for this he is entirely dependent on the promptness with which the family physician recognizes the doubtful nature of the case and refers it for diagnosis. As a matter of fact, the primary responsibility really rests with the family physician who, in too many instances, treats obscure and intractable gastric disorders in a routine manner with only a faint suspicion of their real pathology, and who, in so doing, permits cases of malignant disease to drift supinely on until they enter that realm above whose portals may well be inscribed Dante's words:

"Abandon hope, all ye who enter here."

SOME COMPLETE URINE ANALYSES.

J. H. LONG.

CHICAGO.

A search through the chemical and physiologic literature will show that comparatively few complete analyses of urine, representing the full day's excretion, are on record. In the course of some other work, I found it necessary to make a number of lengthy determinations of this kind, and I present here the results obtained.

Beside the organic substances, urea, uric acid and creatinin, the urine contains essentially combinations of three inorganic acids and five inorganic bases. That is,

there are combinations of sodium, potassium, ammonium, calcium and magnesium with hydrochloric, sulphuric, and phosphoric acids, the last two being largely products of oxidation metabolism. Some of the text-books of urine analysis and of physiology make rather misleading statements about the relations which exist between these substances and the limits within which they vary; and the old errors are still repeated in regard to the normal volume of urine excreted. It is the object of this paper to give some new and accurate data on these and on other points.

THE NORMAL VOLUME OF THE URINE.

Many of our standard data on physiologic chemical matters have been taken from German sources, and in so doing we sometimes make the error of accepting statements which can not be true under American conditions. The average daily liquid consumption here is much below that in Germany, while the consumption of solid foods is certainly higher. The average volume of from 1,500 to 2,000 c.c. of urine for the day is far too high for our conditions, while a specific gravity of from 1,015 to 1,020 is correspondingly low. Among our text-books, the recent work of Charles Simon, "Physiological Chemistry," is the only one I have examined carefully which makes a correct statement on these matters. I will add some figures of my own. In a series of 24 observations, in which the whole day's excretion of a number of men was saved, I found the average volume to be 1,167 c.c., with extremes of 765 c.c. and 1,950 c.c. The average specific gravity was 1,025 at 20 degrees, referred to water at 15 degrees as standard. In a second series of 24 examinations of the urine of vegetarians, a mean volume of 874 c.c. was found and a specific gravity of 1,030 under the same conditions. In a third series of examinations of male students, janitors and nurses, I found a mean volume of 1,221 c.c., and for the same number of urines from female nurses, I found a volume of 859 c.c. These results were secured in 1900 and in 1901. More recently still other collections from various sources have shown a volume of about 1,200 c.c. as an average, and this is certainly as high as should be taken for male urine.

In calculating the day's excretion for the specific gravity by the use of the Trapp or Haeser coefficient, these facts become of importance. In using these coefficients it must be remembered that they are based on a specific gravity at 15 degrees, generally, compared with water at the same temperature. At the present time, following a suggestion of Squibb, many urinometers are graduated for a temperature of 25 degrees, and usually without a statement as to the comparison water temperature.

CHEMICAL ANALYSES.

Six complete analyses have been made by methods which need but little explanation. The alkalis were separated from 100 c.c. of urine as pure chlorids, by the Bunge process,¹ and the presence of potassium was determined with platinum chlorid. Calcium and magnesium were found in 200 c.c., and ammonia in 50 c.c. by the Schloesing method, the result being corrected by a previously determined factor. Chlorin was found by the Volhard-Arnold process, the excess of silver used in titration being measured after filtration. Phosphoric acid was found by the uranium titration, with use of cochineal as an indicator. The total sul-

1. Neubauer und Vogel: *Analyse des Harns*, 10th ed., p. 738.