

above, surgical or mechanical measures to correct anatomical faults which interfere with proper drainage of the urinary tract.

Elsewhere in the paper I have stated that colon bacilluria is not an uncommon occurrence. In many individuals with this urinary infection there may be no perceptible effects from it. In other patients who suffer from some systemic infection, the conditions may be ascribed to the existing colon bacilluria without due regard for some other possible cause. This statement I think is necessary, because I have found that colon infection of the urine has been brought into the foreground by some physicians who have known of pathological effects due to it and who may misinterpret the condition and fail to look for or to find a real focal infection somewhere else in the body. We must not forget that focal infection of the tonsils, of the sinuses of the head, or of some other mucous tract of the body may produce systemic disease. Therefore, while I believe that colon bacillus infection of the urinary tract is sometimes a cause of not only local but also of systemic disease, I would caution those who find this infection of the urine not to be led astray by it, and to make sure of its relation to local or systemic evidence of disease by proof of its specificity by agglutinative, phagocytic, bacteriolytic, and other tests, and at the same time to look for other possible sources of infection before the treatment is begun.

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### PAROXYSMAL ARTERIOSPASM WITH HYPERTENSION IN THE GASTRIC CRISES OF TABES.

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AMONG the most interesting of the problems which the clinician has to solve is that of the interpretation of acute abdominal pain. The subject is a large one, and it is my purpose in this communication to deal with only one phase of it—that indicated by the title of this paper. The topic may best be approached by the presentation of a case which illustrates the main features of the condition under discussion.

Hattie T., aged forty-nine years, white, married woman, a cigar-maker, was admitted to Ward G, Johns Hopkins Hospital, October 9, 1909.

Her complaint was severe pain in the back and stomach, and headache. Her family history is negative. She has been married twenty-four years. She is the mother of six children, two of whom died in infancy. She had had several miscarriages, all occurring early in the pregnancies.

Except for vague "rheumatic" pains for some ten years she suffered from no disease until the present trouble began. About eight years ago she began to have attacks of pain in the back, indigestion, and pains in the joints, especially in the shoulders and knees. The pain in the small of the back was tolerably severe, and was sometimes associated with nausea. These attacks recurred at intervals. One and one-half years ago she separated from her husband, and since then the attacks have increased in number and severity. In May, 1909, the uterus, tubes, and ovaries were removed in one of the city hospitals, but since the operation she has been more nervous than before. She has suffered much from headache, frontal and vertical, and she thinks her eyesight has failed during the last few years.

The individual attacks begin with a feeling of a lump in the throat which cannot be swallowed (*globus?*). Vomiting soon comes on, so that nothing can be retained in her stomach, and she has extreme pain in the back and abdomen and complains of sensitiveness of the skin of the trunk. The pain is so severe that she usually weeps violently and tosses about in bed, grinding her teeth. She has never lost consciousness in an attack, nor has there been any disturbance of the sphincters. Her mind seems clear during the attacks. Her physician frequently was compelled to give her morphine for the pain. She has had more or less of the drug during the last five or six years. Since about a year ago there have been nearly two attacks per week, each lasting from a few hours to three days. She has noticed palpitation of the heart during some of the attacks.

On examination the patient was found to be somewhat emaciated; the skin was sallow, the muscles soft and flabby. There was no anemia. Her eyes were rather prominent; there was a tendency of the eyeball to run ahead of the lid in making von Graefe's test. The pupils were contracted, and reacted but little to light or accommodation, but it was thought on admission that this might be due to the morphine. There was no glandular enlargement. There was slight enlargement of the heart, the relative dullness extending to the left 10 cm. from the mid-sternal line. The radial and temporal arteries were tortuous and somewhat thickened. The lungs were negative, except for a moderate grade of emphysema. The stools contained some mucus, but no parasites or blood.

On the day after admission she began to suffer from severe pain in the abdomen and back, lying in a crunched position, crying constantly, and complaining bitterly. She vomited at short intervals. The vomitus was greenish in color and was accompanied by nausea. Chemical examination showed a total acidity of 42 per cent.; 23 per cent. of free hydrochloric acid; no lactic acid; no blood. Examination of the blood revealed: Red blood corpuscles, 4,258,000; white corpuscles, 13,800; hemoglobin, 92 per cent. Differential count: Polynuclears, 66 per cent.; large mononuclears, 7 per cent.; lymphocytes, 24 per cent.; and eosinophiles, 3 per cent.

An examination of the stool two days later revealed the presence of ova of *Trichocephalus dispar* and also ova of *Ascaris lumbricoides*.

On October 13 I observed her myself during a paroxysm of pain. The face was very anxious, the lips somewhat cyanotic, the eyes reddened and lacrymose. One got the impression at once that the pain was that of organic disease. The radial pulse was 124, regular but of very high tension, feeling like a fine whipcord under the finger. The blood pressure was measured at once and found to be about 190 mm. Hg. She was given an inhalation of amyl nitrite, and the pressure fell at once to 90. A short while after, however, the pressure again became high, going to 200 and later on to 210 mm. Hg. The knee-jerks were overactive; the plantar reflexes normal. The pupils did not respond to light. There was no tactile anesthesia of the chest, but definite analgesia in large areas in the lower extremities were present.

The urine contained no albumin or casts. Acetone was present, doubtless due to the prolonged vomiting, though the test for diacetic acid was negative. Palpation of the abdomen revealed nothing abnormal.

In spite of the active knee-kicks, I felt that the character of the pain and the vomiting, together with the sluggish pupils and the analgesia of the legs, made the diagnosis of gastric crises of tabes probable. This diagnosis received support also from the extreme hypertension due to arteriospasm accompanying the attack. I suggested that lumbar puncture be done and the spinal fluid examined. On the same day Dr. Kingsley withdrew 10 c. c. of cerebrospinal fluid. It was under a pressure of from 150 to 200 mm.  $H_2O$ , clear and colorless. There were 50 cells per cubic millimeter, all lymphocytes. The fluid contained both globulin and serum albumin. These tests demonstrated the existence of either a luetic or a metaluetic lesion of the central nervous system.

Sensation was carefully tested on October 15, when the left lower extremity was found to be almost wholly analgesic and the right also, except for a portion on the lateral surface of the limb. There was also analgesia in the domain of the second thoracic of each arm. A patch of analgesia was found upon the right side of the scalp (Figs. 1 and 2). Touch was nowhere impaired and thermal sensation was not markedly involved.

On October 20 the eyes were thoroughly examined by Dr. Bordley. One of them had been dilated with atropine. The other showed extreme myosis and did not react to light and only imperfectly to accommodation. Stelwag's and von Graefe's signs were positive. Convergence was poor. There was advanced arteriosclerosis of the retinal vessels, some of the smaller arteries being almost completely obliterated. The veins were markedly indented by the arteries, and in places tortuous. There was no change in the papillæ nervi optici except hyperemia from obstruction to the venous circulation.

The Wassermann reaction done by Dr. Guthrie was found to be negative.

Examination of the urine: Normal in color; specific gravity, 1010 to 1018; acid; no sugar; no albumin. Microscopic examination was negative. Acetone was present only during the vomiting.

The course of the blood pressure is shown in the accompanying chart (Fig. 3).

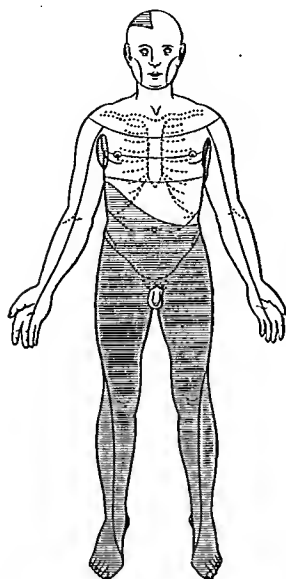


FIG. 1.—Analgesia at the first examination.

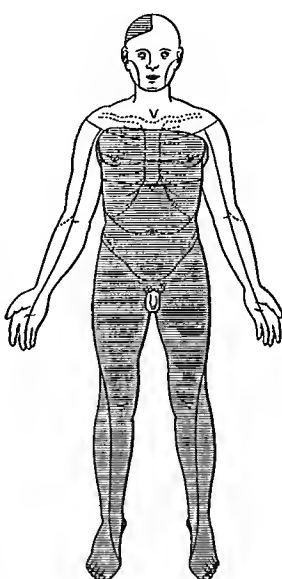


FIG. 2.—Analgesia at the second examination.

The patient's pain was relieved by morphine. As soon as the vomiting stopped she was given small quantities of milk every two hours. During the next five days she had only two attacks of nausea and vomiting. She began to have a good appetite and to feel very much better. The blood pressure (maximal) varied between 175 and 215 mm. Hg. until the 18th. On the 19th the maximal pressure was found to be only 120 mm. Hg., and since then it has varied between 110 and 125 mm. Hg.

Since the fundamental studies of Fournier upon the phenomena of early tabes the pains in the upper abdomen in this disease have

been classified under four main headings: (1) Crises in which there is vomiting alone; (2) crises in which there is pain alone; (3) the *grande crise gastrique*, in which the phenomena are complicated and violent, and include extreme pain, vomiting, and retching, with severe general symptoms; and (4) crises in which the appetite is entirely lost, though other signs may be absent.

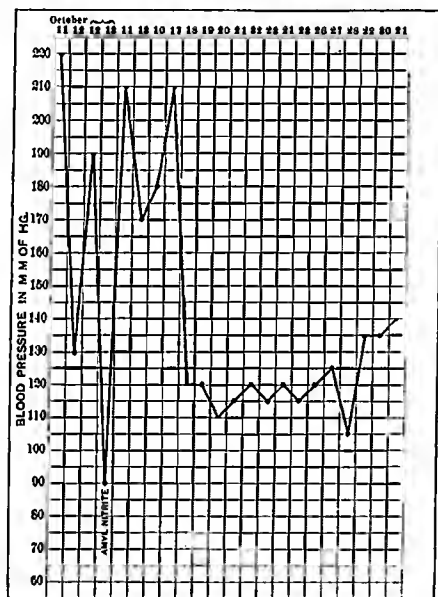


FIG. 3.—The course of the blood pressure.

The patient whose history has been given evidently suffered from crises of the third type, and it is to this form of gastric crises in tabes that I desire to refer, making it, however, distinctly understood that in the other three types of crises many of the features of Type 3 may be lacking.

In the crises from which this woman suffered the pain was situated in the upper abdomen and radiated into the back. The pain was accompanied by paroxysmal arteriospasm, with great elevation of the maximal arterial pressure. That the hypertension depended upon the arteriospasm was evident from the effect of amyl nitrite,

which reduced the maximal pressure promptly to 90 mm. Hg., though as soon as the effects of the nitrite had worn off the hypertension reappeared. The marked oscillations in the maximal pressure during the crises are evident in the blood pressure chart (Fig. 3). It was only after the pressure returned to normal and remained on the normal level that the symptoms disappeared. A study of similar cases in the literature indicates that partial falls of the pressure are significant only of remissions in the crises, not of termination. The abrupt terminal fall in pressure is striking, and the maintenance of a tolerably steady pressure at the low level after the period of hypertension seems to me most interesting.

There are at least three conditions in which attacks of severe abdominal pain with paroxysmal hypertension occur: (1) The gastric crises referred to above; (2) lead colic; and (3) the angina abdominis of arteriosclerosis. A number of cases of all three conditions have been collected and carefully analyzed by J. Pal.<sup>1</sup> In these cases, besides the pain and hypertension, the attacks presented several other characteristic features, including (1) constipation, (2) boat-shaped retraction of the abdomen, (3) in some cases meteorism, and (4) in many instances segmental sensory disturbances (usually hyperesthesia or hyperalgesia) in the root domains of the lower thoracic and upper lumbar spinal nerves.

There has been much dispute as to the origin of the pain in these cases and its relation to the hypertension. Some authors assume a primary neuralgic pain with secondary hypertension due to the pain; others, with Pal, regard the hypertension as the result of vasoconstriction of the small arteries of the stomach and intestines, and look upon the pain as due to stretching of nerves in the arterial sheaths of the same arteries proximal to their constricted portions, assuming that in these proximal regions of the gastro-intestinal arteries the arterial wall is distended and under very high pressure. The researches of experimental physiologists and surgeons tend to confirm the view that the only pain nerves in the stomach and intestines are those in the walls of the bloodvessels. It has long been known that the visceral peritoneum (not the parietal) is insensitive, and there is evidence to prove that even violent constriction of the intestine or stomach (such as crushing with Dnpuytren's scissors) causes no pain.

In the gastric crises of tabes it is assumed that irritation in either the posterior roots of the spinal nerves or their continuations within the cord leads to a reflex vasomotor constriction which is most extreme in the splanchnic domain. If this explanation is correct we must assume that we have to deal in tabes at times with elective stimulation of posterior root fibers, for when tabetics suffer from lacerating pains in the lower extremities the blood pressure is

<sup>1</sup> Gefäßkrisen, Leipzig, 1905, pp. 1 to 275.

usually low and we must assume in such cases a reflex vasodilatation. In the gastric crises of tabes there is paroxysmal arteriospasm and hypertension, and we must assume here a reflex vasoconstriction. It is interesting that lancinating pains and gastric crises rarely occur together in tabes, though their alternation is not uncommon. This disparity in the symptomatology of incipient tabes, pointing to an elective stimulation of the posterior root fibers or their intramedullary continuations, has led me to think of our embryological knowledge of the posterior roots. Since the studies of Flechsig and, later, of Trepinski we have known that the fibers of the dorsal funiculi do not become medullated all at once. Definite groups of these fibers receive their myelin at very different periods; and Flechsig has subdivided the fibers into four distinct embryological systems.<sup>2</sup> The fibers of these different systems have different terminations in the cord and in all probability subserve different functions. It has also been shown, through the microscopic study of the spinal cord in cases of tabes, that a very distinct parallelism occurs between the areas degenerated in this disease and the embryological membership in the fetal cords. Furthermore, it has been shown that in tabes the sequence in which the several systems suffer may vary. It seems to me highly desirable, therefore, that cases of incipient tabes carefully studied clinically, which, through some intercurrent disease, come to autopsy before degeneration is advanced, should be most closely investigated microscopically. In this way we may hope for gradual enlightenment concerning the functions of the different systems of fibers contained within the dorsal roots of the spinal nerves.

The explanation of the phenomena other than the pain and hypertension in the gastric crises of tabes has also been attempted by various writers. Though the explanations thus far offered leave still much to be desired, opinion at present leans to the view that the vomiting is a reflex vagal phenomenon; that the constipation is due to paralysis of the intestine from ischemia due to the vasoconstriction; that the boat-shaped retraction of the abdomen is to be regarded as a reflex through the motor spinal nerves of the corresponding segments; and that the segmental hyperesthesia is to be thought of as due to "referred sensation" in the sense of Head, resulting from the violent impulses passing along the stretched perivascular sympathetic nerves and reaching the cell bodies (within the spinal ganglia) of the neurones of the lower thoracic and upper lumbar dorsal nerve-roots.

Since in arteriosclerosis attacks of angina abdominis closely resembling those of the great gastric crises of tabes occur, it might be thought that the attacks in the patient reported above were due to the arteriosclerosis rather than to tabes, but, though the knee-

<sup>2</sup> L. F. Barker, *The Nervous System*, New York, 1890, p. 424 et seq.

kicks were lively, the pupils were very sluggish to light and, above all, the lymphocyte count in the cerebrospinal fluid was markedly increased, and the protein content of that fluid indicated the existence of a parasyphilitic disease. Moreover, vomiting appears to be less common in the angina abdominis of arteriosclerosis than in the gastric crises of tabes.

To one other point attention should be called, namely, the wide distribution of the analgesia and the great differences in this distribution at different periods. In the absence of disturbances of tactile and thermal sensation such an extensive analgesia could scarcely be due to the tabes. It seems much more probable that this analgesia and the globus of which the patient complained are hysterical manifestations complicating the more serious malady.

Should these severe crises continue in this patient, we shall consider the advisability of cutting intradurally the seventh, eighth, and ninth dorsal nerve roots on both sides of the body (Foerster's operation). In Küttner's case and in that reported by Bruns and Sauerbruch<sup>3</sup> the results were eminently satisfactory.

## A STUDY OF FIVE HUNDRED AND FIFTY CASES OF TYPHOID FEVER IN CHILDREN.

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IN November, 1903, I read a paper before the Medical and Chirurgical Faculty of Maryland, the subject being a study of 337 cases of enteric fever in children. Now it is my intention to present a further study, by analyzing 213 additional cases, which have been treated during the half decade ended December, 1908.

In this study of 550 cases of typhoid fever treated in the Children's Hospital, District of Columbia, many obstacles, some insurmountable, were encountered. The period over which the investigation extends has been divided into three and a half decades, which seem to conform to the changes of ideas respecting this particular disease, embracing the years 1872 to 1908, inclusive. During the first decade all cases of typhomalarial fever were excluded, because this was then thought to be a distinct disease possessing only a few symptoms similar to those found in enteric fever. During the second decade these were included, because, by common consent, all typhomalarial cases were then recognized as enteric. In the

<sup>3</sup> Operativer Behandlung gastrischer Krisen, Foersterscher Operation, Mittheil. n. d. Grenzgeb. d. Med. u. Chir., 1909, xxi, 173 to 178.