OBSERVATIONS ON THE FLUID CONTENTS OF A CYST OCCUPYING THE EPIGASTRIC REGION OF THE ABDOMEN *

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The observations on the fluid obtained from a cyst, probably pancreatic in origin, which are here reported, seem worthy of record even though no satisfactory explanatory theory of the findings can be advanced by the observer. The fluid was obtained at operation from a patient who was admitted to the medical service at the Carney Hospital, March 29, 1911, and whose medical record was as follows:

Patient.—Carney Hospital Medical No. 2055. Male, aged 42.

Family History.—Father died of sarcoma. Mother died of pneumonia. Brother died of bronchitis. Sister died in infancy. No family history of pulmonary tuberculosis.

Previous History.—Measles, mumps, pertussis, and scarlet fever in childhood. Pneumonia thirteen years ago. Gonorrhea twenty-three years ago.

Habits.—Drinks alcohol to excess; chews tobacco.

Present Illness.—Fourteen months ago his right leg between the shoe-top and knee became swollen. Soon after this his abdomen became swollen. He was admitted to the Boston City Hospital, where his abdomen was tapped twice in March, 1910, yielding a clear straw-colored fluid. He remained at the City Hospital about a month, and was discharged feeling fairly well. During the following month, April, it was necessary to tap his abdomen again. After his abdomen was tapped in April he began to notice a sharp pain in his upper abdomen, which radiated to his left shoulder, and a little later he began to have a constant gnawing pain in his abdomen with occasional sharp exacerbations. He lost appetite, and began to lose weight and strength. The latter part of November, 1910, he noticed a "lump" which appeared in the upper half of his abdomen, but which disappeared, or as he expressed it, "broke" in January, 1911. Following this the patient vomited once or twice daily for about a month. During the time that the "lump" was in his abdomen there was more or less tenderness in this region, he had considerable nausea, and was annoyed by having an uncomfortable full feeling after eating. At this time he coughed a good deal, and said that once he raised sputum containing a coffee-ground sediment, and for four or five days there was red blood in his sputum. About the middle of February, 1911, another "lump" appeared in his abdomen, and this has continued to be present. During the past year he has lost 50 pounds in weight, has become very weak, and has worked only at short intervals, the total amount of time that he has worked being nine weeks. He has lost his appetite, complains of an uncomfortable full feeling in his abdomen, says that as soon as he begins to eat his

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stomach feels very much distended and uncomfortable, and he is able to eat very little, being prevented rather by the sense of fullness than by any actual pain. His bowels move regularly, he has no headache, no shortness of breath, no jaundice, no abdominal cramps. He has had no edema except the swelling of his right leg, which occurred fourteen months ago, and remained only a short time. He gets up once at night to pass urine. There is no difficulty in urination. His urine appears normal.

Physical Examination.—A well-developed, poorly nourished man lying comfortably in bed, breathing regularly, not rapidly. His lips and mucous membranes seem somewhat pale and there are numerous dilated venules on his cheeks and nose. His pupils are equal, slightly irregular, react promptly to light and accommodation. There is a very slight internal strabismus. Ocular movements are normal; no pigmentation of the scleræ. Tongue is clean. Teeth are in fairly good condition, with rather marked pyorrhea alveolaris. Throat is negative. In the neck there is visible pulsation in the suprasternal notch. Thyroid is not enlarged. Numerous cervical lymph glands can be easily palpated, though they are not greatly enlarged. The same is true of the axillary lymph glands, and to a less degree of the inguinal. The thorax is well formed. The right side moves rather more than the left during respiration. Percussion over the lungs gives good resonance throughout. Voice and breath sounds are normal on auscultation and no râles are heard.

Heart.—Maximal cardiac impulse is seen and felt just inside the nipple line in the fourth interspace, $4\frac{1}{2}$ inches to the left of the mid-sternal line, and the left border of cardiac dullness corresponds to the position of the apex beat. The right border of cardiac dullness is $2\frac{1}{4}$ inches to the right of the mid-sternal line in the fourth space. The upper border is at the second interspace. The cardiac action is regular, sounds are very distant, except at the base, where the second sounds are loud and strongly accentuated. The pulmonic second is louder than the aortic second. The percussion note over the upper third of the sternum is distinctly dull, almost to the level of the suprasternal notch, and this dullness extends on each side for about $1\frac{1}{2}$ inches from the mid-sternal line. The pulses are equal, regular, of small volume and low tension.

Abdomen.—The upper epigastrium is filled with a bulging tumor mass extending out from under the costal margin down to a point $1\frac{1}{2}$ inches above the umbilicus. This mass is rounded, measures $8\frac{1}{2}$ inches transversely, $5\frac{1}{2}$ inches vertically, is symmetrical, smooth, firm and elastic. In certain places it is slightly tender. It descends slightly with respiration. Percussion note over the greater portion of it is flat. Inflation of the stomach shows an area of tympany above and to the left of this mass, indicating that the stomach is pushed up and lies largely above the left costal margin. Below the mass the entire abdomen is tympanitic, and auscultatory percussion indicates that there is an air-containing viscus lying transversely below the mass, probably the transverse colon. The edge of the liver can be felt distinctly about an inch below the right costal border, and the upper border of hepatic dullness is at the fifth interspace in the right mammillary line. The edge of the spleen cannot be felt. Percussion dullness of the spleen extends from the sixth rib in the mid-axillary line to the costal margin. No masses are to be palpated in the abdomen, with the exception of this one in the epigastrium.

Genitals.—Normal with the exception of a moderate varicocele on the left side.

Extremities.—The first and second fingers are missing on the left hand. There is no edema of the arms or legs. Over the lower half of the right leg there is an extensive superficial scar from an old burn.

Reflexes.—Knee-jerks are normal. There is no Babinski's sign; no ankle-clonus.

Urine.—March 30, high color, acid, specific gravity 1.019; very slight trace of albumin, no sugar. Sediments show a moderate number of leukocytes and

round cells, rare hyaline and finely granular casts. April 1, normal color, acid, specific gravity 1.015; slight trace of albumin; no sugar. Sediment shows many leukocytes.

Stool.—April 2, liquid, dark yellow color, very slightly positive guaiac reaction. There is a considerable amount of mucus, many undigested muscle fibers, with no increase in the fat elements.

Blood.—March 30, hemoglobin 85 per cent.; white blood cells, 10,000 per cubic millimeter. Stained smear shows no abnormality of the corpuscles.

Radiography.—An *x*-ray of the thorax shows, corresponding to the area of dulness, a shadow of moderate size occupying the upper anterior mediastinum, interpreted as a slight enlargement of the normal mediastinal shadow possibly brought about by the heart and adjacent tissues being crowded up by the epigastric mass beneath the mediastinum.

Operation.—A presumptive diagnosis of pancreatic cyst was made, and the patient was transferred to the surgical service April 2 and operated on April 3, 1911. At operation by Dr. J. T. Bottomley, a very large cyst was found adherent to the abdominal parietes and adjacent structures, occupying the epigastric region, with the stomach above and to the left, the transverse colon below. Incision showed a moderately thick wall to the cyst, and the cyst to be made up of a large single sack filled with a dark colored, somewhat syrupy fluid. With the hand in the cyst it appeared that the cyst extended back to the posterior abdominal wall, and no viscera could be definitely made out back of the cyst. The cyst was drained.

Course and Recovery.—The patient made an uneventful recovery. Three weeks after the operation, when the patient had returned to an unrestricted house diet, his urine showed for one day a sugar reaction by the Fehling test. This promptly disappeared on reducing somewhat his carbohydrates, and did not subsequently reappear during his stay in the hospital, as shown by the following urine examinations, though his diet was not further restricted.

April 9, Sugar 0	April 27, Sugar 0
April 20, Sugar 0	April 28, Sugar 0
April 22, Sugar 0	April 29, Sugar 0
April 25, Sugar +	April 30, Sugar 0
April 26, Sugar 0	May 1, Sugar 0

When last heard from July 15, 1911, the patient was feeling in good condition, and the sinus present on discharge from the hospital had healed.

Histologic Examination.—A portion of the cyst wall removed at operation was examined. This showed a cellular connective tissue structure lined in places with vascular granulation tissue, uncovered by epithelium in numerous blocks of tissue which were examined. Outside of the connective tissue was an irregular layer of adipose tissue.

Diagnosis.—The situation of the cyst, the history of its development, and the character of its contents seem to justify the diagnosis of pancreatic cyst. As no epithelium was found lining the cyst, and no pancreatic tissue was found in the cyst wall, it is realized that an absolute diagnosis cannot be made. Furthermore, the various tests made with the fluid do not give any definite information as to the origin of the cyst, and yet they will be described as being of considerable interest.

Examination of Fluid.—Fluid obtained from the cyst cavity was of a dark brownish black color, of a slightly syrupy consistence, contained no sediment and on standing did not clot. It was of a faintly alkaline reaction, contained a large amount of albumin, and gave no sugar reaction by the Fehling test. It gave a strongly positive guaiac reaction for blood. The following tests were made on the fluid.

April 4 to 6, 1911. To 20 c.c. of the fluid was added 5 c.c. of a chloroform solution of thymol, and in this was placed a two-inch tube filled with coagulated egg albumin. A second experiment of the same kind was prepared. These were placed in the thermostat at 37.5 C. temperature and left for forty-eight hours. The reaction remained alkaline and there was no evidence of digestion of the egg albumin.

A portion of the fluid was tested¹ for the presence of trypsin by the method of Gross² slightly modified by Spooner as follows. The fluid was rendered alkaline with sodium carbonate and filtered through a Büchner funnel. One c.c. of the filtrate was added to solutions of Grubler's casein in 1:1000 sodium carbonate. At the end of twenty-four hours these solutions were tested for undigested casein by precipitating with 1 per cent. acetic acid. The tests resulted as follows when 1 per cent. acetic acid was added after the mixtures had stood for twenty-four hours at 37.5 C.

- Casein solution 1:200 ; very cloudy.
- Casein solution 1:500 ; markedly cloudy.
- Casein solution 1:800 ; markedly cloudy.
- Casein solution 1:1000; considerable cloudiness.
- Casein solution 1:1500; considerable cloudiness.
- Casein solution 1:2000; cloudy.
- Casein solution 1:3000; cloudy.
- Casein solution 1:4000; cloudy.
- Casein solution 1:5000; moderately cloudy.
- Casein solution 1:6000; moderately cloudy.

The cloudiness in these experiments indicates that there had been no digestion and so the tests were negative for the presence of trypsin in the fluid.

To 20 c.c. of the fluid was added 20 c.c. of a starch paste solution and 5 c.c. of the chloroform thymol mixture. This was placed in the thermostat at 37.5 C. At the end of twenty-four hours the fluid remained alkaline in reaction, and it markedly reduced Fehling's solution.

The control experiment with the mixture of 20 c.c. of water, 20 c.c. of starch paste, and 5 c.c. of chloroform thymol mixture, placed under similar conditions did not reduce Fehling's solution at the end of twenty-four hours.

A mixture of 20 c.c. of fluid, 20 c.c. of water and 5 c.c. of chloroform thymol mixture placed in the thermostat at 37.5 C. for twenty-four hours did reduce Fehling's solution, though the reduction was less marked than was the case when starch paste was added to the fluid. Undiluted fluid treated in the same way for twenty-four hours reduced Fehling's solution.

A portion of the fluid was placed in a thermostat at 55 C. until evaporated to dryness. This precipitate rubbed up in water did not reduce Fehling's solution.

The remainder of the fluid was placed in the cold room at a temperature slightly above freezing, and remained there until May 3, 1911 (one month). At the end of this time the fluid still failed to reduce Fehling's solution. A portion of the fluid was then boiled (May 3) allowed to cool, and filtered free of precipitate through cotton. Twenty c.c. of the filtrate from the fluid after boiling was added to 20 c.c. of starch paste, and 5 c.c. of chloroform thymol mixture, and placed in the thermostat at 37.5 C. for twenty-four hours. At the end of this time there was a marked reduction of Fehling's solution, whereas a mixture of 20 c.c. of starch paste and 5 c.c. of chloroform thymol mixture placed under similar conditions yielded a very slight reduction of Fehling's solution. Unboiled fluid with and without starch paste after twenty-four hours' exposure at a temperature of 37.5 C. reduced Fehling's solution in the same way as had been the case one month previously.

The experiments with the tubes containing coagulated albumin were repeated at this time without digestion being evident. A rabbit was killed and mucous

1. I am indebted to Dr. Leslie H. Spooner for making these tests.

2. Gross: *Deutsch. med. Wchnschr.*, 1909, xxxv, 706.

membrane scraped from the duodenum was mixed with the fluid and the digestion experiments with coagulated albumin were repeated, equally with no resultant digestion.

Experiments similar to those carried out at 37.5 C. of temperature were repeated at a temperature of 60 C. At the end of twenty-four hours at this temperature the fluid still failed to reduce Fehling's solution.

Some of the fluid after standing for twenty-four hours at a temperature of 37.5 C. was placed in a fermentation tube, yeast was added and the tube placed in the thermostat at 37.5 C. After twenty-four hours an abundant formation of gas had taken place. Fluid without previous exposure to a temperature of 37.5 C. similarly yielded gas after the addition of yeast. Controls of water and yeast yielded no gas.

July 15, 1911 (three and a half months after the fluid was obtained), a portion of the fluid which had remained in the cold room at a temperature slightly above freezing point had acquired a slightly foul odor and still failed to reduce Fehling's solution. A portion of this fluid, to which was added some of the chloroform thymol mixture, was placed in the thermostat at 38.5 C. for forty-eight hours; at the end of this time it reduced Fehling's solution slightly. After forty-eight hours longer in the thermostat at 37.5 C. there was no increase in the reducing power of the fluid for Fehling's solution. Another portion was treated with subacetate of lead, followed by animal charcoal to remove the coloring matter. In this way a clear fluid was obtained which showed no rotation with the polariscope. To this clear fluid was added chloroform thymol mixture, and this was placed in the thermostat at 38.5 C. for forty-eight hours. At the end of this time the fluid reduced Fehling's solution very slightly, but there was no demonstrable rotation of polarized light. The excess of lead now was removed from the fluid by precipitation with dilute sulphuric acid and the fluid, after neutralization with sodium hydrate, was again placed in the thermostat at 37.5 C. for forty-eight hours. At the end of this time there was no increase in the power of reducing Fehling's solution and no rotation of polarized light.

SUMMARY

Fluid was withdrawn from a cyst occupying the epigastric region in a man aged 42, which had developed as follows: Twelve months previous to admission in the hospital ascites appeared and a simple ascitic fluid was withdrawn on three occasions during a period of two months. Following the tapplings a constant, gnawing pain with occasional sharp exacerbations developed in his upper abdomen. Four months before admission to the hospital a tumor mass appeared in his upper abdomen, to disappear after a month and a half. Five weeks before admission this mass reappeared and persisted. On admission there was found a large bulging tumor extending from beneath the ribs to an inch and a half above the umbilicus, elastic, smooth, moving slightly with respiration, apparently a cyst crowding the stomach up and the transverse colon down. At operation this was found filled with a slightly viscid fluid, dark brownish-black in color, containing changed blood. The wall of the cyst showed granulation tissue and no epithelium.

The fluid from the cyst was slightly alkaline, and did not reduce Fehling's solution. It gave no trypsin reaction, and did not digest coagulated egg albumin at body temperature, either as it came from the cyst or after the addition of scrapings from the duodenum. In the

thermostat at body temperature at the end of twenty-four hours it had acquired the power of reducing Fehling's solution, and previous boiling did not prevent this reducing substance from appearing. In the thermostat, however, at 60 C. no such reducing substance appeared. The addition of yeast to the fluid caused fermentation with the production of gas. Preservation at a temperature slightly above freezing for one month had no appreciable effect on the reactions of the fluid. Until the fluid was placed in the thermostat at 37.5 C. it still did not reduce Fehling's solution. At the end of three and a half months at a temperature slightly above freezing the fluid had acquired a slightly foul odor and still did not reduce Fehling's solution, and now when placed in the thermostat at 37.5 C. there was but a slight production of a reducing substance.

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