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DUODENAL ULCERS IN INFANCY*

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Until recently, duodenal ulcers have been considered rare in infancy and childhood. Since 1908, groups of cases have been published by several writers, and the increasing number of reports during the past three years indicates that the condition is not a very uncommon one, and that it has been probably overlooked in the past.

In the literature I have found references or full reports of ninety-one cases of duodenal ulcer in the first year of life, making, with four cases of my own reported in this paper, ninety-five cases for study. All but twenty-one of these have been published since 1908. These facts indicate how little this condition was known until five years ago. In the post mortem records of the Babies' Hospital embracing 1,800 autopsies, fully 90 per cent. of which were in children under 1 year, duodenal ulcer is recorded but four times, and, curiously, three of these cases were observed within a period of three months, the other case two and a half years before. It is doubtless true that had it always been carefully looked for, other cases might have been discovered.

Entz[1] (Budapest) reports 10 instances of duodenal ulcer in 364 autopsies on infants under 1 year, made in an infant asylum. Schmidt[2] (Breslau) observed 20 cases in 1,109 autopsies in infants under 1 year. A still greater frequency is indicated by the observations of Helmholz,[3] who found in 16 autopsies on atrophic infants, duodenal ulcers in 8. He calls especial attention to certain superficial ulcers which may easily be missed even when autopsies are made with considerable care, since they cause no symptoms during life, and neither hemorrhage nor perforation is found at autopsy. Half his cases belong to this group. Granting that

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* Read at the annual meeting of the American Pediatric Society, Washington, D. C., May 6, 1913.

1. Entz: Közhórházi Orvostárs üléski jkoe, Budapest, Nov. 4, 1908, quoted by Flesch in Jahrb. f. Kinderh., lxxvi, 542.
2. Schmidt: Berlin Klin. Wchnschr., 1913, xiii, 593.
3. Helmholz: Deutsch. med. Wchnschr., 1909, p. 534; Arch. Pediat., September, 1909.

there is a considerable number of such ulcers which may be detected at autopsy only with some difficulty, even then we cannot assume that duodenal ulcers in infancy are at all common. However, as compared with round peptic ulcers of the stomach they are certainly much more often seen. Thus Entz observed ten duodenal to one gastric ulcer. There is no case of peptic ulcer of the stomach in the autopsy records of the Babies' Hospital.

Of sixty-five cases in which the age of infants with duodenal ulcers is given, 70 per cent. of the patients were between 6 weeks and 5 months old, the greatest frequency being between the sixth and tenth week; only seven patients were over 5 months old; nine were in the new-born. The age incidence is very striking. It corresponds very closely with the age incidence of deaths from marasmus.

While duodenal ulcers may be seen in patients of any age and in those who are well nourished, the great majority occur in infants of the marasmus (atrophic) type. Whether there is a more definite association than simply a lowered vitality of the mucous membrane of this part of the intestine, it is impossible to say.

Two predisposing factors seem of some importance: A lowered general vitality of the patient, as in infants suffering from marasmus, and previous digestive disturbance, a history of which is present in a very large proportion of the cases.

The situation of the ulcer in the great majority of the cases is in the posterior wall of the duodenum. Practically all of them are above the papilla, and when but a single ulcer is present the usual seat is just below the pyloric ring (Fig. 2).

Of 51 cases in which the point is mentioned, there was only a single ulcer in 35 cases; two ulcers in 8 cases, and more than two in 8 cases. In size the ulcers vary from 2 or 3 mm. to 1.5 cm. in diameter. Duodenal ulcers are circular in shape, they have shelving, sharp edges, usually described as "pushed out," and often show at the base open blood-vessels of considerable size. They may involve only the mucous membrane or they may go to the muscular coat, quite to the peritoneal coat or may perforate.

Microscopical examination shows an almost complete absence of round celled infiltration and other evidences of inflammatory reaction. The mucous membrane of the duodenum elsewhere is generally normal, except that it may be blood stained. Large clots may be present in the duodenum or the small intestine lower down and blood may even be found in the colon. The stomach also may contain fresh or old blood. It is rather surprising that although gastric ulcers are believed to have the same etiology and pathology, in but a single case have I found recorded the coexistence of gastric and duodenal ulcers in the same patient, even including the cases observed in the new-born.

The association of duodenal ulcer with burns is so constantly mentioned in works on adult medicine that it is of some interest to note that not one of the recorded cases of duodenal ulcer in infants which I have collected have complicated burns. Ulcer has been found complicating many pathological conditions, but there seems to be no adequate reason for connecting it with any except marasmus, and even this is regarded by some writers as accidental.

I have nothing to add to the generally accepted view of the pathogenesis of these ulcers, viz., that they are due to thrombosis followed by self digestion of the mucous membrane over a circumscribed area. The situation of the ulcers, above the papilla, indicates that the lesion is due to the action of the gastric juice.

Below the papilla the presence of the alkaline pancreatic and hepatic secretions seems to exert a protective influence on the mucous membrane of the intestine. That it is the direct action on the intestine of the gastric juice not yet neutralized is indicated by an observation of Freund's[4] on an infant 2 months old, who was operated on by gastro-enterostomy for pyloric stenosis. For a time progress was favorable, then bloody stools followed by death, the autopsy showing ulceration of the jejunum below the opening which communicated with the stomach.

SYMPTOMS

In a little more than one-third of the recorded cases no symptoms which could be attributed to ulcer were present during life, the condition being found at autopsy in infants dying of intercurrent disease or of marasmus.

In a second group of cases death occurred suddenly in collapse, sometimes preceded by ordinary gastro-intestinal symptoms and sometimes not. In a few patients with such a history the autopsy disclosed a concealed hemorrhage, the duodenum, and in some cases the intestine lower down, containing large clots, though no bloody discharges were present during life. In other cases there was found an acute perforating ulcer and usually commencing general peritonitis. After the development of the first symptoms of collapse death may ensue in a few hours, or life may be prolonged for a day or a day and a half, rarely longer in patients of this age and class. The diagnosis of peritonitis under these conditions is extremely difficult, since neither vomiting, fever nor distention may be present, the only thing suggesting it being the acute collapse. On account of the age of the patients such symptoms as pain and localized tenderness, of much value in older subjects, are of no assistance in making the diagnosis in infants.

4. Freund: Mitt. a. d. grenzgeb. d. Med. u. Chir., xi, 326.

There is then practically only one definite symptom pointing to duodenal ulcer, viz., hemorrhage. This may appear as blood vomited or as blood in the intestinal discharges. Some idea of the relative frequency with which these symptoms occur may be gained from the following statistics: Of 64 cases of duodenal ulcer in which the clinical histories are recorded, bloody stools were noted in 28; bloody vomitus in 10; both bloody stools and bloody vomitus in 6 cases, 4 of these being in the new-born. In 2 patients there was no discharge of blood during life though the intestine at autopsy contained large blood-clots. The blood vomited may be bright, clear blood, or coffee-ground material. It is not usually in large amount, although in the new-born as much as half an ounce or an ounce has been recorded. Blood from the bowel may be in such small amount as merely to show a trace in the stool, or large clots may be passed and even fluid blood in considerable quantity. Once the hemorrhage has occurred it is apt to persist until the death of the patient, which usually comes within twenty-four or thirty-six hours from its first appearance. It is surprising how small an actual loss of blood may produce very serious symptoms in the class of patients in which most of these ulcers occur. In several cases the collapse has been so acute and so severe as to suggest perforation, though the autopsy showed only concealed intestinal hemorrhage. It is, then, the appearance of blood in the stools, usually in considerable amount, which first suggests duodenal ulcer; and in patients of the marasmus class or in young infants from 1 to 5 months old this cause of hemorrhage should always be borne in mind.

The association of duodenal ulcer with spasm of the pylorus has been too often observed to be considered accidental. In Torday's case,[5] an infant 8 months old, exhibited characteristic symptoms of pyloric stenosis — persistent, forcible vomiting and marked peristaltic waves — yet the autopsy showed no stenosis, but a duodenal ulcer just below the pyloric ring, with a greatly distended stomach. Ulcer of the duodenum associated with pyloric stenosis has been mentioned by Finny,[6] Ibrahim[7] and Freund,[4] and Birk[8] observed three cases associated with pyloric stenosis and one with pyloric spasm. In the above references the distinction between pylorospasm and pyloric stenosis is not always clearly made. It is easy to see how an ulcer in the duodenum just below the pyloric ring might by irritation cause pyloric spasm with symptoms closely simulating pyloric stenosis, although the latter condition was not present. It is perhaps enough in this connection to call attention to the association of these two conditions, and to emphasize the point that when symptoms

5. Torday: Jahrb. f. Kinderh., 1906, lxiii, 563.
6. Finny: Proc. Roy. Soc. Med., 1908-9.
7. Ibrahim: München. Ergeb. der inn. Med. u. Kinderh., 1908, i, 220.
8. Birk: Referred to by Helmholz, Arch. Pediat., September, 1909.

suggesting pyloric stenosis are seen for the first time in an infant over 3 or 4 months old, duodenal ulcer should be borne in mind as a possible explanation.

Something should also be said regarding the relation of duodenal ulcer to melena, or the gastro-intestinal hemorrhages of the new-born. Dusser,[9] in thirty-one collected autopsies on such cases, mentions five in which the only lesion was a single duodenal ulcer; in four of these, blood was vomited as well as expelled by stool. In a patient of my own (Case 4) dying on the twelfth day, multiple erosions were found in the stomach as well as an ulcer in the duodenum. In reviewing the cases seen in the new-born one is struck by the fact that the hemorrhages were more extensive than in other cases of duodenal ulcer and seemingly out of proportion to the size of the ulcer; also that they were usually both gastric and intestinal. This gives rise to a suspicion that the cause of the bleeding in these cases is a general one and not entirely the ulcer and possibly not even connected with it. There are no sufficient reasons for invoking a different pathology for the ulcers occurring at this time of life and those which are seen in later infancy.

In only one case, No. 2, of my own series, was jaundice mentioned as an associated symptom. In this case the connection was not quite clear. The jaundice was so intense as to suggest malformation of the bile ducts, yet no obstruction was found at autopsy either in the cystic or hepatic ducts. It was apparently due solely to catarrhal swelling of the mucous membrane of the ducts.

DIAGNOSIS

The gastro-intestinal symptoms preceding duodenal hemorrhage are usually of a mild type and subacute, so that enterocolitis with its frequent bloody and mucous stools is not likely to be confounded with ulcer. There is lacking also the persistent vomiting (not bloody), the paroxysmal pain, the tenesmus, with the passage of blood and mucus from the bowels, but no fecal matter, all of which are characteristic of intussusception; although the age of the patients, the suddenness of the invasion and the acute prostration somewhat suggest it. With blood appearing both in the vomitus and in the stool one might be in doubt as to whether the lesion was gastric or duodenal. The far greater frequency of duodenal ulcers of course makes this lesion much the more probable one.

In the case of symptoms pointing to acute perforative peritonitis in an infant, duodenal ulcer should be remembered as one of the possible causes and next to appendicitis probably the most frequent one.

From what has been said it will be evident that the diagnosis always has been and still is a matter of much difficulty, and it is not surprising

9. Dusser: Thèse, Paris, 1889.

that the disease has been recognized only at autopsy in the great majority of the cases reported. There is one method of diagnosis which I believe is likely to assist materially in these very obscure cases—the passage of the duodenal catheter. An opportunity to try it was afforded in one of my cases (Case 2). Ulcer was not at first suspected in this patient, but on account of the intense jaundice Hess's duodenal catheter was introduced to see if the presence of bile in the intestine could be demonstrated. On its withdrawal the catheter was found to contain a clot of blood, but no bile. Although the duodenal catheter had been passed many times before in other patients, blood had never been seen under such circumstances. We did not, therefore, believe it could be the result of traumatism. The suspicion of duodenal ulcer was strengthened by the presence of blood in the stools. Given a young infant with intestinal hemorrhage and showing no other symptoms of colitis, intussusception, polypus, etc., the introduction of the duodenal catheter is not only justified, but indicated, and it may give, as in my own case, very definite information on which in the future successful treatment may possibly be based. I know of no other means of diagnosis which will tell as much. The possibility of doing harm by the catheter cannot be denied; but the risk in my opinion is so slight that it may be ignored.

PROGNOSIS

In a condition so difficult of diagnosis and where the great majority of the cases are recognized only at autopsy, there are but few data available for prognosis. That such cases may recover seems certain from the observation of Schmidt, who found at autopsy in an infant dying of some acute infection at 5 months the cicatrix of an old ulcer, and also from one of Helmholz's cases in which recovery followed after an attack with fairly typical symptoms. The probabilities are that such a termination is a very infrequent one. The fatal outcome is due quite as much to the condition of the patients in which most of the ulcers are seen as to the ulcer itself.

TREATMENT

Regarding treatment, little can be said; medical treatment is to be symptomatic only, and surgical treatment is as yet inadvisable in most cases.

REPORT OF PERSONAL CASES

CASE 1.—*Perforating duodenal ulcer followed by general peritonitis.*

History.—D. M., a female child, 3 months old, admitted to Babies' Hospital because of loss of weight, vomiting and constipation. Family history unimportant; ninth child; plump at birth; no breast feeding, and had never thriven. The previous history suggested pyloric stenosis; there had been frequent vomiting since the child was 2 weeks old. This occurred after nearly every feeding and was forcible, but the food had been principally milk formulas rather high

in fat. Examination showed a poorly nourished infant of the marasmic type; weight but 5 pounds, 7 ounces. Except for the presence of a moderate degree of thrush and erythema of the buttocks, the physical examination was negative. The abdomen was normal; there were no peristaltic waves and no pyloric tumor; heart and lungs normal.

The infant was placed on a skimmed milk formula containing fat 0.60; sugar 6.00; protein, 1.20 per cent. The child lived eight days after admission, during which time she vomited in all but six times, twice on the first day, twice on the second day and only twice thereafter. The vomiting was not forcible. The appetite was good; the child generally took her food well. The bowels moved usually twice a day; for the first three days the stools were yellow, smooth and well digested; afterwards they were yellow and thin, but never frequent, and no blood was present. Even from the beginning the prostration was marked. The temperature was habitually subnormal in spite of artificial heat and the use of a cotton jacket. The loss in weight continued for the first four days, after which the child became somewhat edematous. During the last three days in the hospital the temperature was not above 95 F. Death occurred quite unexpectedly in a condition of collapse. There was no marked abdominal distention and no tenderness was noted.

Necropsy.—Permission to examine the brain was not obtained. The heart and lungs showed nothing of importance. On opening the abdominal cavity the parietal peritoneum and omentum were found much congested and showed numerous small hemorrhages. The peritoneal cavity contained about 70 c.c. of turbid yellow fluid, which after standing deposited a heavy precipitate of pus cells. The cause of the peritonitis was found to be a perforating duodenal ulcer. It was situated on the posterior wall just below the pylorus. It was circular, about 5 mm. in diameter and had a typical "punched out" appearance. No signs of repair at its borders. The mucous membrane of the intestine was blood-stained, but no other lesions were present. The stomach was congested but showed no ulcers. Cultures from the peritoneal fluid showed the streptococcus and colon bacillus. Streptococci were also obtained from the heart's blood and lungs.

Microscopical examination of the ulcer was made by Dr. Martha Wollstein, pathologist to the hospital. There was no inflammatory reaction, but a loss of substance which at one point involved all the coats of the intestine. The edges of the gap were sloping, not undermined. The walls of the mucosa, submucosa and muscular coats forming the edge of the ulcer had undergone necrosis and were converted into a granular, poorly staining layer. The epithelial layer of the mucosa was degenerated or absent for some distance beyond the borders of the ulcer; beyond this the duodenal wall was normal. The adherent pancreas was also normal.

CASE 2.—*Two ulcers in the duodenum; intense jaundice; intestinal hemorrhage; death from marasmus.*

History.—M. N., a male Italian child, 2 months old, was admitted to the hospital on account of marked jaundice and progressive loss of weight. The parents were not very intelligent and no detailed previous history could be obtained. It was ascertained, however, that the child was born at full term after a normal labor and had been breast fed up to admission. It had never thrived. Jaundice was first observed two weeks before and had steadily increased. The stools were gray and the urine stained the napkins. The history of the jaundice, given by the parents, was corroborated by a physician who had previously seen the patient.

Examination on admission showed a small, wretched looking infant; weight 5½ pounds. The jaundice was intense, the skin being of an olive-green hue. The sclerae and mucous membranes were also stained with bile. Nothing of importance was discovered in the head, neck or chest. The abdomen was

tympanitic, only moderately distended, the circumference being 13½ inches. The lower border of the liver was felt just below the costal margin; the spleen was not palpable. No abnormal masses were felt.

The child was placed on a milk formula having the following percentages: Fat, 0.60; sugar, 5.00; protein, 1.20 per cent. This patient also lived eight days after entrance into the hospital. During this time the temperature was much of the time subnormal, 94 F. being noted on one occasion. The urine gave a strong reaction to bile, but contained no blood or casts; urobilinogen test negative. All the stools were white, pasty, offensive and large for the food taken. The presence of bile salts could not be demonstrated. The stools contained immense quantities of fat which formed approximately 90 per cent. of the dried residue. This was chiefly in the form of soaps, although there was also a large excess of neutral fat. There was both macroscopic and occult blood in the stools. At no time was there diarrhea, and there was no vomiting of blood. Both Wassermann and tuberculin tests were negative. Blood examination at the time of admission showed: Hemoglobin, 55 per cent.; red cells, 3,900,000; white blood-cells, 15,000; polymorphonuclears, 23.3 per cent.; lymphocytes, 76.3 per cent.; eosinophils, 0.3 per cent. One week later the hemoglobin was but 20 per cent. and red cells, 1,700,000.

The duodenal catheter was passed without much difficulty to ascertain the presence of bile. None could be obtained but on withdrawing the tube it was found to contain a blood-clot. This was repeated three or four days later and a larger clot obtained. The child grew progressively worse and died of exhaustion. From the presence of blood in the stools and in the duodenal catheter the diagnosis of duodenal ulcer was made.

Necropsy.—Body emaciated and deeply jaundiced, and all the internal organs deeply bile stained; a small area of bronchopneumonia in right upper lobe; heart normal; pancreas and peritoneum normal; spleen, normal in size and appearance. Liver, dark greenish color, not enlarged and not hard; capsule thickened, especially at the border; slight increase in the connective tissue; no recent exudate; gall-bladder contained thick, dark green bile which could easily be expressed through the duct into the duodenum. Cystic and hepatic ducts appeared normal. Duodenum showed two small round "punched-out" ulcers, each about 5 mm. in diameter. One was situated just below the pylorus (Fig. 1). It extended quite to the peritoneal coat; at its margin was seen a small blood-clot from a bleeding vessel; a large blood-clot in the duodenum lower down. The other was similar in appearance and situated 1 cm. lower down in the duodenum. The rest of the intestine, both small and large, showed areas of congestion and enlargement of the solitary follicles. The kidneys were normal, except jaundiced. Cultures from the lung showed Gram-negative bacilli and pneumococci.

Microscopical examination by Dr. Wollstein showed a loss of epithelium of the mucosa, edema of the mucosa and submucosa, but no cellular infiltration. The muscular and peritoneal coats were normal. The liver showed no increase of connective tissue. The blood vessels and capillary bile ducts were normal.

Case 3.—*Single ulcer of the duodenum; concealed hemorrhage; sudden death.*

History.—M. F., a female child, 4 months old, admitted to hospital on account of diarrhea and vomiting which had lasted one week. Family history unimportant. For the first two months the baby had been breast fed and did well; then had been put out to board and had not thriven. The bowels had been generally loose, but no vomiting had been noted till one week before admission. Stools thin and green, four or five daily; no fever, but steady loss in weight.

On admission the child weighed 8 pounds, 14 ounces; fairly well developed; did not appear acutely ill; heart and lungs normal; spleen palpable one-half inch below costal margin; liver, enlarged, the lower border 1½ inches below the costal margin; Wassermann negative. Blood: hemoglobin, 60 per cent.; red cells, 4,400,000; white cells, 14,000; polymorphonuclears, 40 per cent.; lymphocytes, 60 per cent.

The child was put on protein milk (*Eiweissmilch*) 4 ounces every three hours. No further vomiting occurred after admission. The stools continued from four to six a day and for the most part were thin and of a grass green color; no macroscopic blood. The temperature remained normal for four days when it rose to 101.4 F., later to 102.6 F. Until this day the child did not appear seriously ill and looked much the same as during the previous four days. A marked pallor was then noted, the patient looking almost exsanguinated, though no blood was seen in the stools and no other hemorrhage had been observed. Death occurred quite suddenly on this day, almost without warning.

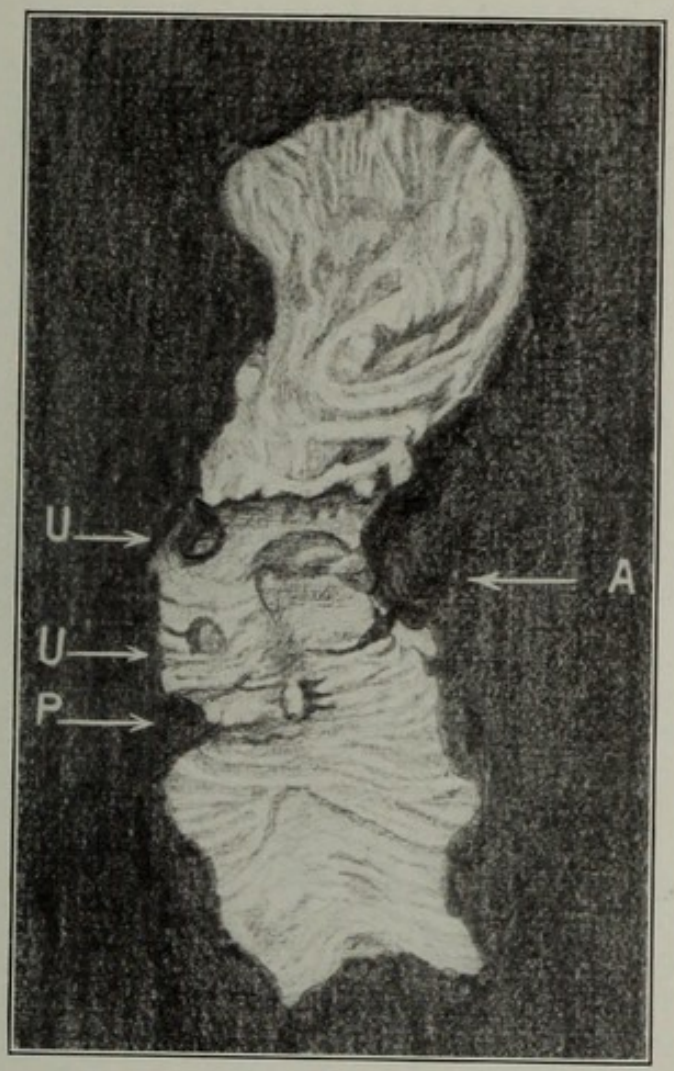

Fig. 1.—Two ulcers in the duodenum. Case 2. A, artefact; U, ulcers; P, papilla.

Necropsy.—Body well nourished; small areas of atalectasis in lungs but no pneumonia; liver extremely fatty, with a few small subcapsular hemorrhages especially on the under surface. The stomach contained a large amount of blood-stained fluid and showed many submucous hemorrhages, but no ulcers. The stomach contained one large soft, dark red clot which extended into the duodenum. Three millimeters below the pyloric valve on posterior wall (Fig. 2), there was an oval ulcer, 4 by 8 mm., edges sharply defined; no surrounding inflammation. At the base of the ulcer small clots and a bleeding point were discovered. The ulcer had the typical "punched-out" appearance; it extended through the muscular coat to the peritoneum. Mucous membrane in the neigh-

borhood was pale. The rest of the small intestine showed nothing abnormal. Nothing of importance in the other viscera.

Microscopical Examination by Dr. Wollstein: The normal mucosa showed an abrupt solution of continuity without any inflammatory products. The epithelial layer and Brunner's glands had disappeared leaving an irregular, narrow, glandular, poorly staining layer internal to the muscularis mucosa. The submucosa contained no Brunner's glands, but showed no inflammatory products. The muscular coats were normal. The duodenum on either side of the ulcer was quite normal, even the epithelial covering being intact.

CASE 4.—*A single ulcer of the duodenum, with multiple erosions in the mucous membrane of the stomach in a newly born child; no hemorrhages present.*

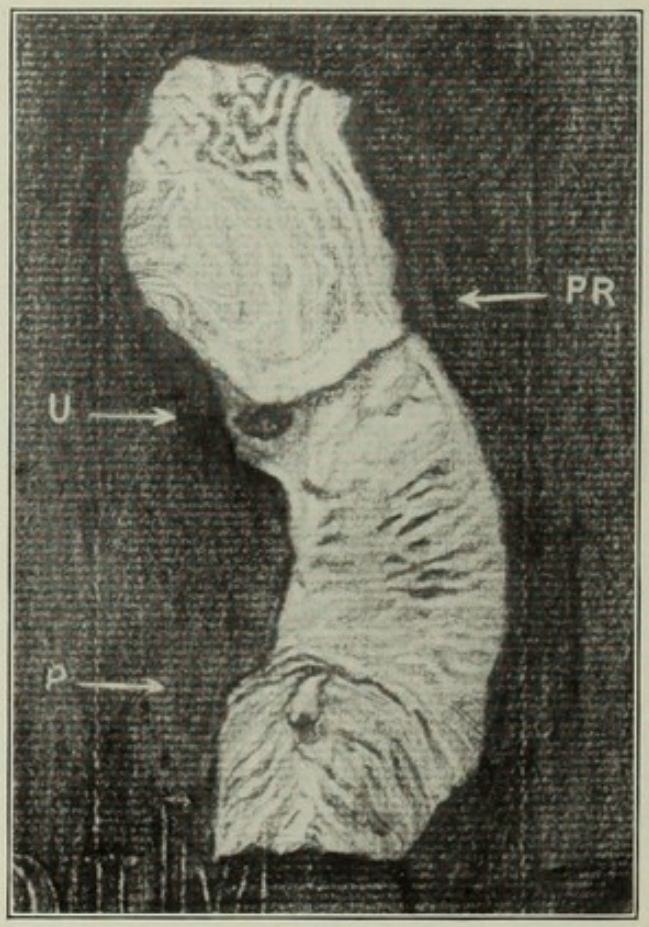

Fig. 2.—A single ulcer of the duodenum in the usual situation. Case 3. U, ulcer; P, papilla; P. R., pyloric ring.

History.—R. D., a male child, 12 days old, was admitted for vomiting and diarrhea which had existed almost from birth. The infant was one of twelve, five of whom were living and six dead; all from marasmus, the history stated. The birth was at term and the labor normal. No breast feeding had been given; at first the food had been condensed milk, afterwards nothing but barley water. All the food had been poorly taken and much of it had to be forced. The stools had never been normal; for a few days before admission they had been from two to five daily, thin, of a yellow-green color and contained mucus. Vomiting had occurred after almost every feeding. The stomach was emptied two and a half hours after feeding and was found to contain a small amount of mucus, but no blood.

On admission the child was in extremely bad condition, very feeble, almost moribund in fact; weight six pounds. No local evidences of disease in the

abdomen; râles at the bases of both lungs; no nervous symptoms; temperature nomal.

The child was put on a weak milk formula, fat 0.90; sugar, 5.00; protein, 0.70 per cent., and castor oil was administered. On the following day the temperature rose to 104.6 F. and remained above 102 F. the entire day. Vomiting continued, though but little food was taken. The stools never contained blood but were frequent, thin and green, at times only a stain on the napkin. There was no improvement in any of the symptoms and death occurred forty-eight hours after admission.

Necropsy.—Body wasted; nothing of importance in thoracic organs; liver, fatty and slightly congested, no increase in connective tissue; pancreas congested; kidneys showed uric acid infarcts in many pyramids.

The stomach contained blood-stained mucus and the mucous membrane showed many erosions extending quite to the muscular coat. They were of irregular shape, some rounded and some elongated. They were below the rugae rather than on them. In the duodenum was an ulcer 4 by 8 mm. situated on the anterior wall, about 1 cm. below the pylorus and 1 cm. above the papilla. It had a bile stained base; edges congested and elevated. Elsewhere the duodenum appeared normal. The rest of the small intestine showed intense congestion, but no hemorrhages and no ulceration. The solitary follicles of the colon were generally swollen. There was swelling and congestion of the mesenteric lymph-nodes.

I wish to acknowledge my indebtedness to Dr. Stafford McLean for assistance in collecting the literature and to Dr. E. A. Morgan for the drawings of the pathological specimens.

SUMMARY OF LITERATURE ON DUODENAL ULCERS IN INFANCY

The earliest cases reported in the new-born were collected by Dusser[9] in 1889. In thirty-one collected autopsies on gastro-intestinal hemorrhage in the new-born there were five in which duodenal ulcer was found. These are as follows:

Spiegelberg:[10] Case 1. On the fourth day, suddenly, hemorrhage from the stomach and intestine; death in a few hours. Stomach showed ecchymoses only. The duodenum showed round ulcer close under the pyloric valve; swelling in the follicles of the large intestine; no other lesion. Case 2. Thirty hours after birth sudden occurrence of bloody vomiting and shortly afterwards bloody stools; death in twenty-four hours. The stomach contained 30 c.c. of fresh blood; the mucous membrane was normal. Midway between pylorus and papilla a large coagulum in the duodenum; in the posterior wall one large and two smaller ulcers.

Landau:[11] An infant dying on the fifth day had bloody vomiting and bloody stools. Necropsy: Large clots in the stomach; mucous membrane normal. Round ulcer in the duodenum 5 cm. from the pylorus, size 5 by 8 mm. Rest of the intestine and mucous membrane normal.

Kling:[12] Death on the fourth day. Symptoms, vomiting of blood and bloody stools. In second portion of duodenum, posterior wall, ulcer, 1 by 1.5 cm., perforated at one point.

Zeischwitz:[13] Thirty hours after birth copious hemorrhage from the rectum; arterial blood. Death the following morning. In the posterior wall of the duodenum a little above the papilla an ulcer going to the muscular coat; an artery opened; intestines elsewhere normal.

More recently Gruber in a report of seventeen cases under 10 years old, mentioned two duodenal ulcers in the new-born.

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10. Spiegelberg: Jahrb. f. Kinderh., 1869, p. 333.
11. Landau: Ueber Melena Neugeborenen, Monograph, Breslau, 1874.
12. Kling: Ueber Melena Neonatorum, Inaugural Dissertation, München, 1875.
13. Zeischwitz: Schmidt, 1888, xxxv.

Schmidt[2] reports one case in an infant five days old, and one of my own cases, an infant 12 days old, should probably be included in this group.

The principal reports of cases of duodenal ulcers in later infancy are the following:

Veit:[14] An infant 1 week old, previously healthy; sudden onset, pain, fever, anorexia; death in thirty-six hours; no blood in stools or vomitus. Necropsy: coffee-ground material in stomach and intestines; large blood-clot in the duodenum; two duodenal ulcers on posterior wall; no perforation.

Adriance:[15] An infant 10 months old suffering from marasmus with marked gastro-intestinal symptoms for two weeks. Vomiting persistent, but vomitus contained no blood. Four days before death blood from the rectum following intestinal irrigation. After this two or three bloody stools daily until death. Necropsy: bright and dark blood in stomach; a duodenal ulcer, 1 by 2 cm., just below pylorus on posterior wall, going through all the intestinal coats.

Borland:[16] An infant 8 months old; severe general pustular eczema; gastro-intestinal symptoms for three days; vomiting of blood; no mention of blood in stools. Necropsy: round ulcer just below pylorus on posterior wall; large mass of clotted blood in peritoneum; no peritonitis.

Torday:[5] An infant 8 months old, admitted for atrophy and rickets; shortly after began to vomit in a manner characteristic of pyloric stenosis. This continued in spite of diet changes, stomach washing, etc. No blood in the vomitus or stools. Peristaltic waves present. Pylorus, not palpable. Death six weeks later. Necropsy: stomach greatly dilated; no pyloric stenosis; but ulcer 5 mm. below pylorus; blood in the intestines. Author believes that pyloric spasm was caused by the ulcer.

Entz,[1] quoted by Flesch: In 364 autopsies on infants under 1 year, ten duodenal ulcers and one gastric ulcer; ages between 6 weeks and 5 months. Two perforated and caused a purulent peritonitis. Death in three from hemorrhage. In most cases definite gastro-intestinal symptoms with infantile atrophy preceded. Diagnosis usually made at autopsy only.

Küttner:[17] Patient 1 month old; seven days after birth vomiting, diarrhea and for two days bloody stools. Twenty-three days later vomiting of blood and death. Necropsy: A single round ulcer upper part of duodenum, 5 mm. in diameter. Author reports also a case in a child 4 years old. Refers to Collin's monograph[18] who in 279 cases of duodenal ulcer found seventeen under one year.

Finny:[6] An infant, 2½ months old, had been vomiting almost from birth in spite of stomach washing, etc. Pyloric stenosis diagnosed; later bloody stools led to a suspicion of duodenal ulcer, confirmed by autopsy. Two ulcers present 1.5 cm. below pylorus in posterior wall; one had perforated; pylorus contracted and its muscular coat thickened.

Sochaczewski:[19] An infant 5 months old; gastro-intestinal symptoms since 4 weeks old; general condition wretched. During the last twenty-four hours three to four large bloody stools; no vomiting. Necropsy: single ulcer in posterior wall two fingers' breadth below pylorus. Peyer's patches swollen but no other ulcerations.

Helmholz[3] (first communication 1909): Reports nine cases of duodenal ulcer of which eight came to autopsy. Five of these were between three and five weeks old; three between 2½ and 4 months. All were in atrophic children. A single ulcer was present in four of the eight cases. Intestinal hemorrhage was noted in four; in four others no definite local symptoms. In the child who recovered

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14. Veit: Deutsch. med. Wchnschr., 1881, p. 681.
15. Adriance: Arch. Pediat., 1901, p. 277.
16. Borland: Lancet, London, 1903, ii, 1084.
17. Küttner: Berlin Klin. Wchnschr., 1908, xlv, 2009.
18. Collin: Thèse, Paris, 1890.
19. Sochaczewski: Arch. der Kinderkr., 1909, l, 25.

the diagnosis rested on the sudden development of marked prostration; almost collapse, followed by intestinal hemorrhage which lasted three days. Patient was an infant 2 months old and was well five months later. In a second communication (1909), he reports seven additional cases; like the former ones these were seen in different German clinics; all of these patients were likewise atrophic infants. In three intestinal hemorrhage occurred and in one of these there was also perforation; in four there were no definite symptoms. Six of these patients were between 1 and 3 months old and one was 7 months. In three of the cases a single ulcer was present; in four two or more.

Griffith:[20] An infant 6 months old; symptoms for two days; vomiting followed shortly after by trace of blood in the stools. On the following day vomited clear blood several times and one large hemorrhage from the bowel; death in collapse. Necropsy: ulcer, 5 mm. in diameter, in posterior wall of duodenum just below the pylorus. Ulcer extended through the intestine, but adhesions prevented the escape of fluid into peritoneum. Stomach contained 1 ounce of bloody fluid.

Hertz:[21] An infant 2½ months old, artificially fed. Frequent bloody stools for two days, followed by death. A single ulcer in the upper part of the duodenum, 1.5 by .75 cm. in diameter.

Gruber:[22] In 4,208 autopsies, 1,147 peptic erosions, scars or ulcers; 17 duodenal ulcers in children under 10 years; six in infants between 3 and 8 weeks; details not given.

Weill[23] and Gardére: An infant 1 month old; digestive disturbances from birth with diarrhea and irregular vomiting; traces of blood noted in stools, but no real bleeding. Case regarded as a delayed hemorrhage in the new-born, due to intestinal lesion. Necropsy: a single ulcer just below pylorus; blood-clot in the duodenum.

Flesch:[24] An infant, 3 months old, atrophic, anemic, losing weight. Symptoms for last fifteen hours; large, bloody stools; subnormal temperature; death in collapse. Necropsy: two ulcers, one just below pylorus and one just above papilla; follicular gastro-enteritis present.

Schmidt:[2] In 1,109 necropsies on infants in the first year, twenty cases of duodenal ulcer. Most of the patients in poor general condition; ten were atropic. They were seen associated with a great variety of conditions — rickets, whooping-cough, nephritis, empyema, meningitis, pyloric stenosis. Author thinks no closer association with atrophy than with any other condition of marasmus. Of the twenty cases, peritonitis was present in three and hemorrhage in seven. In ten, ulcers were latent. The usual situation was just below the pyloric ring.

Birk[8] (quoted by Helmholz, unpublished): Eight cases; ages eight weeks to ten months. Three with pyloric stenosis; one with pylorospasm; two in normal infants who were well up to a day or two before death from hemorrhage; two with acute pneumococcus infections.

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20. Griffith: New York Med. Jour., Sept. 16, 1911.
21. Hertz: Referat im Hospitalstidende, 1911, liv, 35.
22. Gruber: Referat im München. med. Wchnschr., 1911, lviii, 1668.
23. Weill and Gardére: Lyon méd., 1911, cxvii, 1177.
24. Flesch: Jahrb. f. Kinderh., 1912, lxxvi, 542.
25. Fischl: Pfaundler and Schlossmann, Am. Ed., 1908, iii, 149.