SURGERY IN PEPTIC ULCERATION OF STOMACH AND DUODENUM IN INFANTS AND CHILDREN*

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BECAUSE of the general impression that peptic ulceration of the stomach and duodenum is excessively rare in infants and children, there is a tendency to neglect this lesion in young patients. For this reason, it seems to us of interest to present evidence which, though largely indirect, indicates that the disease is not very uncommon.

Several internists and roentgenologists (*e.g.*, Nisbet, 1911; Michaëlsson, 1925; Dickey, 1926; Potter, 1930; Jankelson, 1932; Reuben, 1934; Hirsch, 1935; Prévôt, 1935; Blechmann, Gutmann and Nemours-Auguste, 1932) have published two or more cases in which the diagnosis of peptic ulcer was adequately established on clinical grounds, and others (Wertheimber, 1882; Adler, 1907; Loeber, 1929; Herz, 1930; Oldfield, 1932; Bermond, 1933; Moore, 1934; Gillespie and Gianturco, 1935; Menna, 1937; Cathala, 1938) have reported individual examples in this category. Many of these authors voice the opinion that the disease is not rare but frequently overlooked. Altogether, a considerable number of ulcers, about 200 or 300 in the world literature, have been demonstrated at autopsy,† and undoubtedly many have existed undiagnosed in patients who have recovered or who have died without postmortem examination.

By careful search, we have gathered what we believe to be an almost complete collection of the cases reported in which operations have been performed for peptic ulcers in infants and children. The cases number 119, and include one of our own. The diagnoses, we think, though based on clinical features

* This paper is not concerned with peptic ulceration of the esophagus or of Meckel's diverticulum. For those who are interested in these subjects, the articles by Diamantopoulos (1926), and Black and Benjamin (1936) should be consulted.

† Through the kindness of Dr. B. Earl Clarke, pathologist at the Rhode Island Hospital, we record, here, a previously unpublished case of an acute ulcer of the posterior wall of the duodenum, 3 Mm. in diameter, observed at autopsy in a male, aged two months. The infant was well until two or three days before death. It then refused food and whined as if in pain. There was no vomiting, and blood was not noticed in the stools. Except for a moderately enlarged heart with a patent foramen ovale and a wide interventricular defect, nothing else abnormal was observed at the postmortem examination. A blood culture was not made.

or gross observations at operation in some of the patients in whom gastroenterostomy alone was performed, can scarcely be questioned. We have also accumulated representative reports of 124 cases in which no operation was undertaken. In most of these instances, the diagnoses were established at autopsy, and in the others the clinical features, often substantiated by characteristic roentgenologic findings, were unmistakable.

An analysis of our collected cases shows that ulcers in the newborn, by which we mean infants in whom the symptoms become outstanding within the first two weeks of life, have special characteristics: (1) The great majority, at least of ulcers that are recognized, bleed seriously, or perforate, or do both (Table I); (2) in many the onset is precipitous without recognizable premonitory symptoms or signs; (3) except in a few cases, neither clinically nor at autopsy, is there evidence of intracranial injury, or localized or generalized sepsis; (4) with few exceptions the lesions are acute, without cellular reaction or bacterial invasion; (5) because of the sudden, acute, fulminating symptoms, very few of these newborn patients are operated upon; (6) duodenal ulcers outnumber the gastric in a ratio of 2:1 (Table II); and (7) males outnumber females, but not strikingly so (Table III).*

Peptic ulcers have been shown to occur even *in utero* (Lee and Wells, 1923).

TABLE I

TYPES OF ULCER REPORTED IN VARIOUS AGE-GROUPS

	Stenosing	Perforated	Bleeding	Persistently Painful, *etc.*	Totals
Newborn (0–14 days)	1	18	22	1	42
15 days–1 year	8	15	25	6	54
2–6	2	3	10	5	20
7–11	18	15	8	16	57
12–15	31	26	3	12	72
Totals	60	77	68	40	245

Note that: (1) At least among the cases which have been recognized, ulcers in the newborn, and in the early months of life, characteristically, either bleed seriously or perforate, or do both.
(2) The number of cases of all types, which are recognized, is small in children between two and six years of age.
(3) Among the recognized cases the incidence of pyloric stenosis and perforation increases during the later years of childhood, while the occurrence of serious hemorrhage decreases.
(4) After the eighth year, there are a considerable number of patients with uncontrollable abdominal symptoms, especially pain.

During the first 24 months of life, beyond the newborn period, the number of infants with ulcer diminishes. The nature of the disease also changes, as follows: (1) Although again the great majority of ulcers bleed grossly, or perforate (Table I), there are often premonitory symptoms such as refusal of feedings, evident abdominal pain, vomiting, occasional streaking of blood in the vomitus and melena, sometimes occurring over a period of weeks or

* Kennedy (1926), and others, believe that most cases of melena neonatorum are due to ulcers, and that many of them heal. He states (1924) that acute ulcers are often overlooked at autopsy, and that, frequently, they are quite invisible in a fresh specimen although they may be seen easily if the specimen is examined after a few hours of fixation.

months before the onset of graver symptoms; (2) persistent pylorospasm or inflammatory or cicatricial pyloric stenosis is seen occasionally; (3) many of the patients are septic and marasmic, and the ulcers when seen at autopsy present, as a rule, an acute, subacute or chronic inflammatory base in which are seen numerous bacteria; (4) because of poor general condition very few of these patients are operated upon; (5) in an undetermined number, the symptoms recede and health is regained; (6) in this group the duodenal and pyloric ulcers outnumber the gastric in a ratio of more than 5:1 (Table II); and (7) males outnumber females (Table III).

TABLE II

RATIO OF DUODENAL AND PYLORIC TO GASTRIC ULCERS IN VARIOUS AGE-GROUPS

	Duodenal and Pyloric	Gastric	Total
Newborn (0–14 days)	26 (2)*	12 (1)	38
15 days–1 year	43 (5)	8 (1)	51
2–6	16	6	22
7–11	44	16	60
12–15	55	17	72
Totals	184 (3)	59 (1)	243

* Ratios are in parentheses.

Note that: (1) The ratio of duodenal and pyloric to gastric ulcers is approximately 2:1 in the newborn.

(2) This ratio is about 3:1 for the entire group.

Between the ages of two and six years, the recognized examples of the disorder are very few (Table III). Among 243 cases, only 22 occurred within this period. This contrasts strongly with 89 recorded for the first 24 months of life, 60, for ages between seven and 11 years, and 72 for ages between 12 and 15. Among the examples reported, chronicity, hemorrhage, perforation and stenosis are outstanding features and, except in the children with burns, foci of infection are observed only rarely.

TABLE III

AGE AND SEX DISTRIBUTION AMONG 243 CASES OF DUODENAL AND GASTRIC ULCER

	Male	Female	Sex Not Stated	Total
Newborn (0–14 days)	15	11	12	38
15 days–1 year	22	15	14	51
2–6	11	9	2	22
7–11	35	22	3	60
12–15	43	23	6	72
Totals	126	80	37	243

Note that in all age-groups, males outnumber females, but not strikingly so. The ratio of males to females for the total number is approximately 1.5:1.

As age advances beyond the seventh year, there is a rise in the number of cases recognized, with special accentuation of the symptoms of pyloric stenosis and perforation (Table I). Hemorrhage recedes into the background. A few of the children require surgical treatment because of persistent, uncontrollable indigestion.

Over 70 per cent of the patients reported between the ages of seven and 15 were operated upon. On this basis there must be a large number of unrecognized or unreported cases of acute or subacute ulcer at this time of life, for it is scarcely possible that such a high proportion of the ulcers of childhood should lead to complications which require surgical intervention. It seems probable that acute and subacute ulcers masquerade under diagnoses such as chronic appendicitis, intestinal tuberculosis, mesenteric lymphadenitis, vermiculosis, allergic indigestion, or neurosis.

Among the cases reported in this age-group (seven to 15), the symptoms have often been present intermittently or continuously over a period of months or years. Chvostek (1882) noted a male, age 18, who had had indigestion since age four. Autopsy showed two large, round gastric ulcers, one at the cardia and one at the pylorus, the latter of which had caused pyloric obstruction. Parmentier and Lasnier (1908) told of a female, age 20, whose symptoms of ulcer had been present since infancy; she was improved on medical treatment. Pepper (1899) observed an autopsy on a patient, age 20, whose epigastric symptoms dated back to early childhood and in whom death was due to cicatricial pyloric stenosis. Among patients who were operated upon after the age of 15, and who, thus, were not included in our collection, Ettman (1936) recorded the story of a girl, age 16, whose symptoms for the preceding 18 months were characteristic of ulcer and who then perforated the duodenum; Schalij (1923–1924) reported upon a female, age 18, with recurrent epigastric distress since the age of 12, and high gastric acidity, who at operation revealed a callous ulcer of the duodenum; and Bignami (1939) described a girl, age 17, who had been treated for abdominal distress since the age of 11, and whose chronic duodenal ulcer was relieved by gastro-enterostomy. Von Cackovic (1912) and Proctor (1925) noted that in a considerable number of cases of ulcer in adults the symptoms date back to childhood. Several authors (Kalk, 1928; Rogers, 1928; Hirsch, 1935; Meltzer and Graf, 1936; and Bloch and Serby, 1937) stress the frequency of a familial history of ulcer in affected children.

Surgical Considerations.—Because of advances made in management during the preoperative, operative and postoperative periods, operations upon children, generally speaking, are safer than they were formerly. No rule of thumb can be made in regard to infants and children who present gross gastro-intestinal hemorrhage, or in those in whom septic or marasmic conditions such as malnutrition, furunculosis, otitis media and burns, complicate the picture, but for otherwise healthy children with chronic hemorrhage, perforation, pyloric occlusion, or those in whom pain persists after adequate medical treatment, operation may be said to be indicated.

Our interest in surgery of peptic ulcer in infancy and childhood was aroused by the following case:

Case Report.—Perforated Duodenal Ulcer—Sutured 34½ hours after birth. Recovery. F. W. F., colored, normal appearing, full-term, male infant, weighing seven

pounds and one ounce, was born in the Louisville City Hospital February 19, 1934, at 11:03 A.M.

The mother, age 25, had given birth to four full-term infants in the hospital previously. The third one had died one week after a Ramstedt operation for pyloric stenosis; there was no autopsy. There had been one miscarriage at the third month, but the history did not suggest tuberculosis or syphilis, and the mother's blood Wassermann reaction had been negative on all admissions. When seen in the Prenatal Clinic during the eighth month the blood Wassermann reaction was again negative. Labor began at 2 A.M., February 19, 1934, and she was admitted to the hospital four hours later. The membranes ruptured at 10:45 A.M. During the second stage, which lasted 18 minutes, chloroform was administered in small amounts, and the birth was completed spontaneously in the left occiput anterior position.

There was no asphyxia and the infant cried immediately. He was put to the breast at 6 P.M. and at 10 P.M., and took 35 cc. of water during the first 12 hours. On the day of birth he had one normal meconium stool and voided once. On the next day he was placed on the breast every four hours and allowed water in 15 to 20 cc. amounts between feedings. Another meconium stool was passed and he voided twice. When he was fed at 2 P.M., 27 hours after birth, nothing abnormal was noted, but he cried a great deal shortly afterward, and at 4:30 P.M., 29½ hours after birth, the nurse observed that the scrotum was swollen and that the abdomen was distended. He had not vomited. The rectal temperature was 99.8° F. He was given a colonic irrigation, upon which a pasty, brown stool and a little gas were expelled.

When seen at 6:30 P.M., the abdomen was moderately distended, and the scrotum was ballooned so that the skin seemed stretched to the thinness of paper. The scrotal sac was symmetrical, transilluminated readily, and was tympanitic on percussion. The scrotum could be reduced in size by compression, but on release it refilled and, if at the same time pressure was exerted on the abdomen, the scrotum would distend with a swishing sound. Rectal examination showed nothing abnormal.

Roentgenograms were made with the infant upright, and again in an inverted position. They showed a very large amount of free air in the peritoneal cavity and in hernial sacs, which extended into the scrotum. The findings were diagnostic of a perforation in the gastro-intestinal tract, although the exact nature of the lesion was not suspected preoperatively.

Abdominal exploration was performed under chloroform anesthesia at 9:30 P.M., 34½ hours after birth. This procedure was carried out by Dr. Jacob M. Mayer, then resident surgeon. On opening the peritoneal cavity, free gas and a small amount of serosanguineous fluid were observed. There was moderate hyperemia of the serous surfaces and, here and there, loops of small bowel were bound together by fresh fibrin. The tip of a finger could be introduced into both sides of the scrotum, but no bowel or omentum was present in either hernial sac. Investigation of the upper abdomen revealed an exudate in the region of the gallbladder and duodenum, where all the structures were matted together. When the fresh adhesions were separated, a perforation was found on the anterosuperior surface of the duodenum, immediately distal to the pyloric vein. A moderate amount of bile and mucus exuded from it. The perforation was oval in shape and about 3 Mm. in greatest diameter. There was no induration or edema of its borders and the opening appeared as though a bite had been taken out of the normal duodenum by a sharp instrument. The defect was closed transversely with a row of fine, interrupted chromic catgut sutures and was reinforced by a tier of "A" silk sutures over which was drawn a portion of the gastrocolic omentum. The abdomen was closed securely in layers without drainage. In applying the dressing, the wound was isolated from the umbilicus.

The infant was returned to the ward in excellent condition and was given 80 cc. of 10 per cent dextrose solution intravenously and 350 cc. of isotonic sodium chloride

subcutaneously. During the following 11 hours he vomited small amounts of brownish fluid on three occasions.

At 11 A.M. the next morning, 15 mg. of phenobarbital in a small amount of water were administered by mouth, for restlessness. After 3 P.M., he took water by mouth in 15 cc. amounts at one and one-half hour intervals. At 6:15 P.M., he vomited again and gastric lavage evacuated a moderate amount of brownish fluid. The abdomen was not distended and the rectal temperature had not risen above 99.8° F. He was given 100 cc. of 10 per cent dextrose intravenously and 125 cc. of Hartmann's Ringer-lactate solution subcutaneously. By this time cultures of the free peritoneal fluid, taken at the time of operation, showed no growth.

On February 22, the second postoperative day, the rectal temperature rose at 8 A.M. to 102.2° F. At 9 A.M., he was given 10 cc. of breast milk with 10 cc. of water; at noon and at 3 P.M., he was fed 15 cc. of breast milk with 10 cc. of water and at 6 P.M. and 10 P.M., 20 cc. of breast milk with 10 cc. of water. Water was also given, 30 cc. at a time, during the day, half-way between feedings, and 125 cc. of Hartmann's solution were administered subcutaneously.

On February 23, the third postoperative day, he was fed, as on the last previous occasions, at 2 A.M., and 6 A.M., and was then put to the breast every three hours; each feeding was supplemented by 30 cc. of breast milk. The rectal temperature on this day remained below 99.6° F., and the abdomen was soft.

On February 24, the fourth postoperative day, the temperature was normal and remained so throughout the rest of the stay in the hospital. He took the breast fairly well, although it was necessary to continue the supplementary feedings. The weight, which had dropped seven ounces on the second postoperative day, again approached the birth weight. On the ninth postoperative day he weighed eight pounds, but gradually lost again to seven pounds and two ounces on March 10, then gained gradually. The wound healed cleanly. There was no apparent infection at the umbilicus at any time.

On March 9, the seventeenth postoperative day, a gastro-intestinal examination showed 25 per cent retention of barium in the stomach at six hours; there was a slight residue in the stomach after 24 hours. The infant was discharged in excellent condition March 17, 1934, 26 days after operation. His weight on this date was seven pounds and nine ounces.

The barium meal was repeated on March 31, 40 days after operation. Sixty per cent was found in the stomach at the end of six hours. Five hours later, there was still a large amount of barium in the stomach, but some of it was scattered through the intestinal tract. At 24 hours, the infant had not vomited, and the stomach and most of the bowel were empty.

The patient was readmitted for observation November 2, 1934, at the age of eight and one-half months. According to the mother he had been well since discharge. He had never vomited and the bowels had moved without medication. He had eaten cereals and vegetables in addition to breast milk, orange juice and cod liver oil. He was found to be well-developed, and weighed 17 pounds. The abdominal wound was solidly healed. He had an umbilical hernia. Both inguinal rings were enlarged but definite herniae could not be demonstrated. The testicles were palpable in their normal positions. On November 5, the gastro-intestinal examination was repeated. At the end of six hours there was slight retention of barium, and four hours later the stomach was empty. On November 11, a gastric analysis, using for stimulation 60 cc. of 7 per cent alcohol with histamine added, gave clear, mucoid specimens which contained no blood; the fasting specimen showed free hydrochloric acid 32, total 58; at one-half hour, free 18 and total 24; at one hour, free five and total nine.

On April 30, 1935, 14 months after operation, the child was returned for further observation. He had been well, and his development had proceeded satisfactorily. On May 3, a barium meal revealed the stomach and duodenum to be normal in size, shape, position and function. Barium passed freely from the pyloric antrum into the duodenum and

there was no six-hour residue. The gastric analysis was repeated, this time using 50 cc. of 7 per cent alcohol and 0.09 cc. of 1:1,000 histamine solution. No free hydrochloric acid was found in any of the specimens; the total acidity in the fasting contents was 18, at one-half hour 50, and at one hour 45. Possibly, it is of significance that on the day this determination was made, the rectal temperature was 101.2° F.; two days later he was transferred to the isolation ward with a well-developed case of measles. Recovery was complicated by acute catarrhal otitis media.

The child was studied again in February, 1940, at the age of six. He was in good health. Gastro-intestinal examination showed the esophagus and stomach normal and empty at six hours. There was a smooth outpouching from the duodenal bulb which gave the appearance of a small diverticulum. At 24 hours, the entire tract was empty of barium except for the lower colon. Gastric analysis showed for the fasting specimen free hydrochloric acid two, total 150; one hour after 60 cc. of 7 per cent alcohol, free 20, total 130.

TABLE IV

SITUATION OF ULCERS, AND INDICATIONS FOR OPERATION

	Pyloric Obstruction	Perforation	Hemorrhage	Persistent Pain, *etc.*	Totals
Stomach	7	21	1	1	30
Pylorus or duodenum	42	21	10	10	83
Pylorus and duodenum	4	..	..	..	4
Stomach and duodenum	..	1	..	..	1
Accessory pouch of anomalous stomach	..	..	1	..	1
Totals	53	43	12	11	119

Note that: (1) The pyloric and duodenal lesions constitute 72 per cent of those operated upon.
(2) The indications for operation are, for the most part, pyloric obstruction, perforation of the duodenum or stomach, hemorrhage from the duodenum, or persistent pain due to a pyloric or duodenal ulcer.

Among the 119 cases of peptic ulcer of the stomach or duodenum operated upon between the ages of 34½ hours and 15 years, 53 were for pyloric stenosis, 43 for perforation, 12 for hemorrhage and 11 for uncontrollable symptoms (Table IV). The stomach was involved in 30 cases, the pylorus or duodenum in 83, while in five other cases there were multiple lesions involving more than one part, and in one there was an ulcer in an accessory pouch of an anomalous stomach.

TABLE V

INDICATIONS FOR OPERATION, AND NUMBER OF PATIENTS OPERATED UPON, IN VARIOUS AGE-GROUPS

	Pyloric Obstruction	Perforation	Hemorrhage	Persistent Pain, *etc.*	Number of Patients Operated Upon
Newborn (0–14 days)	1	5	..	..	6
15 days–1 year	3	3	3	..	9
2–6	1	3	4	..	8
7–11	18	7	2	4	31
12–15	30	25	3	7	65
Totals	53	43	12	11	119

Note that: (1) Most of the operations have been upon older children.
(2) The largest number of procedures have been carried out for pyloric obstruction and for perforation, a smaller number for hemorrhage and persistent symptoms.

The indications for operation and the number of patients operated upon in the various age-groups are shown in Table V. In the very young, the

indications were: Persistent pylorospasm, pyloric stenosis, perforation or hemorrhage; in the small group between the ages of two and six years, hemorrhage or perforation; and in the larger groups between seven and 15 years, predominantly cicatricial or inflammatory pyloric stenosis, acute perforation or, in a few, uncontrollable pain. Most of the operations were performed in later childhood.

TABLE VI

TYPES OF OPERATION, AND MORTALITY RATES*

	Closure of Perforation	Pyloroplasty or Gastro-enterostomy	Resection	Totals	Mortality Rate (Per Cent)
Newborn (0–14 days)	5 (4)	..	..	5 (4)	80.0
15 days–1 year	2 (1)	2 (1)	1 (1)	5 (3)	60.0
2–6	1	2	1	4	0.0
7–11	5 (1)	21 (1)	4	30 (2)	6.7
12–15	24† (2)	30	11 (1)	65 (3)	4.6
Totals	37 (8)	55 (2)	17 (2)	109 (12)	11.0

Parentheses indicate deaths.

Note that the mortality rate in the very young has been high, while the rate in the older children has been quite low.

* The following cases are not included in this table:

Šanjck, Weber, Becker; result not stated.
Michaëlsson; gastro-enterostomy, resection elsewhere, at age 21, for jejunal ulcer; result not stated.
Michaëlsson; gastro-enterostomy, second operation at age 17, for jejunal ulcer; died.
Bufe, John; appendicectomies in patients with bleeding ulcers; died.
Lee and Wells; lysis of adhesions in newborn infant with perforating gastric ulcer; died.
Berglund; exploratory celiotomy in an infant with bleeding duodenal ulcer; died.
Phélip and Fey; operative perforation of small bowel in infant with perforated gastric ulcer; died.
Shore; exploratory celiotomy in infant with perforated gastric ulcer; died during operation.
von Móritz; exploratory celiotomy in child with perforated duodenal ulcer and peritoneal abscess; died.
Bechtold; drainage of abdomen, only, in child with perforated gastric ulcer; died.
Peutz; exploratory celiotomy for bleeding duodenal ulcer; recovered.

† The case of Andersen is included in this table, both under closure of perforation and under gastro-enterostomy, and the case of Angel and Angel, and two of Deuticke are included, both under closure of perforation and under resection. In each case there was a long interval between the first and second operations.

The procedures (Table VI) are grouped under the headings: Closure of perforation; gastro-enterostomy (including pyloroplasty); and resection. Although closure of a perforation was carried out in five newborn infants, only our own recovered. The next youngest survivor was a male, age three months, reported by Selinger (1930)—with a recent perforation of the stomach which had sealed over. Downes (1923) successfully sutured an acute perforation of the duodenum in a child, age three. Between the ages of seven and 11 years, five perforations were closed with only one death—in a very ill child, age nine, whose perforation occurred nine days before operation. In the age-group between 12 and 15, 24 perforations were closed with only two deaths, one in a child, age 14, who was operated upon after a delay of 21 hours, and the other, in a boy, age 15, who died 17 days after operation because of an apparently unrelated intestinal obstruction.

The 52 gastro-enterostomies and three pyloroplasties, which are here grouped together, were accomplished with only two fatalities, one in a male infant, age two months, upon whom a Ramstedt pyloroplasty was performed,

under a mistaken diagnosis, and who died of hemorrhage from a duodenal ulcer, and the other, in a boy, age 11, who died following drainage of an hepatic abscess two months after gastro-enterostomy for pyloric stenosis.

We feel the record of resections of stomach and duodenum is remarkable. There were 17 in all, with only two fatalities, one following a pyloroduodenectomy for a large, deeply penetrating juxtapyloric ulcer (Landívar, 1928), and the other, in an infant, age 22 months, with a stenosing ulcer 1 cm. above the pylorus. The surgeon in the latter case (Stohr, 1925) stated that, in his opinion, a gastro-enterostomy would have sufficed.

In Table VI, the mortality rates at different ages may be seen. The chief points of interest are that the rate in the very young has been high (70 per cent), and for the adolescent child rather low (4.6 per cent).

Table VII is introduced for those who may use this article for reference. It indicates the names of the authors; the types of operations performed in the various age-groups; and the survival or death of the patient as the case may be.

Ladd's case has not been published previously. A boy, age 11, gave a history of vomiting and loss of weight of two years' duration. Roentgenologic examination showed pyloric obstruction with 50 per cent gastric retention at the end of 18 hours. A posterior gastrojejunostomy was performed in June, 1938, for an indurated pyloric ulcer. In April, 1940, the boy had gained 33 pounds in weight and was having no symptoms.

Imbassahy refers to the case of E. Mensi, the report of which we have been unable to obtain in the original (Policlinica infantile, January, 1935). A girl, age 13, had had attacks of headache, obstipation and vomiting. Roentgenologic studies showed a niche, characteristic of ulcer, in the duodenal bulb. She was cured by a gastro-enterostomy.

The fact should be mentioned that children are no more immune from the dangers of postoperative gastrojejunal ulcer than are adults. This is seen from the report of three cases by Michaëlsson (1925). We have found two other cases of postoperative jejunal ulcer in individuals within the age-groups under discussion. One of these was described by Freund (1903), and also by Tiegel (1904), the other by Strode (1933).

SUMMARY AND CONCLUSIONS

Our rather complete examination of the literature on the subject forces us to conclude that there are a considerable number of infants and children who at one time or another have peptic ulcers of the stomach or duodenum. We believe that at ages up to and including adolescence there are a large number of unrecognized or unreported ulcers of a potentially serious nature. Probably many of the lesions are acute and superficial and heal quite rapidly when the regimen is altered in some simple manner. In a few cases, the symptoms persist and, if a study with barium is undertaken, an ulcer is found which often shows a definite crater. Roentgenologic studies should, we think, be made more often in the younger patients.

TABLE VII

OPERATIONS FOR PEPTIC ULCER OF THE STOMACH AND DUODENUM IN INFANTS AND CHILDREN

	Closure of Perforation	Pyloroplasty		Gastro-enterostomy	Resection	Appendicectomy	Exploration Only	
Newborn (0–14 days)	Dunham; Thelander and Mathes; Smythe; Bird, *et al.** Stern, *et al.*		Newborn (0–14 days)				Lee and Wells	Newborn (0–14 days)
15 days–1 year	Selinger[7]†; Rosset	Palmer[9]; Bode	15 days–1 year		Stohr		Peutz; Berglund; Shore; Phélip and Fey	15 days–1 year
2			2	Alsberg; Nettelblad	Theile (de Quervain)		von Móritz	2
3	Downes		3					3
4			4			Bufe		4
5			5				Bechtold	5
6			6			John		6
7	Norrlin; Tashiro and Kobayashi		7	Nesselrode, *et al.*; Miller				7
8		Bloch, *et al.*[2]	8	Lund; Rocher; Ceballos				8
9	Lilienfeld-Toal; Löhr[4]		9	Bona; Carro[1]	Paus			9
10	Kårstad[7]		10	Carrick[2]; Smyth, *et al.*; Toro; Gudaitis	Strode[11]			10
11			11	Toro; Norenberg; Vasconcellos; Kennedy; Thevenard[1]; Michaëlsson[13]; Quarella; Henderson; Reydermann; Ladd	Olper; Pototschnig			11
12	Angel and Angel[6]; Kårstad[7]; Deuticke[6]; Paterson; Gordon; Robinson		12	Toro; Larget, *et al.* Weber; Pedrazzi (Solieri)[1]; Rodinò; Obazo and Daza; Norenberg; Micheli; Clairmont; Šanjck[10]	Rodinò; Landívar; Deuticke[6]; Bertrand, *et al.*; Angel and Angel[6]			12
13	Andersen[5]; Deuticke[6]; Cheyne and Wilbe; Nordentoft[4]; Theile (de Quervain); López		13	Foshee[3]; Kellogg[8]; Mensi; Andersen[5]; Proctor; von Cackovic; Caldwell; Micheli	Dickey; Deuticke[6]			13
14	Bichat; Colson, *et al.*[7]; O'Flyn[7]; Selvaggi[3]; Rocher; Wetterstrand; Holm; Korteweg		14	Paus; von Cackovic; Löhr; Reydermann; Proctor[4]	Stocker; Michaëlsson[11]			14
15	Miklós[7]; Imfeld; Holm; Ricard		15	White[4]; Nordentoft (Harsloff); Cavina; Theile (Schanzlin); Micheli; Michaëlsson[12]; Weber[10]; von Cackovic; Dienstfertig	Abadie; Iwata; Becker[10]			15

* Recovery of patient is indicated whenever name of author is underlined.

† *Key*: 1—Plus pyloric exclusion.
2—Plus cauterization of ulcer.
3—Plus cautery excision.
4—Plus excision of ulcer.
5—Gastro-enterostomy; later, two operations for closure of perforations.
6—Closure; later, a resection.
7—Plus gastro-enterostomy.
8—Gastroduodenostomy.
9—Gastro-enterostomy done later.
10—Result not stated.
11—Previous gastro-enterostomy.
12—Operation elsewhere for jejunal ulcer at later date; result not stated.
13—Entero-enterostomy later for perforated jejunal ulcer; died.

For otherwise healthy infants and children with chronic hemorrhage, perforation, pyloric occlusion or uncontrollable symptoms, operation is indicated, but children, like adults, are subject to the dangers of postoperative gastrojejunal ulcer.

Recovery is reported subsequent to the closure, 34½ hours after birth, of a perforated duodenal ulcer in a colored, male infant. The child is well, six years afterward.

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