

DIVERTICULA OF THE JEJUNUM

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JEJUNAL and ileal diverticula (exclusive of Meckel's diverticula) represent the rarest form of diverticulosis affecting the gastro-intestinal tract.

There has been much speculation indulged in regarding the etiology of these diverticula, and much stress has been laid upon differentiating between "true" diverticula, *i.e.*, containing all the coats of the intestine, and acquired or "false" diverticula, *i.e.*, pouchings of the mucous membrane with its submucosa through the muscular layer and thus becoming covered only by the overlying serosa.

In the case reported by Schmidt and Guttman,¹¹¹ in 1934, three diverticula of the duodenum and multiple diverticula in proximal 50 inches of jejunum, both "true" and "false," were present and many transition stages between the two forms were noted. These authors state: "It would be less confusing to designate these diverticula simply as pulsion diverticula without reference to the presence or absence of the muscularis externa."

Godard, Bourdial and Zourekatis,⁴³ in 1932, reported a case of a female, age 39, operated upon for acute intestinal obstruction, from whom 70 cm. of jejunum, containing 25 diverticula, were resected. Five years later, after demonstration of new jejunal diverticula roentgenographically, 80 more cm. of intestine, containing 26 diverticula, were resected. According to them, this would tend to indicate an acquired origin of the diverticula, as none was evident at this site five years previously.

Klebs,⁷² in 1869, pointed out the relationship of diverticula to vessels.

Edwards,²⁸ in 1936, makes out a very good argument elaborating the theory that atypical spasms of the small intestine, as shown roentgenologically in duodenal ulcer cases, might likewise occur in the jejunum and this atypical type of simultaneous spasm at two points, with relaxation in the segment of the gut between, plus the tendency to herniation through weak spots in the musculature at points of vascular perforation, may account for development of jejunal diverticula. Rosedale,¹⁰³ a pathologist, holds the same opinion.

Certain authors, most recently R. W. Butler,¹⁰ suggested traction secondary to sclerosis of mesenteric vessels as a possible predisposing factor. This theory seems to be ruled out in part by the findings in four of Rosedale's seven cases, who found no sclerosis of the vasa recti either grossly or microscopically.

Lewis and Thyng,⁷⁸ in 1908, reported on the regular occurrence of intestinal diverticula in mammalian embryos, notably those of the rabbit, pig and man.

Associated diverticulosis of the duodenum and colon has been noted in a considerable number of cases. Diverticulosis of the colon is the most com-

mon; next, single and multiple diverticulosis of the duodenum; and lastly, a single and multiple diverticulosis of the jejunum. The upper jejunum is the most frequent site of diverticular involvement.

Diverticula may be single or multiple—as many as 400 or 500 have been reported. Their size varies from that of a lentil to that of a mandarin orange or even larger. Their openings into the intestine are usually wide. Stagnation of their contents is exceptional. This explains the rarity of their demonstration roentgenologically. Occasionally, however, stagnation does occur. Four cases of intestinal obstruction from enteroliths arising in jejunal diverticula are reported (Christ,²⁰ Renaud,¹⁰⁰ Terry and Mugler,¹²⁶ and Watson*¹³²). One foreign body, a piece of bone, was reported by Ogloblina.⁹² Two instances of intestinal parasites are noted (Goinard and Courrier,⁴⁴ and Rosedale).

At first they were discovered at autopsy. More recently a considerable number have been found during the course of celiotomies performed for other conditions. And still others have required operation as a result of stagnation, inflammation, or intestinal obstruction from pathologic conditions in the diverticula themselves.

Undoubtedly, jejunal diverticula occur more frequently than has hitherto been supposed. Rosedale, in 1935, reported three cases of multiple diverticula of the jejunum among 5,000 autopsies. Yet, in 1936, as a result of routine insufflation of the small intestine *in situ* under moderate air pressure, he found four cases among 300 autopsies. Guthrie⁵⁰ holds the same opinion regarding their greater frequency.

In most cases the diverticula have given rise to no symptoms. In others, vague gastro-intestinal symptoms, aptly described by Edwards as “flatulent dyspepsia,” that is, epigastric pain and discomfort accompanied by a certain amount of flatulence an hour or two after meals, have been the outstanding feature. Lastly, there have been cases of perforation with peritonitis. Some of these perforations have been rather slow, permitting the walling-off and localization of the inflammatory process. Others have been fulminating and acute (Case 1).

The diagnosis has occasionally been made, since 1920, roentgenologically. In fact, while this is the only positive diagnostic criterion, it is not very reliable, as there are instances where multiple diverticula found during celiotomy could not be demonstrated roentgenologically after operation, notwithstanding their known existence. Rankin and Martin,⁹⁸ in 1934, reported that among 956 cases of “stasis examinations” of the small intestine, in only three instances were diverticula of the small bowel demonstrated. Yet, diverticula were found 18 times at operation for other conditions in their series of 52 cases.

Sometimes roentgenologic examination with the patient erect reveals the partly filled diverticula as a series of horizontally surfaced half moons of dif-

* Zengerle (cited by Kaspar) reported enteroliths in jejunal diverticula but failed to mention the outcome.

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ferent sizes to the left and below the stomach, each with its own supernatant gas bubble. In the early films they were interpreted as multiple points of partial obstruction from tuberculous peritonitis until the subsequent operation showed them to represent jejunal diverticula.

In other instances, irregularly rounded, barium pockets remained after the small intestine had become empty. Their position changed (within a range of several inches) upon change in posture or by palpation under the fluoroscope.

In certain of these, high up in the jejunum, partly visible above the lesser curvature of the stomach, the superimposed shadows gave the picture of a penetrating gastric ulcer. Lateral and oblique views and serial studies in different postures were necessary to establish the correct diagnosis.

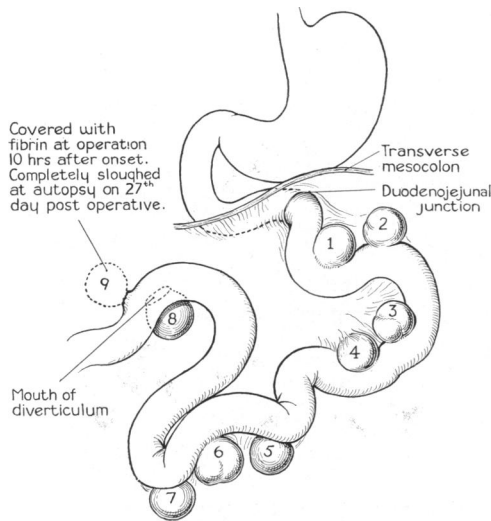


FIG. 1.—Diagram representing multiple (9) large "false" diverticula of the upper jejunum. Numerous smaller diverticula also present. Diffuse peritonitis from perforation of lowermost diverticulum. Operated upon eleven hours after onset. Death from uremia and cardiac failure on twenty-seventh day postoperative. The perforated diverticulum had completely sloughed away.

Indications for Treatment.—If multiple diverticula are found by chance at operation, or in the roentgenogram, and symptoms point to some other lesion, they should be left alone. In Rankin and Martin's series of 52 cases of the diverticula of the small bowel, no case was operated upon for symptoms thought to arise from the diverticula.

On the other hand, there is a group of cases exhibiting the so-called "flatulent dyspepsia" of Edwards, lasting for months or years. In a number of these, side-tracking entero-anastomoses did not improve matters, and secondary resections were necessary to obtain relief. The only exception to this was the case of Godard, Bourdial and Zourekatis, previously referred to, where a resection of 80 cm. of affected jejunum was followed by a second

resection five years later, following development of additional diverticula in a segment of gut not showing any present at the first operation.

In other instances a large, single diverticulum has been excised and intestine infolded. Two or three times the lumen of the intestine was so narrowed by the excision that an entero-anastomosis was necessary. In other cases the diverticula themselves were simply infolded.

Still another group of cases showed subacute and acute perforation with their various complications. Of these, some give a history of previous attacks, mistaken for gastric or duodenal ulcer or appendicitis until their true cause was revealed at operation. Others, however, gave no previous history of any digestive disturbance prior to a sudden onset (Butler,¹⁰ Spackman¹¹⁷). Case 1 belongs to this category.

It is apparent, therefore, that the choice of procedure will depend upon the exigencies of each case.

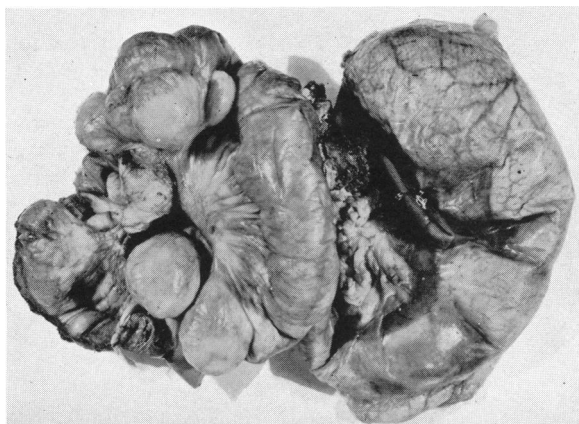


FIG. 2.—Autopsy specimen: Multiple “false” jejunal diverticula.

Case 1.—A. T., male, age 51, a brewery employee, was admitted at 4 A.M., May 19, 1935, to the Lenox Hill Hospital, service of Dr. DeWitt Stetten. He had always been healthy, had enjoyed excellent digestion and for years had been accustomed to drink 60 glasses of beer daily. Nine and one-half hours before admission, there was a sudden onset of abdominal pain accompanied by vomiting. *Physical Examination* showed a very obese man, acutely ill, with signs of a diffuse peritonitis. A tentative diagnosis of a perforated diverticulum of the sigmoid was made.

Operation.—(11 hours after onset): A diffuse, generalized peritonitis with free fluid was found. Beginning about 20 cm. below the duodenojejunal angle were nine large diverticula of the jejunum situated along the mesenteric border at intervals of a few inches for about 100 cm., six on the left and three on the right (Figs. 1 and 2). All except the lowermost (No. 9), were healthy in appearance and could be invaginated. Their size varied between that of a small mandarin orange and a golf-ball. The last diverticulum was covered with fibrin and was obviously the cause of the peritonitis. No gross perforation was to be seen. The patient's condition did not permit doing anything more than the placing of rubber dam drains to the region of the affected diverticulum and to the pelvis. The peritoneal fluid showed pure culture of *Bacillus coli communis*.

Postoperative Course.—There was fair postoperative recovery and free drainage of

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serous fluid for a few days. After the seventh day an impending uremia (urea-nitrogen had increased to 62.5 mg.) responded to treatment within a day or two. Also about this time, there occurred a partial escape of small intestinal contents from the drainage tract to the diverticulum. The general condition was only fair. Although his sensorium was clear, and he took food and liquids freely, and his bowels moved with enemata, his circulation was poor, the extremities were always cold and clammy, and there was profuse sweating. The abdomen was flat, with normal temperatures between the 17th and 25th days, when again signs of increased cardiac failure and uremia supervened which did not respond to treatment. Death occurred on the 27th postoperative day.

Autopsy showed no peritonitis except for adhesions at the point where the inflamed diverticulum (No. 9) had been drained. The latter was found to be completely sloughed down to its opening in the intestinal wall. The specimen shows a large beer drinker's stomach, eight large diverticula of the upper jejunum and only the mouth of the ninth. On inflation many small, additional diverticula became evident.

The heart was small and flabby, and weighed 325 Gm. There was an atrophic cirrhosis of the liver. It seems probable that a thrombosis of the vessels supplying the affected diverticulum was followed by necrosis with perforation and subsequent sloughing of the entire diverticular wall.

Carl Eggers has kindly furnished the author with the following data of a hitherto unpublished case :

Case 2.—(Dr. Carl Eggers) : I. W., female, age 62, had a gastro-enterostomy performed for pyloric stenosis due to ulcer, at the Lenox Hill Hospital, New York, November 19, 1927, in addition to which there was a penetrating ulcer high up on the lesser curvature. In the course of the operation, multiple (12) diverticula of the jejunum along the mesenteric border, diminishing in size from above downward, were found. These varied in size from a walnut to a hazelnut. Nothing was done to the diverticula. Postoperative roentgenologic examination showed no gastric retention and, repeated two years later, gave the same result. The roentgenograms showing the diverticula were unfortunately lost.

CONCLUSIONS

Although diverticulosis of the jejunum occurs more infrequently than elsewhere in the gastro-intestinal tract, its incidence is probably greater than has hitherto been suspected.

A large proportion of diverticula of the jejunum give no symptoms. They are discovered most frequently either at autopsy or during an operation for some other condition.

A second group gives rise to symptoms of so-called "flatulent dyspepsia" (Edwards) over a period of months or even years. Excision of a large solitary diverticulum, or resection of the jejunal segment bearing multiple diverticula, has given relief.

Still another group with acute attacks from time to time, eventually develops chronic intestinal obstruction from kinking of the intestines by adhesions to previously inflamed diverticula.

There is a group that presents no history of antecedent illness, which suddenly experiences acute perforation of a hitherto silent diverticulum.

For the reader's convenience, brief abstracts and explanatory notes have been appended to the list of bibliographic references. Unless specifically

stated otherwise, the diverticula mentioned in these notes, were situated along the mesenteric border of the jejunum.

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128 REFERENCES, RECORDING 187 CASES OF JEJUNAL DIVERTICULA, OF WHICH 135
HAVE BEEN ABSTRACTED

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Figs. 610 and 611 show multiple jejunal diverticula. They filled and emptied rapidly—an elderly female with 60 diverticula in all.
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Case 2.—Male, age 63; two years history of abdominal symptoms. *Roentgenologic diagnosis made*; celiotomy—hundreds of diverticula, nothing done; recovery.
Case 3.—Male, age 61; autopsy, arteriosclerosis, 50 diverticula—history of "flatulent dyspepsia."
Case 4.—Female, age 72; operation 12 hours after onset of symptoms; multiple diverticula—one perforated—resection of two feet of intestine; recovery.
Case 5.—Male, age 56; operation 12 hours after onset; perforation of one of five large diverticula; resection; death on fourth day.
Case 6.—Female, age 72; operation 36 hours after onset; seven diverticula, one perforated with abscess; resection; death from uremia six days postoperative.

- Case 7.—Male, age 64; operation 24 hours after onset, great many diverticula—inflammation with localized peritonitis around upper jejunum—nothing further done—closure—recovery (probably diverticulitis of sigmoid as well).
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Male, age 48; autopsy, cerebral thrombosis—one “true” diverticulum, 18 inches below duodenojejunal angle, on mesenteric border.
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found by chance, adhesion to stomach divided. Recovery. Good roentgenograms taken *after* operation (illustration).

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(2) Female, age 38; "flatulent dyspepsia" for six to eight years. *Preoperative roentgenologic diagnosis positive*. Resection. Recovery. The resected segment of intestine showed six or eight diverticula and also a nodule of aberrant pancreatic tissue on the antimesenteric aspect of the bowel.
(3) Female, age 63; no history. Autopsy; six diverticula of upper jejunum.
(4) Male, age 48; autopsy; no symptoms during life, single diverticulum.
(5) Male, age 7; specimen received from Madras. Solitary diverticulum.
(6) Female, age 62; solitary diverticulum (antimesenteric) found at autopsy.
(7) Female, age 57; autopsy; malignant tumor in neck of diverticulum (patient died of "malignant disease").
(8) Male, age 53; acute onset (24 hrs). Operation; acute inflammation of diverticulum. Resection; recovery.
(9) Male, age 49; abdominal complaints for six years. *Diagnosed roentgenologically*. Excision of diverticulum, lumen of intestine narrowed, necessitating posterior gastroenterostomy.
(10) Male, age 55. Gastric ulcer. *Preoperative roentgenologic demonstration of ulcer and jejunal diverticulum positive*. Operation; partial gastrectomy, diverticulum not disturbed. Death.

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- (11) Male, age 69; "flatulent dyspepsia" for 18 months. *Roentgenologic examination showed several jejunal diverticula, also diverticula of the colon.* No operation.
- (12) Male, age 67; abdominal symptoms for two years. *Roentgenologic examination showed two jejunal diverticula.* No operation.
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with four openings into the intestine; microscopic examination showed all coats present in cyst wall.

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Discussion on etiology of "false" diverticula. No case reports.
- ⁴⁹ Grassberger, R.: *Wien. klin. Wchnschr.*, **10**, 149, 1897.
Male, age 73; autopsy; perforated duodenal ulcer, one jejunal diverticulum, one diverticulum of stomach, two of the duodenum, and multiple diverticula of the colon.
- ⁵⁰ Guthrie, D., and Hughes, F. A., Jr.: Diverticulosis of the Small Intestine. *Surgery*, **1**, 595-609, April, 1937.
(1) Male, age 71; digestive disturbances; preoperative roentgenologic examination negative for diverticula. Operation: Resection of five feet of jejunum containing multiple (70) diverticula. Death.
(2) Male, age 61; "flatulent dyspepsia" for one year. (1) Gastro-enterostomy for duodenal ulcer—vicious circle—for this a second entero-enterostomy; recovery. At second operation three jejunal diverticula were found, the larger two of which were excised.
(3) Male, age 54; several large hemorrhages from bowel; transfusion. *Roentgenologic examination showed jejunal diverticula*. Operation: Resection of 19 inches of jejunum which contained 22 diverticula. Recovery.
- ⁵¹ Hansemann: *Virchows Arch.*, **144**; *Arch. f. path. Anat.*, **138**, 347, 1896.
Male, age 85; autopsy; 400 jejunal diverticula.
- ⁵² Harttung: Dünndarmdivertikel mit eigemartigen klinischen Erscheinungen. *Arch. klin. Chir.*, **143**, 234-237, 1926.
Female, age 66; resection of 20 cm. of jejunum for intramesenteric cyst, which extended to both sides of mesentery, and was hen's egg in size. Recovery.
- ⁵³ Heidecker: Multiple Divertikelbildung des Duodenum und Jejunums. *Ref. XV Taggsudostdsch. Chir. ver. gbl. Chir.*, **3**, 2728, 1927. *Bruns Beiträge zur klin. Chir.*, **142**, 776, 1928.
Male, age 54; multiple diverticula; "flatulent dyspepsia"—celiotomy, multiple diver-

- ticula (30) of jejunum; seven months later second operation; resection of involved intestine. Recovery.
- ⁵⁴ Helvestine, F.: "False" Diverticula of the Jejunum. *Surg., Gynec., and Obstet.*, **37**, 1, 1923.
- (1) Male, age 70; autopsy; 58 jejunal diverticula—old prostatic, one bladder diverticulum—death from uremia.
- (2) Female, age 59; autopsy; peritonitis from ruptured gallbladder; one "false" diverticulum on antimesenteric border.
- ⁵⁵ Hodenpyl: *Proc. New York Path. Soc.*, p. 182, 1900.
- Pathologic specimen of duodenum and upper jejunum seat of a number of thin-walled cysts (diverticula).
- ⁵⁶ Hunt and Cook: Jejunal Diverticula. *ANNALS OF SURGERY*, **74**, 746, 1921.
- (1) Male, age 54; "stomach trouble" for 15 months. *Preoperative roentgenologic diagnosis* of diverticulum of jejunum. Excision of diverticulum 3 by 3 cm. Recovery.
- (2) Male, age 44; acute onset 12 hours—appendectomy—sudden death two days later. One jejunal diverticulum found at autopsy.
- ⁵⁷ Hunter, J. L.: A Mesenteric Cyst of Jejunal Origin Complicated by Retrojejunal Position of the Transverse Colon. *Brit. Med. Jour.*, **2**, 800, 1922.
- Child, age seven days; autopsy; large, bilocular mesenteric cyst compressing jejunum 10 cm. beyond the duodenojejunal flexure. Cyst "originated as an enteric diverticulum." (Ref. Buchwald and Janicke's¹⁶ case.)
- ⁵⁸ Jenkinson, Edward L.: Diverticula of the Small Bowel. *Radiol.*, **12**, 100-105, 1929.
- Male, age 59; "flatulent dyspepsia" for three years. *Roentgenologic diagnosis positive*, and confirmed at operation. Five feet of jejunum showed diverticula. Recovery. Symptoms unchanged.
- ⁵⁹ Johnson, E. A.: Diverticula Spuria Intestinalis. *Australian Med. Gaz.*, **25**, 333, 1906.
- Male, age 90; autopsy; multiple large (3 by 2 inches) diverticula of jejunum, also a diverticulosis of the colon.
- ⁶⁰ Jones, T. J., and Crile, G., Jr.: Diverticula of Jejunum; Report of 4 Cases. *Am. Jour. Digest. Dis. and Nutrit.*, **3**, 120-122, April, 1936.
- (1) Male, age 32; "flatulent dyspepsia" for two years. Operation, excision of jejunal diverticulum; recovery.
- (2) Female, age 67. *Roentgenologic examination showed two duodenal diverticula and many others in the small intestine.* No operation.
- (3) Male, age 42; "dyspepsia" for ten years. Presumptive diagnosis *duodenal ulcer* and one diverticulum of jejunum (probable). No operation.
- (4) Female, age 40; three months' abdominal symptoms. *Roentgenologic findings:* Diverticula of duodenum (1), of duodenojejunal junction (1), and "one farther along in the small intestine." Operation: Multiple diverticula of small intestine—larger ones excised. Recovery.
- ⁷⁰ Kaspar, Fritz: Der Divertikelileus. *Arch. klin. Chir.*, **141**, 389-418, 1926.
- Male, age 49; attacks of abdominal pain for many years. Celiotomy for intestinal obstruction due to old adhesions to diverticulum, other multiple diverticula; invagination and suture, entero-anastomosis; recovery.
- ⁷¹ Keith, A.: Diverticula of the Alimentary Tract of Congenital or of Obscure Origin. *Brit. Med. Jour.*, **1**, 376, 1910.
- Cites seven specimens of multiple diverticula of jejunum in London.
- ⁷² Klebs: *Handbuch der pathologischen Anatomie*, 1869.
- ⁷³ Kornmann (ref. Kaspar⁷⁰): *Zent. f. Chir.*, **1**, 1912.
- Female, age 85; autopsy; multiple (62) jejunal diverticula.
- ⁷⁴ Levy, J. S., and De Groat, A.: Diverticula of Jejunum, Review of Literature and Report of Two New Instances. *Am. Jour. Digest. Dis. & Nutrit.*, **1**, 708-713, December, 1934.
- (1) Male, age 75; vagabond American Indian; autopsy; multiple (25) diverticula.

- (2) Female, age 42; ten years "flatulent dyspepsia." *Roentgenologic diagnosis positive*; one "false" diverticulum. Excision; recovery (gallbladder and appendix also removed).
- ⁷⁵ Lambret, O., et H. Surmont: Un cas de diverticules multiples du jeuno-ileon. Arch. des. Mal. Appar. digest., **18**, 765-771, 1928.
Male, age 50; many previous abdominal attacks, obstructive crisis. Multiple diverticula on mesenteric border. Resection of 50 cm. Recovery.
- ⁷⁶ Latarjet and Murad: Lyon chir., **11**, 425, 1914.
(1) Female, age 50; autopsy; one large diverticulum at duodenojejunal angle.
(2) Male, age 71; autopsy; multiple jejunal diverticula.
- ⁷⁷ Leriche, R.: Sept diverticules jejunaux, dont un tres volumineux immediatement apres l'angle duodeno-jejunal. Bull. et mem. Soc. Nat. de chir., **58**, 1044-1045, July 9, 1932.
Male, age 61; symptoms 40 yrs. *Roentgenologic diagnosis positive*. Excised one large diverticulum. Recovery.
- ⁷⁸ Lewis, F. J., and Thyng, F. W.: The Regular Occurrence of Intestinal Diverticula in Embryos of Pig, Rabbit, Man. Am. Jour. Anat., **7**, 505, 1907-1908.
- ⁷⁹ MacKechnie, H. N.: Diverticula of the Jejunum. ANNALS OF SURGERY, **74**, 96, 1921.
Female, age 43; markedly asthenic, "flatulent dyspepsia" for several years. Operation, 13 jejunal diverticula; three duodenal diverticula; gastro-jejunostomy; death. Autopsy.
- ⁸⁰ McMurrich, J. P., and F. F. Tisdall: A Remarkable Ileal Diverticulum. Anat. Rec., **39**, 325-338, 1928.
Male, age one year (13 mo.); autopsy; paramesenteric "true."
- ⁸¹ McWilliams, C. A.: ANNALS OF SURGERY, **73**, 135, 1921.
Male, age 71; acute abdominal symptoms for 24 hours. Autopsy; mesenteric thrombosis, seven "false" jejunal diverticula.
- ⁸² Merkelbach, O.: Jeuno-ileal-Divertikel. Ztschr. f. Klin. Med., **124**, 426-434, 1933.
(1) Male, age 58; two years "flatulent dyspepsia." Roentgenologic examination, multiple jejunal diverticula. Operation, 40 jejunal diverticula found. Recovery.
(2) Male, age 59; carcinoma of esophagus; *Roentgenogram also showed diverticula of jejunum* (personal communication of Rutimeyer and Baumann).
- ⁸³ Melchior, N. D.: Chir., Bd., **25**.
- ⁸⁴ Miller, A. M.: Isolated Diverticulum of the Jejunum. Am. Jour. Surg., **2**, 116, 1931.
Female, age 42; "stomach trouble" three years. *Preoperative roentgenologic diagnosis*. Excision of diverticulum; recovery.
- ⁸⁵ Moore, N.: Brit. Med. Jour. 1883, **11**, 1920.
Male, age 40; autopsy; pneumonia (?); three "true" diverticula of jejunum on the mesenteric border.
- ⁸⁶ McGrath, B. F.: Intestinal Diverticula. Surg., Gynec., and Obstet., **15**, 429, 1912.
An autopsy specimen of multiple paramesenteric diverticula of small intestine. Remainder of article deals with diverticulitis of colon. Probably included in Rankin's series.
- ⁸⁷ Moreau, J., and Murdoch, J.: Diverticules du Jejunum. Arch. franco belges de Chir., **28**, 192-202, 1925.
Female, age 63; digestive disturbance one year. Roentgenologic diagnosis of diverticula. Operation, multiple diverticula (12). Resection; death.
- ⁸⁸ Moynihan, Berkeley: Diverticula of the Alimentary Canal. Lancet, **212**, 1061-1066, 1927. Brit. Med. J., **3454**, 513-514, 1927.
General considerations—no case reports.
- ⁸⁹ Neumann (ref. Kaspar⁷⁹): Deutsch. Ztschr. f. Chir., **126** (ref. Fischer³¹).
Female, age 49; lumen of small intestine in one loop narrowed to diameter of a probe by scar tissue, ascribed to chronic inflammation arising from multiple diverticula.

- ⁹¹ Nichols, A. G.: Montreal Med. Jour., **28**, 387, 1899.
Female, age 64; autopsy, 45 jejunal diverticula.
- ⁹² Ogloblina, S.: Multiple Divertikel des Dunndarmes, z. sovrem. Chir. (russ), **5**, 1930.
Ref. Nach. zbl. Chir., **3**, 3169, 1931.
Female, age 61; "flatulent dyspepsia." *Preoperative roentgenogram showed two areas suggestive of jejunal diverticula.* Operation, numerous jejunal diverticula—bean to pigeon-egg size; resection; recovery (a piece of bone—foreign body—found lying in one diverticulum).
- ⁹³ Osler, W.: Ann. of Anat. and Surg., **4**, 202-207, 1881.
Male, age 65; "flatulent dyspepsia" for years. Autopsy, 53 diverticula of jejunum.
- ⁹⁴ Modesto Dalla Palma: Über multiple Divertikel des Darmes. Pathologica, **18**, 65, 1926.
Female, age 73; autopsy; multiple paramesenteric jejunal diverticula.
- ⁹⁵ Poncher, H. G., and Miles, G.: Cysts and Diverticula of Intestinal Origin. Am. Jour. Dis. Child., **45**, 1064, 1933.
Excellent bibliography especially on intramesenteric diverticula and cysts of ileum in children (ref. McMurrich and Tisdall⁹⁶).
- ⁹⁶ Pinnering and Burman: (ref. Rankin and Martin⁹⁸).
Male. Operation for obstruction; multiple diverticula on mesenteric border found; died.
- ⁹⁷ Rave: Klin. Wchnschr. No. 15, 1926.
- ⁹⁸ Rankin, F. W., and Martin, W. J.: ANNALS OF SURGERY, **100**, 1123, 1934.
52 cases of diverticula of small bowel; of these 28 were multiple, and 24 were single.
39 jejunal, 11 ileal, two both jejunal and ileal.
18 times found at operation; 31 times found at autopsy.
38 were in males; 14 in females.
Diagnosed roentgenologically three times in 956 roentgenologic examinations.
No case was operated upon for symptoms thought to arise from diverticula.
Symptoms: Thirty had "flatulent dyspepsia"; 11 had gallbladder syndromes, four operated on for gastric, duodenal or appendicular disease.
Operative procedures: two invaginations, two excisions, one side-to-side anastomosis.
- ⁹⁹ Regnier, E.: Multiple Dünndarmdivertikel. Fortschr. a.d. Geb. d. Röntgenstr., **38**, 1101-1104, December, 1928.
Female, age 58; "indigestion" for seven months. *Roentgenologic diagnosis confirmed at operation and autopsy:* Three duodenal diverticula and multiple (100 plus) jejunal diverticula.
- ¹⁰⁰ Renaud, Maurice, et Bergeret: Deux Diverticules de l'intestin. Bull. Soc. Anat. Paris, **18**, 220-223, 1921.
Female, age 62; duodenal ulcer. Operation, duodenal diverticula, also multiple jejunal diverticula; 4 cm. from duodenojejunal angle an especially large diverticulum with a pedicle was excised; contained an enterolith.
- ¹⁰¹ Reinhardt: Multiple Divertikel des Jejunus. Ref. viii Tagg. Ver Mitteldtsch. Chir. 1925; Zentralbl. Chir., **1**, 1091, 1926.
(1) Male, age 66 } All found { Some associated with
(2) Male, age 84 } at { duodenal and gastric
(3) Female, age 86 } autopsy { diverticula.
- ¹⁰² Rodenbaugh, Frederick H., and Ingber, S. Irving: Diverticula of the Small Intestine. Am. Jour. Roentgenol., **18**, 62, 1927.
- ¹⁰³ Rosedale, R. S.: Jejunal Diverticulosis. Surg., Gynec., and Obstet., **61**, 223, 1935.
(1) Male, age 60; autopsy; carcinoma of bladder, 24 jejunal diverticula; *Taenia saginata* 55 inches long, head attached to ostium of a diverticulum (second case on record, ref. Goinard and Courier,⁴⁴ strongyloides intestinalis).
(2) Male, age 73; autopsy; carcinoma of esophagus, 15 jejunal diverticula.
(3) Female, age 62; autopsy; arteriosclerosis, 23 jejunal diverticula, 250 colonic diverticula.

- ^{105a} Rosedale, R. S., and Lawrence, H. R.: Jeunal Diverticulosis. *Am. Jour. Surg.*, **34**, 369, 1936.
 (1) Male, age 53; no history of indigestion. Autopsy; diabetic coma, arteriosclerosis, six jejunal diverticula.
 (2) Female, age 61; autopsy; carcinoma of lung, multiple jejunal and ileal diverticula, also isolated chronic peridiverticulitis.
 (3) Female, age 28; autopsy; pulmonary tuberculosis, multiple diverticulosis of duodenum and jejunum.
 (4) Female, age 68; autopsy; gangrenous appendicitis, multiple diverticula of jejunum (34) and of colon.
- ¹⁰⁴ Rössle, R.: *Münch. med. Wehnschr.*, **57**, 332, 1910.
 Female, age 52; multiple (7) jejunal diverticula.
- ¹⁰⁵ Rothschild, N. S.: Diverticula of the Jejunum. *ANNALS OF SURGERY*, **82**, 250, 1925.
 Female, age 63; abdominal symptoms for 15 years. *Preoperative roentgenologic diagnosis of jejunal diverticulum*. Operation, healed pyloric ulcer, gallstones, large "true" jejunal diverticulum on antimesenteric border. Cholecystectomy, appendectomy, excision of diverticulum using base for posterior gastro-enterostomy. Recovery.
- ¹⁰⁶ Roth: *Arch. d. path. Anat.*, **12**, 197, 1872.
- ¹⁰⁷ Rider, J. R.: *Vet. Records*, **10**, 707, 1930.
- ¹⁰⁸ Roevekamp: *Fortschr. a. d. Geb. d. Rontgenstrahlen*, **36**, 298, 1927.
 Differential roentgenologic diagnosis between niche of lesser curvature and jejunal diverticulum.
 Female, age 28; *Examined roentgenologically* but not operated upon.
- ¹⁰⁹ Rokitansky: *Lehrb. d. Path. Anat.*, **2**, 36, 1856.
- ¹¹⁰ Santoro, Mario: *Reperto radiologica et Operatorio di diverticolo del diguino*. *Arch. di. Radiol.*, **2**, 121-127, 1925.
- ¹¹¹ Schmidt, E. A., and Guttman, P. H.: Multiple Diverticula of Jejunum and Duodenum Simulating Gastric Diverticula and Complicated by Cholelithiasis. *Am. Jour. Roentgenol.*, **31**, 200-203, February, 1934.
 Female, age 50. Very poor condition following previous cholecystectomy for gallstones, digestive disturbances continued. *Roentgenologic examination showed duodenojejunal diverticulosis*. Exploratory celiotomy attempted but condition prevented completion. Death. Autopsy: Gallstone impacted in papilla of Vater; three duodenal diverticula, and 59 jejunal diverticula in the upper 50 inches of intestine.
- ¹¹² Seippel: *Inaugural Dissertation*, 1895, Zurich (ref. MacKechnie⁷⁹).
 Autopsy: Multiple "false" jejunal diverticula.
- ¹¹³ Sheppe, W. M.: "False" Diverticula of the Jejunum. *J.A.M.A.*, **82**, 1118, 1924.
 Male, age 75; uremia. Autopsy; carcinoma of prostate, multiple (54) jejunal diverticula.
- ¹¹⁴ Siera: *Bol. Soc. Chir. Chile*, **5**, No. 15.
- ¹¹⁵ Simons, E. J.: Multiple Diverticula of the Small Intestines. *Minn. Med.*, **2**, 1928.
 Male, age 57; three previous acute abdominal attacks, now sudden abdominal pain. Diagnosis.—Perforated duodenal ulcer. Celiotomy Findings.—Upper jejunum contained innumerable diverticula. It was cyanotic and distended, and its mesentery milky white for two feet. Bowel stimulated with hot packs. Recovery.
- ¹¹⁶ Somerford, A. E.: Two Cases of Intestinal Disease in Infancy; Congenital Diverticulum of the Jejunum. *Lancet*, **1**, 1015, 1930.
 Male, age seven months; melena for two months. Autopsy: Sac (resembling small intestine) 9 by 4 by 2 cm., apparently had bled from this sac as the intestinal tract above was light and below the sac it was dark.
- ¹¹⁷ Spackman, J. G.: Perforation of a Jejunal Diverticulum. *ANNALS OF SURGERY*, **84**, 778-780, 1926.
 Male, age 75; sudden onset of severe abdominal pain. Operation: Free, foul fluid, seven diverticula, two largest acutely injected, one perforated. Resection of 15

- cm. of jejunum. Death in 48 hours. Autopsy: Anastomosis intact; five additional diverticula found. None inflamed.
- ¹¹⁸ Spriggs, E. J., and Marxer, O. A.: An Address on Intestinal Diverticula. *Quar. Jour. Med.*, **19**, 10, 1925-1926.
Diverticula of jejunum observed in seven patients. Duodenal diverticula also in one case.
- ¹¹⁹ Stegmann: 300 Divertikel an Jejunum und Ileum. Ref. 55, *Verh. deutsch. Ges. Chir. fortschr. Rontgenstr.*, **44**, 118, 1931.
Same case as Gisbertz.⁴⁰
- ¹²⁰ Stetten, DeWitt: Multiple Diverticula of the Upper Ileum. *ANNALS OF SURGERY*, **73**, 241, 1921.
Male, age 38; several months' "flatulent dyspepsia"; *Preoperative roentgenologic Diagnosis*: Diverticulosis of entire colon; two diverticula of jejunum. Operation: Excision of jejunal diverticula; recovery.
- ¹²¹ Sudsuki: Ueber Divertikel am S Romanum (sigmoid). *Langenbeck's Arch. f. klin. Chir.*, **61**, 708, 1900.
No jejunal cases cited.
- ¹²² Swanberg, H., and Montgomery, E. B.: Solitary Diverticulum of the Jejunum. *Radiol.*, *St. Paul*, **7**, 1926.
Female, age 55. *Diagnosed roentgenologically*.
- ¹²³ Taylor and Lakin: *Lancet*, **1**, 495, 1910.
Female, age 68. Autopsy: Pneumonia; multiple "false" diverticula of jejunum; colonic diverticulosis.
- ¹²⁴ Tengwall, E.: Case of Multiple Diverticula in the Jejunum. *Acta Chir. Scandinav.*, **68**, 162, 1931.
Female, age 49; chief complaint bleeding from bowel and vague digestive disturbance. *Roentgenologic examination showed many diverticula*. Operation: Multiple diverticula for 50 cm. of jejunum, from hazelnut to hen's egg in size. Resection. Recovery.
- ¹²⁵ Tengwall, Ernst: A Case of Diverticula in the Jejunum. *Acta Chir. Scandinav. (Stockh.)*, **68**, 162-170, 1931.
Female, age 49. *Preoperative roentgenologic diagnosis: Multiple diverticula*. Resection. Recovery.
- ¹²⁶ Terry, W. I., and Mugler, F. R.: Diverticula of the Jejunum. *Arch. Surg.*, **2**, 347, 1921.
Female, age 59; operation No. 1 for duodenal ulcer—five diverticula of jejunum, two were inverted. Operation No. 2 for intestinal obstruction by enterolith in a diverticulum.
- ¹²⁷ Treves, Frederick: Intestinal Obstruction, Jacksonian Prize Essay, p. 45, 1883.
Speaking of false diverticula Treves considers them "hernial protrusions of the mucous membrane of the bowel through the muscular coat, and hence the common name 'distension diverticula.' In structure they are composed simply of mucous membrane and peritoneum. They present in their walls no muscular fibers. The lining mucous membrane in the smaller pouches is quite normal but in the larger diverticula that membrane becomes atrophied and its glandular structures tend to disappear. They may be met with in any part of the bowel, but are somewhat more often found in the large than in the small intestine. They have been seen in the duodenum, are comparatively common in the jejunum, and are encountered with still greater frequency in the ileum. They may appear in any part of the colon, but are most common in the sigmoid flexure and rectum."
- ¹²⁸ Usland, Olav: Diverticula jejuni. *Norsk. Mag. Laegevidensk.*, **91**, 101-112, 1930.
Female, age 65. *Preoperative roentgenogram shows jejunal diverticulum clearly*. Resection.
- ¹²⁹ Vassel: Diverticula du jejunum. *Arch. des. Mal. appar. digest. etc.*, **17**, 786, 1927.

- Male, age 62; previous gastro-enterostomy; still had complaints. *Roentgenologic examination showed* good emptying of stomach also a *jejunal diverticulum*, which was subsequently excised.
- ¹³⁰ Virchow, R.: *Verhandl. d. Berl. Med. Gesellsch.*, 21, 116, 1890.
Male, age 70 plus. Autopsy: Multiple "false" jejunal diverticula.
- ¹³¹ Vorhaus, M. G.: Recognition of Some Less Common Diseases: Duodenal-Jejunal Diverticula. *J.A.M.A.*, 94, 165-169, January 18, 1930.
Female, age 35. Roentgenogram suggestive. Operation: Excision of diverticulum just beyond duodenojejunal angle. Recovery.
- ¹³¹ Walmann, H.: *Virchows Arch. f. path. Anat.*, 14, 202, 1858.
Description of museum specimen: Typical multiple (37), paramesenteric, jejunal diverticula.
- ¹³² Watson, C. M.: Diverticula of Jejunum. A Case with Enterolith Causing Intestinal Obstruction. *Surg., Gynec., and Obstet.*, 38, 67, 1924.
Male, age 73; multiple diverticula with one enterolith causing obstruction. Resection; recovery.
- ¹³³ Weiss, Karl: *Frankf. Ztschr. f. Path.*, 37, 96, 1929.
Female, age 58; "flatulent dyspepsia"; *Roentgenogram suggestive of jejunal diverticula*. Autopsy; multiple diverticula for 140 cm.
- ¹³⁴ Watanabe (ref. Kaspar⁷⁰):
(1) Male, age 40; two diverticula; "false"; 40 cm. from duodenojejunal junction.
(2) Female, age 45; single large diverticulum, adherent to another loop; resection; recovery.
- ¹³⁶ Walker, F. E.: *J.A.M.A.*, 58, 1190, 1912.
Female, age 11; diverticula of ileum, size of a fist, many smaller diverticula.
- ¹³⁰ Zengerle (ref. Kaspar⁷⁰): 1911.
Female; three previous abdominal operations; fourth celiotomy, seven diverticula, walnut to hazelnut in size, containing enteroliths, discovered.

DISCUSSION.—DR. J. M. T. FINNEY, JR. (Baltimore, Md.) was particularly interested in Doctor Gerster's paper, because it so happened that in the last few years he had seen seven cases of duodenal diverticula, six jejunal and two of ileal diverticulitis. That seemed so unusual in view of the comparative rarity of this condition, that the literature was looked up quite thoroughly. As nearly as could be ascertained diverticula are supposed to occur in a ratio of 2 per cent in the duodenum and 0.2 per cent in the jejunum, while those in the ileum, other than Meckel's, are so rare that no percentage has been given relative to the comparative frequency of their occurrence. The paper was additionally interesting because of the report of two or three cases of perforation, a complication which seems to be exceedingly rare in diverticula of the duodenum or jejunum. As the speaker indicated, a large percentage of small intestinal diverticula seems to be found accidentally at autopsy, or in the course of operation for something else. That had also been his experience. Most of the diverticula which cause symptoms are associated with old, healed ulcers or biliary disease, so it is hard to say whether the symptoms are due to the diverticula or to the concomitant lesion.

Diverticula are more apt to be demonstrable fluoroscopically, than roentgenographically. It is at times possible to miss one at first and pick it up later on. One large duodenal diverticulum they missed entirely on first examination. In the 16-hour film there was a shadow overlying the transverse colon, which, on repeating the examination, was found to represent a large diverticulum of the third portion of the duodenum. A little compression of the duodenum where the third portion crossed the prominence of the vertebral bodies, with a retrograde milking of the barium contents, promoted the filling

of the large diverticulum which had been missed the first time. He thought this maneuver useful in demonstrating these duodenal diverticula at times.

A second case was of interest because of the multiplicity of the jejunal diverticula which were discovered at operation. There must have been 200 to 300 in the first six feet of jejunum. That patient was a female, age 75, and was operated upon for an acute intestinal obstruction. The diverticula were found incidentally; they had not been diagnosed before operation. The obstruction was due to the splenic flexure of the colon having protruded through a defect in the diaphragm. After reduction of the hernia, the problem presented itself as to how to close this opening. The patient was old and was not in condition to stand a second incision; in addition the operator was working through a low midline incision, under a low spinal anesthesia, which made it impossible to adequately reach or suture the defect. In this dilemma he came in contact with a fibrotic spleen, and this was pushed up into the hole as one would cork a bottle. A roentgenogram taken at age 81, six years later, shows it still sticking up through the diaphragm. The jejunal diverticula were also demonstrable at this examination.

Another case is cited because of the universal extent of the diverticulosis. The patient was a female, age 77. The roentgenograms showed diverticula extending from the outlet of the stomach to the anus. One could see one large diverticulum of the second portion of the duodenum and also two smaller ones of the third portion; scattered down through the jejunum and ileum are many others, small and large. The colon showed innumerable sacs, after the main column of barium had been evacuated.

Diverticula show quite well roentgenologically if one is careful to look for them, but it is sometimes difficult to demonstrate them in the course of a routine roentgenologic examination unless one is on his guard.

DR. FRANK S. LYNN (Baltimore, Md.).—Doctor Gerster's voluminous bibliography indicates that the condition of diverticula of the small bowel is not as rare as one would gather from a cursory review of the literature.

Case Report.—A white female, single, age 58, was admitted to the University Hospital September 15, 1937, with a diagnosis of intestinal obstruction. In 1911, she had had a gallbladder operation and, in 1924, was operated upon for uterine fibroids. The present attack came on 48 hours before admission. Various efforts were made to relieve the obstruction, both at home and after admission to the hospital, without success. Under spinal anesthesia a celiotomy was performed, and on searching for the site of the obstruction, a number of pouches along the mesenteric border of the jejunum were found. One intestinal segment of about 30 cm. contained from 25 to 30 diverticula varying in size from 0.5 to 4 cm. in diameter. The obstruction was caused by adhesions between the ileum and large bowel. The diverticula showed no evidence of inflammation or infection nor any tendency to perforate, and were left undisturbed. The obstruction was released, and the abdomen closed. The convalescence was uneventful, and the patient was discharged three weeks postoperative.

At the end of a month she was called back for roentgenologic examination. The third slide made from these examinations substantiates Doctor Gerster's statement that these shadows do not, at times, show in the roentgenogram, notwithstanding the fact that their presence had been demonstrated at celiotomy. One film, however, showed three diverticula. The procedure suggested by Doctor Finney, Jr., of pressing on the duodenum in order to demonstrate more clearly the diverticula of this portion of the bowel, is certainly well worth adopting in making roentgenologic examinations.

DR. J. M. T. FINNEY, SR. (Baltimore Md.).—Every surgeon must have been impressed with the fact that the problems of the abdominal surgeon,

instead of becoming less as time goes on, are rather being continually added to. It is only within comparatively recent years that the question of diverticulitis has engaged serious consideration. Now, however, in addition to appendicitis, cholecystitis, colitis and tumors of various kinds, one must seriously consider the question of diverticulitis, in making his differential diagnosis in an acute abdominal condition. The clinical picture of diverticulitis is not infrequently so obscured by other complicating conditions that the diagnosis is rendered most difficult. I have found that where a diagnosis in an obscure abdominal condition cannot readily be made, the possibility of diverticulitis should always be borne in mind.