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Case Report

A Contribution to the Knowledge of the So-Called Pyloric Band ("Double Pylorus")

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Summary. Two new cases of patients with so called muscular pyloric band ("double pylorus") are reported.

Both possible genetic mechanisms of this malformation are discussed in detail: primary or congenital, and secondary or acquired by inflammation. After analysis of the hitherto related cases, the opinion is expressed that the so called pyloric band represents a congenital malformation.

According to the authors, the striking frequency of simultaneous ocurrence of pyloric band and ulcers does not necessarily favour the theory of inflammatory genesis. The accompanying ulcer seems rather to be a "second disease" in the sense of Rössle (1913), manifesting itself at a *locus minoris resistentiae.*

Key words: Peptid ulcer — Pyloric band — Congenital malformation.

Zusammenfassung. Es wird von 2 eigenen Beobachtungen eines sog. muskulären Pylorusbandes („double pylorus") berichtet.

Die beiden möglichen Entstehungsmechanismen dieser Mißbildung, nämlich primär, angeboren oder aber sekundär, entzündlich erworben, werden ausführlich diskutiert. Nach genauer Analyse der bisher beschriebenen Fälle wird die Meinung vertreten, daß das sog. Pylorusband eine angeborene Mißbildung darstellt.

Das auffallend häufige gemeinsame Vorkommen von Pylorusband und Ulcus spricht nach Meinung der Verfasser nicht notwendigerweise für die entzündliche Genese. Das begleitende Ulcus scheint uns vielmehr eine „Zweitkrankheit" im Sinne von Rössle (1913) zu sein, die sich an einem locus minoris resistentiae manifestiert.

Congenital anomalies of the border-area between stomach and duodenum are rare compared to anomalies of other organs. At this site most anomalies have been mucosal membranes (diaphragms) with or without atresia of the pylorus (Louw and Barnard, 1958; Gerber, 1965; Sloop and Montague, 1967; Creedon, 1968; Shartsis and Fox, 1969). Anomalies included under the generic term "duplication" of stomach or intestine are less frequent (Bremer, 1944), but in this connexion mainly mucosal cysts, predominantly of prepyloric localization at the greater curvature have been described (Ramsay, 1957; Abrami and Dennisson, 1961; Gerber, 1965; Bartels, 1967; Kremer *et al.*, 1970; Anas and Miller, 1971). Less frequently the cysts were pyloric or duodenal in position. Comparable malformations are most frequently found in the ileum and less commonly in the duodenum, stomach, oesophagus and colon in that order. A malformation of the kind represented by a pyloric band is extremely rare and has been described

exclusively in adults of advanced age (Smith and Tuttle, 1969; Christien *et al.*, 1971; Hansen *et al.*, 1972; Frühmorgen *et al.*, 1972; Koniszewski and Frühmorgen, 1973; Pohl, 1974). The genesis of the pyloric band is uncertain. Our interest in the problem was stimulated by observation of two cases which we report, together with a review of hitherto published cases and we contribute suggestions about the genesis of this malformation.

Own Observations

Case 1. An adipose male patient aged 69 years who for the previous 8 years had no specific complaints. 4 years previously clinical and biopsy examination had shown a fatty degenerated liver with interstitial fibrosis and latent diabetes mellitus, and there was no previous "history of peptic ulceration". He was admitted to the clinic the day before death, presenting with circulatory shock due to massive haematemesis and melaena. The autopsy (1370/73, Inst. Path. Univ. Heidelberg) showed a stomach with marked chronic inflammation and a localised scarring on the lesser curvature. A deep haemorrhagic ulcer with extension to the duodenal wall was found at the gastric outlet. In the middle it was covered in a bridge-like manner with a soft band measuring 4.5 centimetres in length and 0.7 centimetres in diameter. The so-called pyloric band showed histologically a central cord of smooth muscle with predominantly loose connective tissue surrounded by gastric and duodenal mucosa showing inflammatory changes (Fig. 4).

The ulcer was found to be surrounded by gastric and duodenal mucosa, penetrated the pancreas and showed extensive cicatrization.

Case 2. An adipose male patient aged 61 years. For 10 years he had had asthmatic episodes and cardiac failure, and for some years liver disease due to chronic alcoholism. Ascites and haemorrhage from ruptured esophageal varices occurred one month previous to death. He died 12 hours after admission to the clinic, and had shown signs of ileus, gastro-intestinal perforation and a terminal myocardial infarct. The autopsy (1336/74) revealed hypertrophic cirrhosis of the liver, general arteriosclerosis and a perforated chronic ulcer of the pylorus extending to the duodenum. The ulcer was bridged by a soft band measuring 4 cms long by 0.6 cms wide which was completely covered by mucosa (Figs. 1 and 2). Diffuse peritonitis and recent myocardial necrosis were observed. The microscopic examination of the pyloric band revealed a central cord of connective tissue with large bundles of smooth muscle. The cord was covered by partly intermingled duodenal and pyloric mucosa (Fig. 3). Within the ulcer walls there was extensive cicatrization.

Discussion

In both cases there was a common bridge-like soft band at the pylorus, surrounded all over by mucosa and covering large ulcers which affected both the gastric and the duodenal wall. The "pyloric band" represented something like a gastroduodenal pseudolimit.

The first malformation of this kind with a central muscular cord was reported by Smith and Tuttle (1969). Christien *et al.* reported another case in which the pyloric band was formed only by layers of mucosa and connective tissue as in three other cases described by Koniszewski and Frühmorgen (1973). 5 additional cases (Hansen *et al.*, 1972; Pohl, 1974) showed at gastroscopy the appearance of a double pylorus. The dividing band was biopsied in the 4 cases of Hansen *et al.* and was found to be covered on all surfaces by gastric and duodenal mucosa (Table 1).

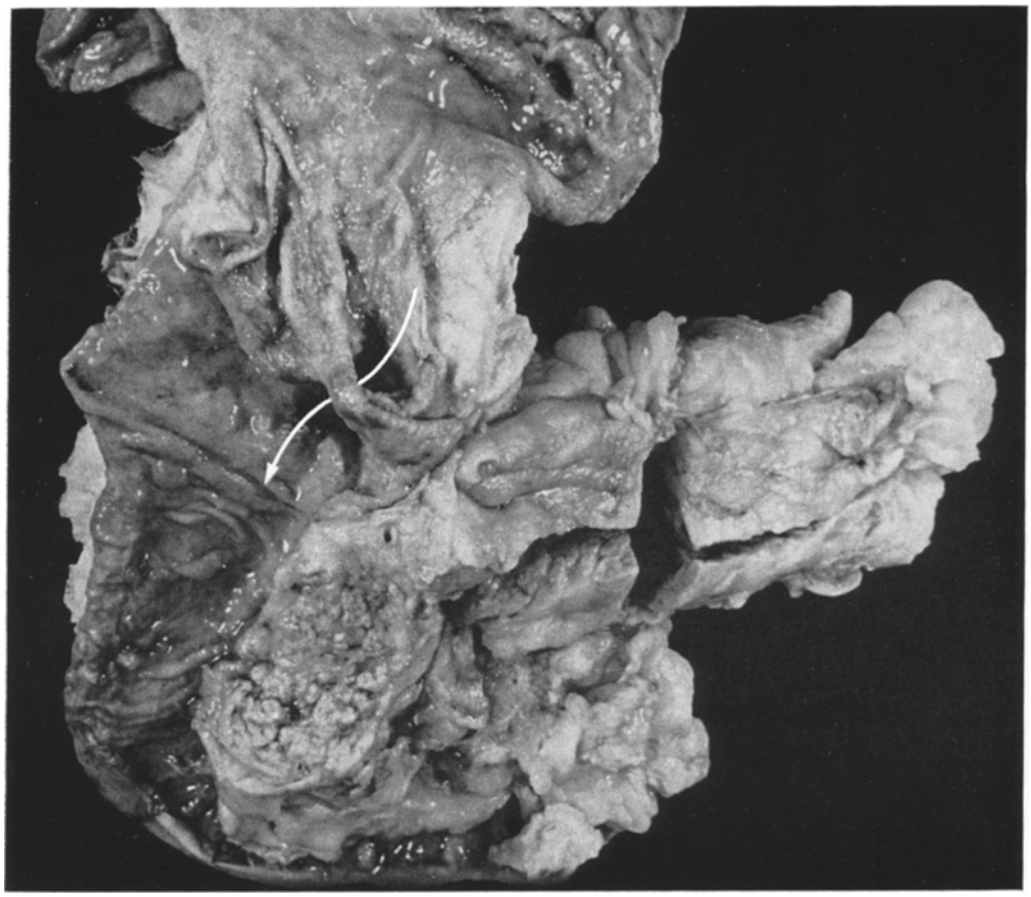

Fig. 1. Gastric outlet; large ulcer affecting pylorus and duodenum, bridged over by band covered by mucosa (Aut. Nr. 1336/74 Path. Inst. Univ. Heidelberg)

The malformation received different names including gastroduodenal band, pyloric band, musculomembranaceous pyloric band, double pylorus. Its macroscopic—and essentially also its microscopic—appearance is always the same. The comparatively frequent pyloric diaphragm has to be considered as a separate entity (Gerber, 1965).

The problem of uniform designation for this cord-like malformation is closely related to the possible mechanism of its development. During the development of the primitive digestive tract it has been known since the description of Tandler (1902) that at one stage the proliferation of the epithelium is so marked as to result in obliteration of the lumen in circumscribed areas and regularly in the duodenum during the 6th and 7th week (Clara, 1967). The new lumen is then formed by confluence of epithelial vacuoles and the remaining intact cells form the epithelial the covering of the growing intestinal tube (Johnson, 1910). According to Edwards (1929) and Bremer (1944) atresia, stenosis, membranes and duplica-

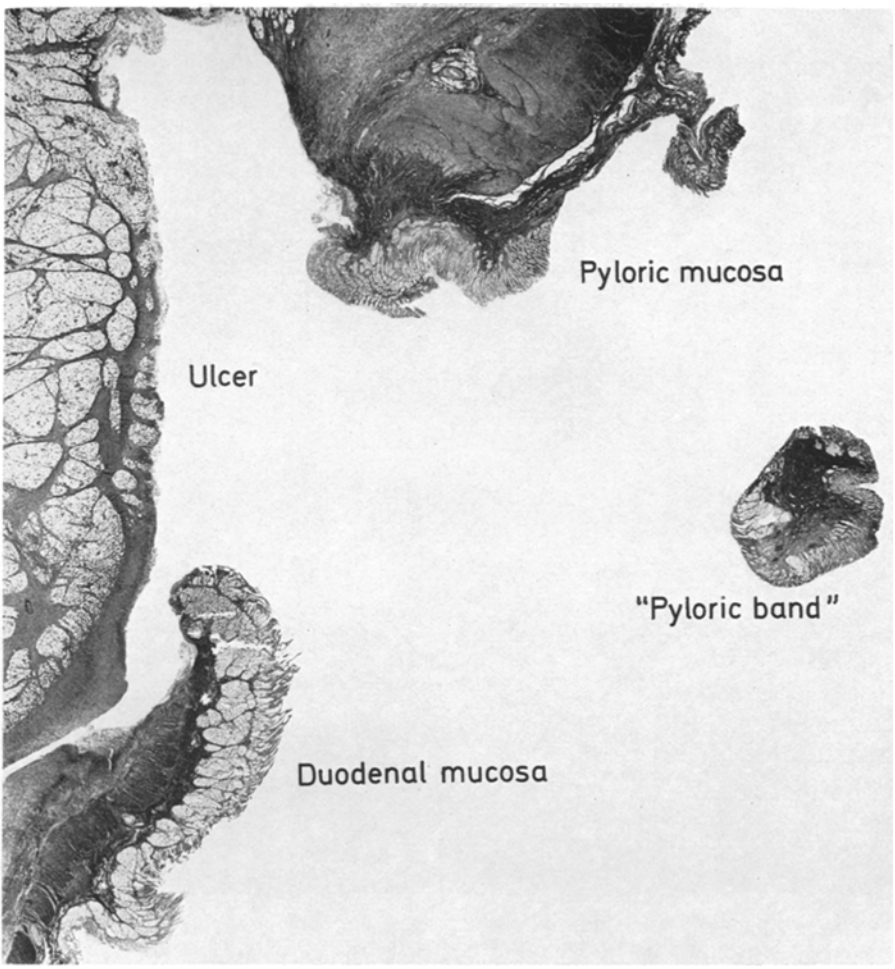

Fig. 2. Gastric outlet, microscopic survey. Pyloric mucosa (top middle); duodenal mucosa (bottom left); ulcer (left); "pyloric band" (right); (Aut.Nr. 1336/74; staining: HE; enlargement 3.3:1)

tions represent a failure in the recanalization of the intestine. The annular muscular layer of the intestines develops at the time of the epithelial obliteration, thus it is possible that the muscular tissue could grow into eventually persistent groups of epithelial cells and so give rise to the central muscular cord of the pyloric band. This view is comparable to Tandler's conception (1902) regarding the development of duplications. Thus the term "double pylorus" would be justified in the case of this malformation.

Louw (1958) was able to obtain atresia and stenoses during foetal development by animal experiments causing vascular insufficiency, but no malformation comparable to the pyloric band was produced.

An inflammatory cause of a pyloric band has also been suggested. It is noteworthy that ulcers occur frequently as a complicating element of pyloric anomalies.

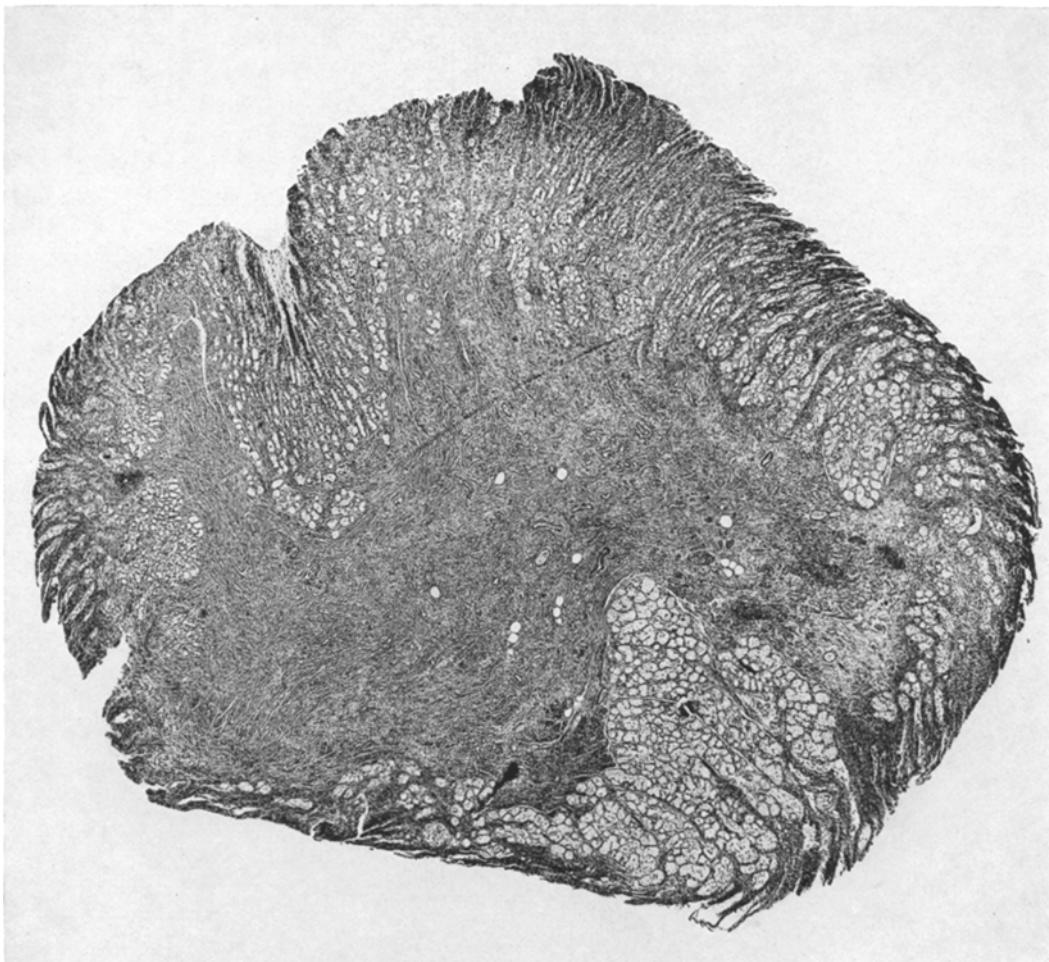

Fig. 3. "Pyloric band" covered all around by partly intermingled gastric and duodenal mucosa (Aut.Nr. 1336/74; staining: HE; enlargement 22.1:1)

Gerber (1965) found ulcers in 11 out of 25 adult patients with pyloric malformation: 10 with gastric ulcers and 1 with a duodenal ulcer. Table 1 shows that 10 of the 12 cases with a pyloric band presented as a gastric or duodenal ulcer. The clinical course or the miscroscopic description showed that the ulcers were chronic thus suggesting that the pyloric band could be due to chronic inflammation. Factors opposing this view include the rarity of the pyloric band compared to the frequency of pyloroduodenal ulcers. Also, despite the great "mesenchymal reserve capacity" (Meyer, 1953) in the wall of ulcers, the formation of muscular fibres is not observed. Hitherto described pyloric bands—as well as the prepyloric diaphragms examined by Gerber (1965)—lack cicatricial or even high grade inflammatory changes; and in two of the seven cases in which the pyloric band was examined histologically no accompanying ulcer was seen (cases 1 and 2 of

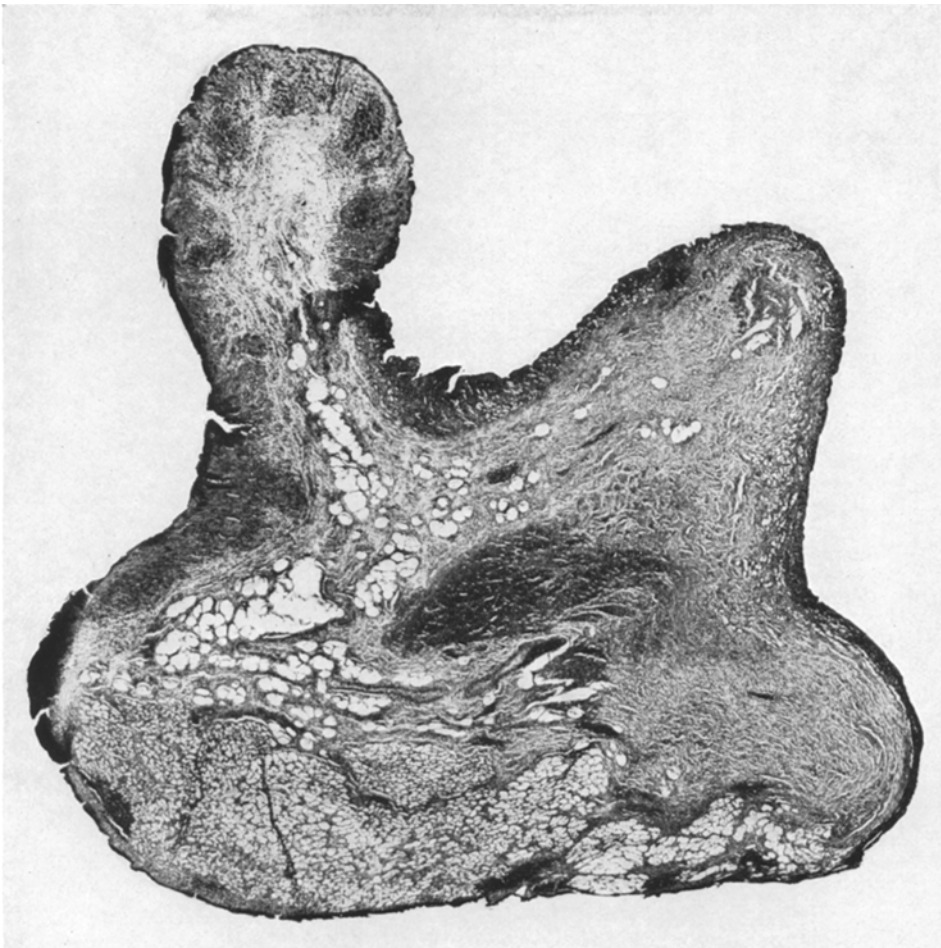

Fig. 4. "Pyloric band". Central muscular cord. Top: gastric mucosa; bottom: duodenal mucosa (Aut.Nr. 1370/73 Path. Inst. Univ. Heidelberg; staining: HE; enlargement 17.7:1)

the table) and this included the first description of the malformation. Thus we are inclined—in agreement with Smith and Tuttle and contrary to Hansen *et al.* and Pohl—to consider the pyloric band as a congenital malformation. Moreover, we believe that the frequently accompanying ulcer should be considered as a "second disease" in the sense of Rössle (1913) or as a "somatic fatum" (Doerr, 1970), favoured by both the existence of the pyloric band and by previous diseases. Our two patients suffered from chronic liver disease and two of the other eight patients with a pyloric band and accompanying ulcers had received therapy with corticotropin and/or corticosteroids because of arthritis. The frequent coincidence of these circumstances with the development of gastroduodenal ulcers is well known (Wanke, 1971). It can be imagined that a dividing cord at the pylorus could offer resistance to the flow of the gastric contents thus causing prolonged delay of food and favouring not only the production of nonspecific

Table 1. Survey of the known cases of so called Pyloric Band

Case	Author	Age (y)	Sex	Ulcus	Histology of band	Observations
1	Smith and Tuttle (1969)	54	♀	—	Central muscular cord, covered by mucosa	Rheumatic arthritis, therapy: acetylsalicyclic acid
2	Christien *et al.* (1971)	62	♀	—	Layers of mucosa only	Cessation of complaints after removal of the band
3	Hansen *et al.* (1972)	55	♂	Prepyloric 4 mm	—	Pyloric band discovered years after ulcer
4	Hansen *et al.* (1972)	66	♂	Duodenal	Biopsy: gastric and duodenal mucosa	Pyloric band discovered 1 year after ulcer
5	Hansen *et al.* (1972)	76	♀	Prepyloric	Biopsy: pyloric mucosa	Dyspepsia for two years
6	Hansen *et al.* (1972)	63	♀	Prepyloric	Biopsy: pyhoric mucosa	Polyarthritis, cortisone therapy for 14 years
7	Koniszewski, Frühmorgen (1973)	58	♂	Prepyloric	Mucosa	Anamnesis of complaints due to ulcer
8	Koniszewski, Frühmorgen (1973)	65	♂	Pyloric a. duodenal	Connective tissue with gastroduod. muc.	Relapsing ulcers known clinically for 8 years
9	Koniszewski, Frühmorgen (1973)	53	♂	Duodenal	Conn. tissue with mucosa covering	Complaints suggest. ulcer for 7 years
10	Pohl (1974)	74	♀	Pyloroduodenal perfor.	—	Rheumatoid arthritis Ther.: Cort. trop. a. cort. ster. for 10 y.
11	Kreinsen *et al.* (1975)	69	♂	Pyloroduodenal haemorrh.	Central muscle and gastroduodenal mucosa	Diabetes mell. Fatty degen. and fibrosis of the liver
12	Kreinsen *et al.* (1975)	61	♂	Pyloroduodenal perfor.	Scant central muscle, gastroduodenal mucosa	Hypertrophic cirrhosis of the liver

complaints but also the possible genesis of an ulcer (Howart, 1961). However, in four patients with a pyloric band and an accompanying ulcer (cases 8, 10, 11 and 12), both the pyloric and duodenal walls were affected by the ulcer, i.e. the "pyloric barrier" was broken; in case 2, a patient without an ulcer, the postprandial complaints of many years duration disappeared after the removal of the pyloric band.

In view of the above mentioned facts, the pyloric band may be a congenital *locus minoris resistentiae* within a general pathological event. It is a rare malformation and leads almost invariably to complaints caused by the secondary development of a regional ulcer at an advanced age. Whether this malformation should be called a "double pylorus", thus implicating a congenital factor,

or should be referred to by the descriptive term "pyloric band" depends on the view taken of its aetiology.

References

Abrami, G., Dennisson, W. M.: Duplication of the stomach. Surgery **49**, 794 (1961)
Anas, P., Miller, R. C.: Pyloric duplication masquerading as hypertrophic pyloric stenosis. J. pediatr. Surg. **6**, 664 (1971)
Bartels, R. J.: Duplications of the stomach. Case report and review of the literature. Amer. Surg. **33**, 747 (1967)
Bremer, J. L.: Diverticula and duplications of the intestinal tract. Arch. Path. **38**, 132 (1944)
Clara, M.: Entwicklungsgeschichte des Menschen. Leipzig: J. A. Barth 1966
Christien, G., Branthomme, J. M., Voluy, L., Deschamps, P., Morice, A.: Pylore double: Malformation congenitale. Sem. Hôp. Paris **47**, 1485 (1971)
Creedon, F.: The adult pyloric mucosal diaphragm. Brit. J. Surg. **55**, 818 (1968)
Doerr, W.: Spezielle pathologische Anatomie II. Heidelberger Taschenbücher, Bd. 70a. Berlin-Heidelberg-New York: Springer 1970
Edwards, H.: Congenital diverticula of the intestine with the report of a case exhibiting heterotopia. Brit. J. Surg. **17**, 7 (1929)
Frühmorgen, P., Koniszewski, G., Classen, M.: Duplication of the pylorus (Gastroduodenal Band). Endoscopy **14**, 234 (1972)
Gerber, B. C.: Prepyloric Diaphragm, an unusual abnormialty. Arch. Surg. **90**, 472 (1965)
Gross, R. E., Holcomb, S., Farber, S.: Duplications of the alimentary tract. Pediatrics **9**, 449 (1952)
Hansen, O. H., Kronborg, O., Pedersen, T.: The double pylorus. Scand. J. Gastroent. **7**, 695–696 (1972)
Johnson, F. P.: The development of the mucose membrane of the oesephagus, stomach and small intestine in the human embryo. Amer. J. Anat. **10**, 521 (1910)
Koniszewski, G., Frühmorgen, P.: On musculo-membranous pyloric bands. Virchows Arch. Abt. A **358**, 369 (1973)
Kremer, R. M., Lepoff, R. B., Izantt, R. J.: Duplication of the stomach. J. pediat. Surg. **5**, 360 (1970)
Louw, J. H.: Congenital intestinal atresia and stenosis in the newborn, observation on its pathogenesis and treatment. Ann. roy. Coll. Surg. Engl. **25**, 209 (1958)
Pohl, W.: „Doppelpylorus" bei gastroduodenalem Band. Leber Magen Darm **4**, 151 (1974)
Ramsay, G. S.: Enterogenous cyst of stomach simulating hypertrophic pyloric stenosis. Brit. J. Surg. **44**, 632 (1957)
Rössle, R.: Das runde Geschwür des Magens und des Zwölffingerdarmes als „zweite Krankheit". Mitt. Grenzgeb. Med. Chir. **25**, 766–796 (1913)
Shartsis, J. M., Fox, Th. A.: Pyloric diaphragm in an adult. Gastroenterology **56**, 580 (1969)
Sloop, R. D., Montague, A. C. W.: Gastric outlet obstruction due to congenital pyloric mucosal membrane. Ann. Surg. **165**, 598 (1967)
Smith, V. M., Tuttle, K. W.: Gastroduodenal (Pyloric) Band. Endoscopic findings and first reported case. Gastroenterology **56**, 331 (1969)
Tandler, J.: Zur Entwicklungsgeschichte des menschlichen Duodenum in frühen Embryonalstadien. Morph. Jb. **29**, 187–215 (1902)
Wanke, M.: Spezielle pathologische Anatomie, Bd. 2, Teil 1. Hrsg.: Doerr-Seifert-Uehlinger. Berlin-Heidelberg-New York: Springer 1971

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