

Annular Pancreas in the Adult: Selection of Operation

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SUCCESSFUL operations for symptomatic annular pancreas must include the relief of the duodenal obstruction and correction of associated disease, while avoiding established pitfalls introduced by the anatomy of this anomaly. Ill-designed operations may be followed by a pancreatic or duodenal fistula, persistent duodenal obstruction, peptic ulcer, or persistent pain. Because symptomatic annular pancreas is rare, we have reviewed the literature to determine the frequency of associated disease and the results of corrective operations.

Annular pancreas was named by Ecker³ in 1862 but Tiedemann⁷ is properly credited with its description in 1818. It develops as a result of malrotation or overgrowth of the ventral anlagen of the embryonic pancreas. The result is a ring of pancreatic tissue encircling the duodenum. Ducts within the annulus drain directly into the duodenum in most instances but in some cases drain into the duct of Santorini or duct of Wirsung. In the adult the annulus is consistently located about the second portion of the duodenum. Pediatric cases of annular pancreas should not be grouped with adult cases since there are important differences in the anatomical and clinical findings.

Symptomatic annular pancreas in the adult is uncommon. Drey² in 1957 was able to collect only 60 cases from the medical literature to which he added two of his own for a total of 62 cases. MacGregor and colleagues,⁵ in 1969 reported a single case of their own and collected nine cases published after Drey's review. French⁴ reported a single case in 1970, and Alexander¹ reported four cases in 1970, making a total of 77 published cases.

One of the unusual features of annular pancreas is that it often remains asymptomatic until adulthood or

throughout a normal life span. The majority of patients who develop symptoms during adulthood are 20 to 40 years of age. The youngest patient in Drey's review² was 17 and one of the patients described in this report was 79. Men are affected twice as frequently as women.

Vomiting and pain are the most common symptoms. Although both are associated with a variety of gastrointestinal diseases, some features of these symptoms may suggest annular pancreas. The vomitus is often described as containing undigested food and both pain and vomiting are often most severe at night. The nocturnal aggravation is probably the result of angulation of the distended proximal duodenum causing an increased degree of obstruction at the point where the duodenum is fixed in position by the annular pancreas. The duration of symptoms prior to diagnosis is variable, but in the majority of cases is less than 5 years.

The physical examination and routine laboratory studies are of little value in the recognition of annular pancreas. The most important examination is roentgenograms after a meal of barium sulfate. It must be emphasized, however, that the "double bubble" sign which is pathognomonic of annular pancreas in infants is of no value in adult cases. In the adult roentgenograms characteristically show an indentation of the lateral wall of the duodenum with eccentric narrowing of the duodenum. These findings and the absence of mucosal destruction distinguish annular pancreas from neoplasm but are similar to the findings of postbulbar ulcer. If a crater can be identified then the diagnosis is likely postbulbar ulcer. In only one recorded instance has an ulcer been identified at the annulus in a case of annular pancreas. However, ulcers in the duodenum proximal to the annular pancreas and ulcers of the stomach are rela-

Submitted for publication July 29, 1971.

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tively common associated findings. In Drey's review 16 (26%) of 62 patients had associated peptic ulcers. Pancreatitis was reported in 15 (24%) of the 62 patients.²

Certain anatomical features of annular pancreas are especially important when deciding upon the proper operation to correct this anomaly. A major duct may be present in the ring of pancreatic tissue and division of this duct may interfere with drainage of the pancreas. In other instances division of the duct may result in pancreatic fistula. Abnormalities of the adjacent wall of the duodenum also deserve emphasis. Unlike children, adults with annular pancreas do not have congenital atresia of the adjacent duodenum. However, in some adults with annular pancreas there is an acquired atresia of the duodenum. As a result division or removal of the annular pancreas may not relieve the duodenal obstruction.

The primary goal of the surgical management of annular pancreas is relief of the duodenal obstruction. Several procedures have been utilized and each has had its advocates. The majority of surgeons have elected to bypass the obstruction by establishing a duodenojejunostomy or gastrojejunostomy. Others have preferred to directly attack the obstruction by dividing or removing a portion of the annular pancreas despite the associated hazards of pancreatic or duodenal fistula. In addition to relief of the duodenal obstruction, operation for annular pancreas must correct associated abnormalities such as peptic ulcer. In an effort to identify the preferred operation for symptomatic annular pancreas in the adult we have reviewed published reports and reviews as well as four cases from our hospital records.

Findings

The results of study of four cases from our hospital records are summarized in Table 1. It is noteworthy that two (Nos. 3 and 4) of these patients had undergone previous operations in the area of the duodenum but the presence of annular pancreas was overlooked. Three of the four patients had an associated duodenal ulcer. Three patients were relieved of their symptoms by operation; but the fourth patient, in whom the surgical procedure was limited to division of the annular pancreas, continued to have epigastric pain.

Of the 77 cases collected from the literature, 68 cases were described in sufficient detail to allow an assessment of the results of operation. These 68 cases together with the four cases from our hospital provided a total of 72 cases for study (Table 2). The cases were divided into four groups as follows: annular pancreas alone, annular pancreas with duodenal ulcer, annular pancreas with gastric ulcer and annular pancreas with pancreatitis. The results of each of the several corrective operations performed for each group of patients were determined.

There were 40 cases of annular pancreas without associated gastrointestinal disease. In nine cases the operation was vagotomy and gastrojejunostomy or gastric resection with or without vagotomy and the results were excellent. Operations in the remaining 31 cases were division of the annulus, gastrojejunostomy or bypass by duodenoduodenostomy or duodenojejunostomy. Each type of procedure resulted in persistent symptoms or other complication in one or more cases. A fatal duodenal fistula occurred in one case.

TABLE 1. *Symptomatic Annular Pancreas in the Adult—4 Cases*

Case #	Age & Sex	Medical History	Roentgenograms after Barium Meal	Associated Findings	Operation	Complications & Results
1	60 M	Epigastric pain 3 yrs. Vomiting 2 mos.	"Duodenal ulcer with obstruction"	Ulcer of duodenum proximal to annulus	Bilateral vagotomy Gastrojejunostomy Division of annulus	None Asymptomatic
2	35 M	Epigastric pain 3 yrs. Vomiting 3 weeks	"Duodenal ulcer with obstruction"	Ulcer of duodenum proximal to annulus	Bilateral vagotomy Hemigastrectomy Gastroduodenostomy Division of annulus	None Asymptomatic
3	79 M	Closure perforated duodenal ulcer at age 64. Massive GI hemorrhage	"Pyloric obstruction"	Ulcer of duodenum proximal to annulus	Bleeding ulcer sutured Gastroenterostomy	None Asymptomatic
4	44 F	RUQ pain 4 years Vomiting 4 years Cholecystectomy, age 40, no calculi Choledochotomy, age 41, no calculi	"Stenosis 2nd portion of duodenum"	None	Division of annulus	Persistent epigastric pain

TABLE 2. *Annular Pancreas—Results of Operation in 72 Patients*

Findings	Operation	No.	Results			
			Asymptomatic	Pain	Obstruction	Other
Annular Pancreas (40 cases)	Division annulus	10	6	2	2	
	Gastrojejunostomy	11	9	1		Marginal Ulcer (1)
	Gastrojejunostomy and vagotomy	4	4			
	Duodenoduodenostomy or duodenojejunostomy	10	8			Duodenal Fistula A (1)* Pseudocyst (1)
	Gastric resection (B II) with or without vagotomy	5	5			
		40	32	3	2	3
Annular Pancreas with Duodenal Ulcer (16 cases)	Division annulus	1			1	
	Gastrojejunostomy	6	5		1	
	Duodenoduodenostomy	1	1			
	Gastric resection (B II)	6	6			
	Gastric resection (B I)					
	Division of annulus	1	1			
Vagotomy and pyloroplasty	1	1				
		16	14	0	2	0
Annular Pancreas with Gastric Ulcer (5 cases)	Duodenojejunostomy	1	1			
	Gastric Resection (B II)	4	4			
		5	5	0	0	0
Annular Pancreas with Pancreatitis (10 cases)	Division annulus	5	4			Persistent pancreatitis (1)
	Gastroenterostomy	1	1			
	Duodenoduodenostomy or duodenojejunostomy	3	3			
	Gastric resection (B II)	1	1			
		10	9	0	0	1

* Complication was fatal

In sixteen cases annular pancreas and duodenal ulcer were present. Division of the annulus in a single case was followed by persistent duodenal obstruction. Gastrojejunostomy in six cases resulted in gastric outlet obstruction in one case. Gastric resection gave excellent results in six cases as did various other procedures in the remaining three cases.

In five cases of annular pancreas and gastric ulcer the results were excellent from gastric resection in four cases and duodenojejunostomy in one case.

In five of 10 cases of annular pancreas with associated pancreatitis the operation was division of the annulus; in one case the pancreatitis persisted. Bypass in the remaining five cases, including gastric resection in one case, yielded excellent results in all five cases.

Simple division of the annulus was the operation in 16 of the 72 cases. In eight (50%) of the 16 cases operation was followed by persistent, symptoms or other complications.

In 20 cases the operation was gastric resection with or without vagotomy or vagotomy and gastrojejunostomy. There were no complications in these cases and the results of operation were excellent.

Comment

The primary goal of operation for annular pancreas is relief of the duodenal obstruction. Available information suggests that neither safe nor consistent relief may be expected from division or removal of the annular pancreas. Indeed, the results of this study suggest division of the annular pancreas is often inadequate and may be hazardous.

Logic favors duodenoduodenostomy or duodenojejunostomy as the most simple and physiological operation for bypass of the obstructed segment of duodenum. However, published experience suggests that bypass of annular pancreas utilizing a duodenal anastomosis is hazardous. If this impression is correct, the problems associated with a duodenal anastomosis may be related to inflammation or other abnormalities of the wall of the duodenum. Since duodenoduodenostomy and duodenojejunostomy do not reduce gastric acid secretion, failure of these operations may also occur if associated peptic ulcer or pancreatitis is overlooked.

The frequent association of peptic ulcer or pancreatitis with annular pancreas suggests the need for a procedure

which reduces acid secretion by the stomach in addition to bypassing the obstructed duodenum. Vagotomy and gastrojejunostomy as well as gastric resection, with or without vagotomy, have yielded uniformly good results. Thus from available evidence it appears corrective operations for annular pancreas should include vagotomy and gastrojejunostomy and avoid the duodenum and the annular pancreas.

Summary

Seventy-two cases of annular pancreas, including four of the author's cases, were studied. In 31 (43%) of the 72 cases pancreatitis (10 cases) or peptic ulcer (21 cases) were associated with annular pancreas. Division of the annulus and bypass operations utilizing a duodenal anastomosis proved hazardous. Operation which combined bypass of the obstruction with reduction in gas-

tric acid secretion yielded uniformly good results. Corrective operations for annular pancreas should include vagotomy and gastrojejunostomy and avoid the duodenum and annular pancreas.

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