

AN APPRAISAL OF PANCREATODUODENAL RESECTION: A FOLLOW-UP STUDY OF 61 CASES*

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AND

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THE OPERATION of pancreatoduodenal resection has been performed for 13 years, since it was first reported by Whipple¹ and associates in 1935. Large numbers of patients have been operated on during this period. Their course has been followed for a sufficient time to permit evaluation of the procedure when employed for carcinoma of the head of the pancreas, carcinoma of the ampulla, carcinoma of the duodenum and carcinoma of the lower end of the common bile duct. The operation as described by Whipple was the first attempt to apply the general principles of radical cancer surgery to these serious and relatively inaccessible lesions. A few large series of cases have been reported by Whipple,² Orr,³ Waugh and Clagett,⁴ Waugh,⁵ Bartlett⁶ and Cattell.⁷

In the six-year period from August 1942 to August 1948, 165 patients with carcinoma in the region of the head of the pancreas were observed at the Lahey Clinic, and on 56 of these a pancreatoduodenal resection was performed. During this time five additional patients had pancreatoduodenal resections for benign disease, giving a total experience for pancreatoduodenal resection of 61 cases. Careful follow-up studies have been made on every one of the resected cases.

Basing our data on a review of this experience, we have attempted to answer certain logical questions that have arisen, which can be stated as follows: (1) What patients are suitable for resection? (2) Should a one-stage or a two-stage operation be employed? (3) Is it essential to anastomose the pancreatic duct? (4) Can carcinoma of the ampulla be cured? (5) Is it worth while to resect carcinoma originating in the head of the pancreas? (6) Can a reasonable operative mortality be obtained? (7) Does pancreatoduodenal resection offer sufficient palliation in extensive cases to be worth while?

Too few series of cases have been followed for the generally accepted period of five years to judge curability on this basis. In our own series, only 12 patients were operated on more than five years ago. Orr,³ in 1945, collected 103 cases from the literature, including 11 personal cases, and of this group found that no patient survived over three years. Waugh,⁵ in reporting a follow-up study of 30 cases in which operation was performed at the Mayo Clinic, reported that one patient who had had a carcinoma of the ampulla survived for three years. Bartlett⁶ reported 25 cases from the Massachusetts General Hospital and found one survival of five years.

* Read before the Southern Surgical Association, White Sulphur Springs, W. Va., December 9, 1948.

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From August 1942 to August 1948 at the Lahey Clinic, 165 patients with carcinoma of the head of the pancreas, ampulla of Vater, duodenum and lower end of the common bile duct were treated (Table I). Fifty-six patients were submitted to pancreatoduodenal resections, an operability rate of 34 per cent. During this time two additional patients with carcinoma arising in a hyper-functioning pancreatic adenoma were submitted to local resection. These two patients have previously been reported on by Allan and Marshall.⁸ Most of the remaining patients had exploratory laparotomies and palliative procedures such as cholecystjejunostomy.

TABLE I.—*Pancreatoduodenal Resection—Operability (1942-1948)*

Patients with carcinoma.....	165
Pancreatoduodenal resections.....	56 (34%)
Local resections.....	2

Fifty-six cases of pancreatoduodenal resection for carcinoma were divided according to the location of the lesions (Table II). In 20 the lesion arose in the ampulla. In two the lower end of the common duct was the primary site, while four had a primary lesion of the duodenal mucosa near or about the ampulla of Vater. A somewhat larger number, 30, apparently arose in the head of the pancreas, usually thought to be in the duct of Wirsung. In this latter group the process was frequently diffuse, making the point of origin impossible to determine. Three patients are submitted to pancreatoduodenal resection with an operative diagnosis of carcinoma of the head of the pancreas; in these the lesion was found to be benign. These patients were excluded from the group of 56 operated on for carcinoma and included in the five operated on for benign disease. The other two were operated on with the diagnosis of benign disease.

TABLE II.—*Pancreatoduodenal Resection—Pathology*

Carcinoma of ampulla.....	20
Carcinoma of head of pancreas.....	30
Carcinoma of duodenum.....	4
Carcinoma of common duct.....	2
Total.....	56

Among the patients submitted to resection were both favorable and unfavorable cases. Particularly in our earlier experience, some extensive carcinomas of the head of the pancreas were included in which it was known at the conclusion of the operation that all the malignancy was not excised. These included patients with involvement of the superior mesenteric vessels, invasion of the portal vein and retroperitoneal extension. Regional node involvement, likewise, was frequently demonstrated, particularly at the inferior angle of the common bile duct and the duodenum, as well as those nodes superior to the duodenum in the gastrohepatic omentum. Our experience with these cases of more extensive malignant disease has been unsatisfactory and led us to discontinue resection in

these unfavorable cases. It is now our opinion that when local invasion or metastases to lymph nodes are present, operation should not be advised.

The operation of pancreatoduodenal resection may be done in one or two stages. Whipple,^{1, 2, 9, 10} in his extensive experience, began with a two-stage operation and now feels that the one-stage operation can be done. Trimble,¹¹ Orr,⁸ Waugh⁵ and Brunschwig¹² likewise favor the one-stage operation. In our experience with 61 pancreatoduodenal resections (Table III), at the Lahey Clinic, 25, or 40 per cent, were done in one stage. This includes all five resections for benign lesions. Thirty-six patients, or 60 per cent, were operated on by a two-stage operation, 10 of these having had their first stage done elsewhere. The first-stage operation which we recommend is a cholecyst-jejunostomy utilizing a long antecolic loop of jejunum. The second stage is

TABLE III.—*Pancreatoduodenal Resection—Operation*

One-stage operation (including 5 benign)	25 (40%)	4 deaths
Two-stage operation*	36 (60%)	5 deaths
Total	61	

* 10 patients had first stage done elsewhere.

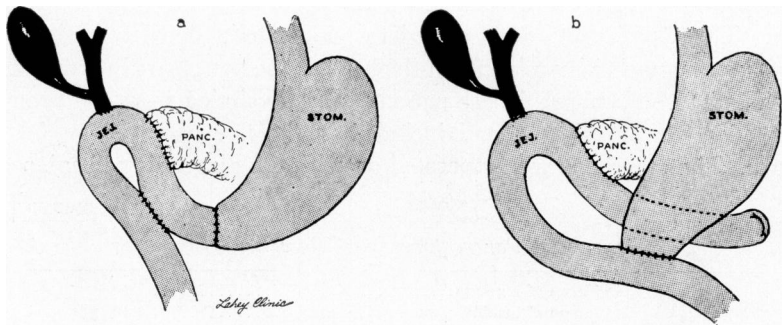


FIG. 1

delayed for from two to three weeks, during which time the condition of the patient greatly improves. In our experience, this procedure does not add appreciably to the technical difficulties of the resection. We believe that the employment of the two-stage operation has enabled us to extend the operation to patients who would not otherwise be suitable risks for such a major procedure. Furthermore, it permits surgeons who do not choose to carry out the radical procedure to perform a first-stage operation at the time of their exploration. From our own experience, we believe that the employment of the two-stage operation has been the most important factor in maintaining a low mortality.

The two-stage operation is employed in patients with long-standing jaundice, in those with marked enlargement of the liver and in the group represent-

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ing the poorest surgical risks. If the gallbladder has previously been removed or is unsuitable for the anastomosis, choledochostomy is satisfactory for a first stage. It adds considerably to the technical difficulty of the resection, but may be the wise procedure.

The technic of operation will not be presented in this paper. The operation that we usually employ has recently been presented.¹³ The one-stage operation which we prefer has all anastomoses in an antecolic position and they consist of

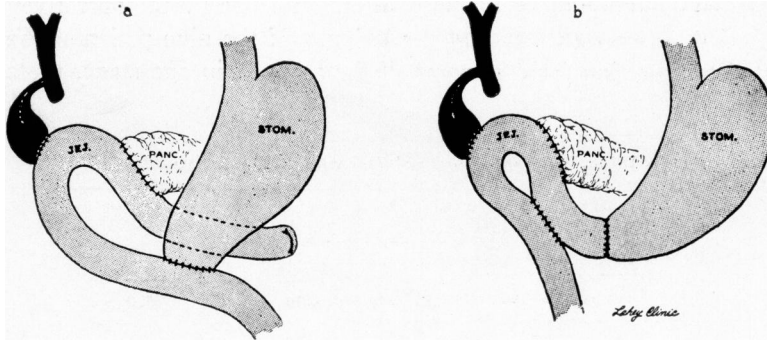


FIG. 2

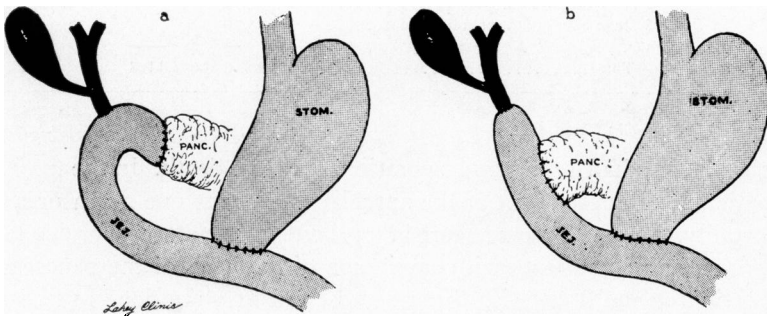


FIG. 3

end-to-end gastrojejunostomy, entero-enterostomy, pancreatojejunostomy and choledochojejunostomy (Fig. 1 *b*). The entero-enterostomy may be avoided by implantation of the stomach distal to the pancreatic and biliary anastomoses and then become an end-to-side gastrojejunostomy (Fig. 1 *a*). In the two-stage operation, the common duct is turned in (Fig. 2 *a* and *b*) or if its division is close to the entrance to the cystic duct, it is implanted in the jejunum beside the cholecystjejunostomy. Anastomosis of the end of the jejunum to the common

duct with implantation of the pancreas and stomach below the biliary anastomosis, as employed by Whipple and Waugh, has been utilized (Fig. 3 *b*). This may be reversed so that the end of the jejunum is joined to the pancreas (Fig. 3 *a*).

The operative mortality following pancreatoduodenal resection has varied in the reported series from 11 to 45 per cent. In the 56 resections for carcinoma in our series, there were eight deaths, a mortality of 14.3 per cent. In addition to this, there were five resections for benign disease, with one death, or 20 per cent. This one death occurred in a patient who was operated on with the mistaken diagnosis of malignant disease. In Table IV the operative deaths are recorded, based on the site of the lesion. Of the nine patients who were submitted to resection for carcinoma of the ampulla in one stage, there were

TABLE IV.—*Pancreatoduodenal Resection—Operative Mortality*

	Cases	Deaths	Per Cent
1-stage carcinoma, ampulla	9	0	
2-stage carcinoma, ampulla	11	1	
	20	1	5.0
1-stage head of pancreas	9	3	
2-stage head of pancreas	21	2	
	30	5	16.7
1-stage carcinoma, duodenum	1	0	
2-stage carcinoma, duodenum	3	2	
1-stage carcinoma, common duct	1	0	
2-stage carcinoma, common duct	1	0	
Total	56	8	14.3

no deaths. Eleven had a two-stage operation, with one death. In the total series of 20 patients with carcinoma of the ampulla, there was one death or a 5 per cent mortality. It must be remembered that these are the most favorable lesions.

There were nine patients with carcinoma of the head of the pancreas who had resection in one stage with three deaths, and 21 were done in two stages with two deaths, a total of 30 with five deaths, or a mortality rate of 16.7 per cent. Four patients with carcinoma of the duodenum had resection, with two deaths. These occurred in the three patients submitted to a two-stage operation. A one- and a two-stage operation were each done for carcinoma of the common duct, without a fatality.

In the interpretation of these results it should be appreciated that the patients who were the most serious risks, those with the greatest interference with liver function, were operated on in two stages. We feel that this mortality rate of 14.3 per cent for malignant disease, 14.8 per cent including benign disease, is evidence in favor of a two-stage operation for the deeply jaundiced individual.

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The causes of death in fatal cases are seen in Table V. Fatal gastrointestinal hemorrhage occurred in two. The site of bleeding could not be determined. Generalized peritonitis was found in two patients. In one the pancreatic anastomosis had separated. In this patient, metastases were found in the retroperitoneal region and also in the lungs. One patient died of surgical shock with possible transfusion reaction; this was the patient who had resection with a mistaken diagnosis of cancer. One of the patients early in the series died as a result of sepsis with liver abscess occurring nine weeks after operation.

TABLE V.—*Pancreatoduodenal Resection—Fatal Cases*

Gastro-intestinal hemorrhage.....	2
Peritonitis.....	2
Liver abscess.....	1
Shock.....	1
Hepatorenal syndrome.....	1
Cerebral thrombosis.....	1
Coronary thrombosis.....	1

Death followed one-stage resection in a case with an hepatorenal syndrome and associated renal suppression. The cause of death in another was cerebral thrombosis in a poor-risk patient with arteriosclerotic heart disease and hypertension. Coronary insufficiency and thrombosis caused death during operation in a 77-year-old man with a favorable lesion of his ampulla.

The duration of life following the onset of cancer in the region of the head of the pancreas is quite short. In an earlier report,¹⁴ we found in 56 consecutive patients who were operated on prior to 1935, in whom cholecyst-jejunostomy was performed, that 75 per cent were dead within six months of

TABLE VI.—*Pancreatoduodenal Resection—Five-year Survival, 1942-1943*

1942.....	2	1*	6 years, 2 months
1943.....	10	2*	5 years, 7 months
Recurrent Cases			
1 (carcinoid).....			lived 4 years, 7 months
1*.....			lived 3 years, 4 months
1*.....			lived 3 years, 2 months

50% (6) lived 3 years or more
25% (3) living and well

* Carcinoma of ampulla.

the operation. A review of our patients submitted to pancreatoduodenal resection definitely demonstrates that life can be prolonged when the operation is performed in suitable cases and that some patients may be cured. Only a small group in this series was available for a five-year follow-up study. During 1942, two resections were done, and during 1943, 10 resections were performed, making a total of 12 patients whose course has been followed for five years. One patient with carcinoma of the ampulla is living and well after six years and two months; the second is in good condition for five years and seven months, and a third, five years and five months after operation. All had adeno-

carcinoma of the ampulla of Vater without extension. Of the patients who had recurrent disease and subsequently died, one who had carcinoid of the ampulla lived four years and seven months and two others with carcinoma of the ampulla without metastases lived three years and four months and three years and two months, respectively. Thus, in this small series of 12 cases, three, or 25 per cent, of those submitted to resection five years or more ago are living and well, while six, or 50 per cent, lived three years or more.

It seems worth while to report the three-year survival rate in our series. For the years 1942 to 1945, 27 of the 56 patients had resections. Of these, eight, or 30 per cent of the group, lived three years or more. The two patients with carcinoma of the duodenum surviving resection lived two years and eight months respectively. The two with carcinoma of the common duct, lived three years and five months and one year and nine months, respectively.

There were 30 patients with carcinoma of the head of the pancreas submitted to resection, with five fatalities. This left 25 patients, all of whom have

TABLE VII.—*Pancreatoduodenal Resection—Three-year Survival, 1942-1945*

1942.....	2	1
1943.....	9	5
1944.....	6	0
1945.....	10	2
	—	—
1942-1945.....	27	8 (30%)

had follow-up studies. Eighteen were found to be dead of recurrence, with an average duration of life of 11 months after resection. The longest duration of life was 19 months. Seven patients are still living, as follows: three years and seven months, two years and three months, one year and three months, one year, and three patients have been followed for less than one year.

This relatively short survival time after pancreatoduodenal resection for carcinoma of the head of the pancreas is the most discouraging finding in all of our experience with these cases. It is a similar observation to that of the other recorded series. It must be admitted that no patient with carcinoma of the head of the pancreas has yet been cured or survived five years or more. While many of these patients have a smooth recovery and are quite comfortable for a number of months, the duration of their life following resection hardly justifies such a major procedure since satisfactory palliation might have been procured by a sidetracking operation, such as cholecystjejunostomy, for the relief of obstructive jaundice. In the light of our present experience, we must modify the operative procedure or abandon radical surgery for carcinoma of the head of the pancreas. We have observed rapid peritoneal dissemination with carcinomatosis in patients in whom the line of resection passed through malignant tissue, and it is quite possible that in some unfavorable cases we have hastened death rather than delayed it. We can certainly assume that resection for extensive cases of carcinoma of the head of the pancreas or those with local direct extension or regional metastases should no longer be consid-

ered for resection. Even with apparently very favorable lesions confined to the duct of Wirsung, we have seen recurrence as early as nine months. An isolated observation by Cole¹⁵ may explain early recurrence with favorable lesions. He found malignant cells free in the obstructed duct of Wirsung and it is possible that dissemination of cancer occurs by cutting across the duct, with the escape of pancreatic fluid. Before discontinuing radical pancreatectomy for carcinoma of the head of the pancreas in favorable cases, we wish to suggest the employment of total pancreatectomy in which this possible complication could be avoided. It has not yet been employed under these circumstances in our clinic. According to our present understanding of this problem, the employment of total pancreatectomy in early carcinoma of the head of the pancreas offers the only chance of a possible improvement of these results.

We have undertaken a survey of the nonfatal complications as well as physiologic studies on patients after resection but these will not be reported in this paper. An excellent study of 10 cases has been recently reported by Wollaeger¹⁶ and others.

From our experiences with 61 pancreatoduodenal resections, including 56 for carcinoma, and five for benign disease, the following points have been answered. (1) The operation is technically feasible as it has been developed. (2) With proper selection of cases and the employment of a two-stage operation in selected cases, the operative mortality can be maintained at a reasonable level, one similar to that for other gastro-intestinal cancers. (3) Physiologic functions so far as the gastro-intestinal tract and pancreatic and liver function are concerned can be established and maintained. (4) Carcinoma of the ampulla can be cured in an appreciable number of cases. (5) Pancreatoduodenal resection should be confined to favorable lesions. (6) Carcinoma of the head of the pancreas has not yet been cured. (7) The operation of pancreatoduodenal resection as now employed is suitable for carcinoma of the ampulla. Pancreatoduodenal resection for carcinoma of the head must be modified or discarded.

CONCLUSIONS

A series of 61 pancreatoduodenal resections performed at the Lahey Clinic has been reported. Fifty-six were employed for carcinoma in the region of the pancreatoduodenal area and five were performed for benign disease.

Twenty patients with carcinoma of the ampulla were operated on, with one death, a 5 per cent mortality. Thirty patients with carcinoma of the head of the pancreas had resections, with five deaths, a mortality rate of 16.7 per cent. Fifty-six resections for carcinoma were done, with eight deaths, or 14.3 per cent. Five resections for benign disease were done, with one death, 20 per cent. Sixty-one resections were followed by nine operative deaths, 14.8 per cent.

Twenty-five patients, 40 per cent, had pancreatoduodenal resection as a one-stage procedure. Thirty-six, 60 per cent, were operated on in two stages.

Of 27 patients having pancreatoduodenal resections for carcinoma, eight (30 per cent) survived three years or more.

Of 12 patients followed for five years or more, three show no evidence of recurrence. All had carcinoma of the ampulla of Vater. The longest period a patient was followed was six years and two months.

Pancreatoduodenal resection should be reserved for those patients with favorable lesions.

Carcinoma of the ampulla may be cured by pancreatoduodenal resection.

Carcinoma of the head of the pancreas has not been cured by pancreatoduodenal resection. A more extensive operation, such as total pancreatectomy, should be carried out or resection for this condition should be abandoned.

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DISCUSSION.—DR. MALCOM THOMPSON, Louisville, Ky.: One of my medical friends has said that his most fervent prayer is to be delivered from a surgeon who is always talking about his one case. As Doctor Cattell has shown us, follow-up reports of seven years' duration upon cancer of the ampulla of Vater are infrequent, so I will risk my friend's censure and solicit your indulgence by being brief. (slides)