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Severe Chronic Cephalic Pancreatitis: Use of Partial Duodenopancreatectomy with Occlusion of the Pancreatic Duct in 289 Patients

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Partial duodenopancreatectomy and occlusion of the remaining ductal system by Ethibloc® to induce rapid exocrine atrophy for treatment of severe chronic cephalic pancreatitis was introduced in our department in January of 1978. Since then, this surgical procedure has been performed in a total of 289 patients. Postoperative morbidity was 12.2%, 5 pancreatic and 3 biliary fistulas occurred. Postoperative mortality was 1% and relapses of pancreatitis occurred in only 2.2% due to incomplete filling of ducts with Ethibloc®. A total of 88.2% of patients became pain-free and symptomless, 10.8% voiced minor complaints, and 85.9% gained an averaged of 7.8 kg weight postoperatively.

We conclude that Ethibloc® occlusion is highly effective in inducing complete exocrine atrophy, thus abolishing the inflammatory process and preventing relapses of chronic pancreatitis and preserving the endocrine function from further impairment. This was demonstrated by biochemical assays during a 36-month follow-up in a prospective study in 23 of 289 patients.

Our results compare favorably with and are superior to results from any other operative procedure for chronic cephalic pancreatitis. We consider partial duodenopancreatectomy combined with Ethibloc® occlusion of the pancreatic duct the procedure of choice in the surgical treatment of severe chronic cephalic pancreatitis.

For the past 12 years, we have observed a steady increase in the number of patients presenting to our department with severe chronic pancreatitis where the main destructive lesions are located in the head of the pancreas. Until a few years ago, independent from the type of operative procedure used, our results in these patients were far from satisfactory [1, 2].

Between 1972 and 1977, our procedure of choice for this type of lesion was a Whipple operation; this was performed in 49 patients. Because of the high postoperative relapse rate, total duodenopancreatectomy was substituted, especially in selected cases with severe diffuse pancreatitis.

A study done in 1977 revealed, however, poor results [1]: early postoperative mortality following total duodenopancreatectomy was 20.6% (out of a total of 68 patients). During a follow-up period of 6.5 years, a further 19.1% died, most because of uncontrollable diabetes mellitus. We, therefore, abandoned total duodenopancreatectomy as treatment for chronic pancreatitis. In 49 patients with partial duodenopancreatectomy, the postoperative mortality was 8.2%. The main causes were: lacerations of the main vessels, severe diffuse bleeding, and leakage of the gastrointestinal, biliary, and pancreaticojejunal anastomoses. In this group, a late mortality of 20.4% was found during a follow-up period of 6.5 years, this was mostly due to recurrent pancreatitis.

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Material and Methods

Rationale for Pancreatic Duct Occlusion

The natural course of untreated chronic pancreatitis is characterized by a progressive reduction of both exocrine and endocrine function [3–5]. The inflammatory process is maintained by the exocrine parenchyma and is responsible for the terminal development of irreversible high-grade or complete exocrine and endocrine failure. It is well-known that pain and relapses of pancreatitis cease when the exocrine pancreas is completely "burned-out" at about 8–10 years after onset [6].

Early studies by Mering and Minkowski [7], Banting and Best [8], and Little and associates [9] showed that occlusion or ligation of the main pancreatic duct leads to complete exocrine atrophy leaving endocrine islet cells intact. A rapid therapeutic destruction of exocrine pancreatic parenchyma by means of complete pancreatic duct system occlusion might, therefore, be suitable in halting the inflammation seen in chronic pancreatitis, thus protecting endocrine pancreatic function from further damage.

In animal studies, Gebhardt and Stolte [10] were able to demonstrate complete atrophy of exocrine pancreatic parenchyma occuring within 20–25 days after complete pancreatic duct occlusion by injection of a slowly-hardening Prolamin solution (Ethibloc®, Ethicon GmbH, Hamburg-Norderstedt, Federal Republic of Germany). Ethibloc® is absorbed in the ductal system within 14 days and recanalization of the efferent ducts takes place. The islets of Langerhans remain intact (as shown by light microscopy exam) and serum glucose levels are normal.

Table 1. Morphological findings in 174 specimens taken at partial duodenopancreatectomy for chronic cephalic pancreatitis in which the main operative indication was intractable pain.

Morphological findings	n	%
Choledochal stenosis	107	61.5
Pancreatic calcification	115	66.1
Pseudocysts	116	66.7
Duodenal wall cysts	62	35.6
Duodenal stenosis	60	34.5
True cysts	2	1.2
Duodenal diverticulum	7	4.0
Pancreatic abscess	2	1.2

Based on these results, since 1978, partial duodenopancreatectomy has been combined with Ethibloc® duct occlusion in order to induce prompt and complete exocrine atrophy, terminate chronic inflammation, prevent further recurrences, induce lasting pain relief, and preserve residual endocrine function over a long period. We also aimed to decrease the complication rate from the pancreaticojejunostomy and, thus, decrease operative mortality.

Patients

From January 1, 1978 to December 31, 1986, partial duodenopancreatectomy combined with Ethibloc® occlusion of the remaining pancreatic duct system was performed in 289 patients.

The great majority of patients were male (n = 268) and the percentage of females was 7.3% (n = 21). At the time of operation, patients were, on average, 41.6 years old. The duration of preoperative symptoms was, on average, 44 months.

The main indications for operation in these patients were: intractable pain in 60.2% (174/289), duodenal stenosis in 9.7%, jaundice in 14.2%, suspected carcinoma in 12.8%, and complications from pseudocysts in 3.1%. This, however, does not imply that two-thirds of patients were operated on because of pain alone. As shown in Table 1, pain in these patients was a symptom arising from severe pancreatic changes which fulfill the operative criteria for so-called complicated pancreatitis. Intractable pain was the main symptom in these patients, but, in fact, all patients had abdominal pain suggestive of pancreatic disease.

Of the 289 patients, 35.6% had previous gastric, biliary tract, and pancreatic surgery, and severe abdominal adhesions in most of these cases complicated resection.

Whipple Procedure and Duct Occlusion

Complete dissection of the pancreatic head was performed as in the Whipple procedure, by dividing the pancreas left of the portal vein and then identifying the pancreatic duct. If preoperative endoscopic retrograde cholangiopancreatography was not possible, intraoperative Wirsungography was performed to exlude ductal stones. This procedure was soon replaced by probing of the main duct to find calculi; these must be removed before injection of Ethibloc® in order to establish complete filling and occlusion of the remaining ductal system. A purse-string suture was applied and drawn tightly around the injection needle to prevent retrograde leakage of the injected solution. Depending on the actual diameter of the pancreatic duct, 2–6 ml of Ethibloc® were injected using slight pressure until complete occlusion was achieved. After withdrawal of the injection needle from the pancreatic duct, the purse-string suture was closed to prevent retrograde loss of Ethibloc® solution.

Too-forceful an injection with high pressure may cause rupture of the smaller side ducts and lead to leakage of the solution into the parenchyma; however, minimal leakage was not found to cause any side effects. In a few cases, leakage of the solution via a ductal fistula into the retroperitoneal space was discovered. These fistulas were closed using interrupted sutures and Ethibloc® injection was then completed. No postoperative complications were observed in these cases.

Histomorphological Survey

All resection specimens were subjected to a thorough and exact preparation using standard methods under the supervision of Prof. Becker at the Institute of Pathology, University of Erlangen-Nürnberg. Special attention was paid to the degree and extent of fibrosis and calcification, the degree of stenosis in the choledochal and Wirsung ducts and in the duodenum, to the size and site of pseudocysts, presence of duodenal wall cysts, and changes in the duodenal papilla.

Prospective Study Data

Furthermore, to confirm our results, we carried out a prospective study in 23 of 289 patients with partial duodenopancreatectomy and Ethibloc® duct occlusion operated on consecutively from January, 1983 to February, 1984. We evaluated clinical exocrine and endocrine status as well as inflammatory activity. Endocrine status was closely examined in order to clarify the issue of whether delayed endocrine failure could be induced by extensive scar formation following Ethibloc® duct occlusion [11].

Preoperative exocrine pancreatic function analysis consisted of a secretin-pancreomyzin test [12] in all patients with intact upper gastrointestinal tract anatomy (n = 18) as well as indirect tests (pancreolauryl test) [13] and fecal chymotrypsin determination [14] in patients with previous Billroth II resection (n = 5). A decrease in plasma amino acid concentrations in response to secretin-pancreozymin stimulation of the exocrine pancreas was used to evaluate postoperative exocrine pancreatic function. This recently-developed technique [15] is approximately as sensitive as the secretin-pancreozymin test (which cannot be done following partial duodenopancreatectomy) and is also suitable in patients with previous major gastric resections, e.g., Billroth II. In addition, postoperative exocrine pancreatic function was measured in all 23 patients using both indirect tests mentioned above.

Inflammatory activity of chronic pancreatitis before and during the follow-up period (2–36 months) after partial duodenopancreatectomy with pancreatic duct occlusion was measured using serum levels of exocrine pancreatic enzymes [5].

Analysis of endocrine pancreatic funtion before and at 2–36 months after partial duodenopancreatectomy with pancreatic duct occlusion was comprised of a determination of serum levels of insulin [16] and C-peptide [17] under fasting conditions

Table 2. Pathomorphological changes in 289 resected specimens in severe cephalic chronic pancreatitis.

Morphological findings	n	%
Diffuse pancreatitis	191	66.1
Segmental pancreatitis	66	22.8
Groove pancreatitis	28	9.7
Pancreas divisum	3	1.0
Syphilitic pancreatitis	1	0.4
Total	289	
Further pathomorphological changes		
Pancreatic calcification	166	57.4
Choledochal stenosis	172	59.5
Papillary stenosis	8	2.8
Duodenal stenosis	99	34.3
Duodenal diverticulum	9	3.1
Duodenal wall cysts	100	34.6
Pseudocysts	176	60.9
True cysts	19	6.6
Ectopic pancreas	127	44.0
Pancreatic abscess	16	5.5
Insulinoma	1	0.4
Cyst of choledochus	1	0.4
Low grade fibrosis	74	25.6
Moderate fibrosis	87	30.1
Severe fibrosis	128	44.3

and subsequent maximal combined intravenous β-cell stimulation [5].

Results

Histopathological Findings

Becker's 1984 review of morphological findings [18] are listed in Table 2. A rare form, a so-called "groove pancreatitis," which consists of scarring and fibrosis of the pancreas combined with extensive stenosis of the lower biliary tract and segmental obstruction of the proximal pancreatic duct, and which is frequently associated with duodenal wall cysts, was found in 9.7%. Groove pancreatitis affects only the head of the pancreas and is localized within the "groove" between the head of this organ, the duodenum, and the common bile duct [19]. In these cases, a small band of pancreas, 2–3 cm wide, manifested all the changes of severe pancreatitis while the rest of the parenchyma was relatively normal.

The extent and severity of the pathological changes were manifested as frequent multiple pseudocysts in 60.9%, duodenal wall cysts in 34.6%, extensive stenosis of the distal biliary tract in 59.5%, diffuse calcifications in 57.4%, and moderate and severe fibrosis in 74.4%. The duodenal papilla was normal in only 20.5%, papillitis was found in 54%, stenosis in 3.5%, and stones impacted in the papilla in 0.5%. The different forms of pancreatic duct changes are listed in Table 3. The islets showed moderate to severe changes in 42%, were absent in 3%, and normal in 55%. This plethora of pathological changes clearly demonstrates that all cases which were operated on had severe chronic pancreatitis.

Postoperative Morbidity and Mortality

Severe nonlethal complications occurred in 35 patients (12.2%) (Table 4). Intraabdominal bleeding on the first or second postoperative day and intraabdominal abscesses were successfully treated by relaparotomy. Biliary fistulas occurred in 3 and pancreatic fistulas in 5 patients. One of the biliary and 4 of the pancreatic fistulas were successfully managed conservatively. One patient with a normal-sized common bile duct developed obstructive jaundice due to occlusion of the choledochojejunostomy on the fifth postoperative day. This was demonstrated by percutaneous transhepatic cholangiography. Without percutaneous transhepatic drainage, revision of the blocked anastomosis was postponed until the tenth postoperative day, when creation of a new anastomosis was facilitated by a greatly dilated common bile duct.

Evaluation of early mortality includes all hospital deaths and all discharged patients who died postoperatively within the first 60 days. Three patients died, 1 from myocardial infarction, 1 from a ruptured false aneurysm of the splenic artery, and 1 from overwhelming candidiasis. This early postoperative mortality of 1.0% compares very favorably with figures reported in the literature, which range from 1.5% to 15.9% (Table 5) [20–27].

Table 3. Changes in pancreatic duct morphology in 289 resected specimens taken at partial duodenopancreatectomy.

	%
Normal duct system	16.0
Multiple stenosis without dilatation	12.5
Multiple stenosis with dilatation	32.5
Dilatation only	35.0
Occlusion	4.0
Total	100

Table 4. Postoperative abdominal complications in 286 patients following partial duodenopancreatectomy with ductal occlusion (operative mortality excluded).

Postoperative complications	Total n	Relaparotomy n
Intraabdominal bleeding	9	8
External bleeding from drainage canal	2	2
Biliary fistula	3	2
Stenosis of the biliary anastomosis	1	1
Pancreatic fistula	5	1
Subphrenic abscess	3	2
Subhepatic abscess	2	1
Subhepatic seroma	3	–
Wound infection (subcutaneous abscess)	3	–
Ileus	2	2
Thrombosis of the portal vein	1	1
Ischemic colon	1	1
Total	35 (12.2%)	21 (7.3%)

Follow-Up

A total of 286 patients were followed-up for a mean of 5.5 years (range: 6 mo–9.5 yr).

Clinical Findings for All Patients. Recurrent pancreatitis occurred in only 6 of 286 patients, small pseudocyst formation took place in 2 cases, a pancreatic abscess developed in 1 case, and pancreatic relapses occurred in the remaining 3 cases. The recurrence rate was only 2.1%.

Table 5. Operative mortality rates in the literature for partial duodenopancreatectomy as treatment for chronic pancreatitis.

Author	No. of patients	Operative mortality (%)
Frey and Bodai, 1984 [20][a]	289	9.0
Flautner et al., 1984 [21]	42	9.5
Trede, 1984 [22]	85	1.5
Taylor et al., 1981 [23]	29	6.9
Leger et al., 1974 [24]	16	6.3
Mangold et al., 1977 [25]	44	15.9
Moreaux, 1984 [26]	50	2.0
Dohi et al., 1985 [27]	7	0
Gebhardt, 1984 [2][a]	917	6.3
Erlangen, 1978–1986	289	1.0

[a]Collected series.

Table 6. Causes of late deaths.

	n	%
Liver cirrhosis	14	28
Carcinomas	7	14
Heart and circulatory diseases (also cardiomyopathy)	8	16
Lung (pneumonia, tuberculosis)	4	8
Sepsis/abscess	4	8
Esophageal varices bleeding	3	6
Cachexia/neglect	3	6
Diabetes/coma	3	6
Portal vein thrombosis	2	4
Other	2	4

Late mortality: 68/286 (23.8%).
Mean follow-up period, 5.5 years (range: 6 mo–9.5 yr).
Exact cause of death was known in 50 patients only.

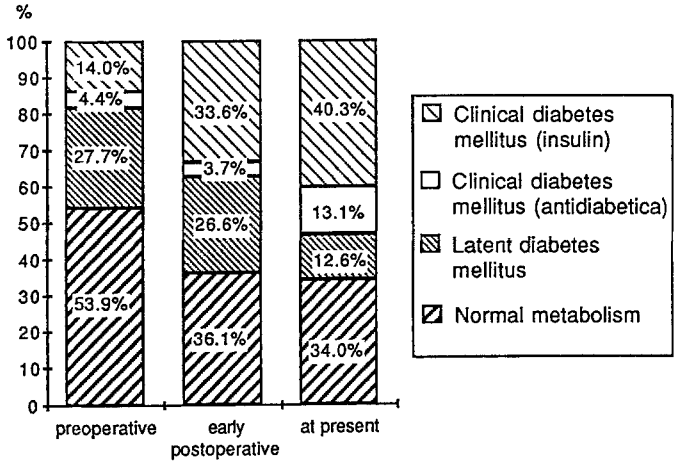

Fig. 1. Pre- and postoperative carbohydrate metabolism following partial duodenopancreatectomy with duct occlusion.

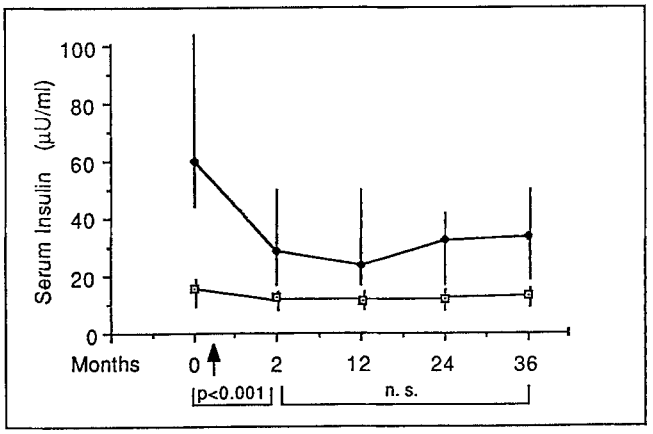

Fig. 2. Serum insulin activity measured under fasting conditions (●) and subsequent maximal combined β-cell stimulation (□) in 23 patients. n.s. = not significant.

Permanent pain relief is considered to be one of the most reliable criteria in assessing the effectiveness of any operation for chronic pancreatitis. A total of 53.6% of patients became completely pain-free and 34.6% had occasional complaints. Minor complaints, which occurred frequently but significantly less often than did preoperatively, were voiced by 10.8% of patients. Only 2 (1%) patients reported that they suffered from pain of the same degree of severity as they did preoperatively. Relief of pain was constant and permanent during long-term follow-up and most patients did not relapse.

A mean increase in weight of 7.8 kg was noted in 85.9% of patients, no change in weight in 6.5%, and a mean decrease of 2.7 kg in 7.6%. Most patients, especially those with marked weight increase, expressed a feeling of well-being and were able to return to a normal, active lifestyle.

Changes in carbohydrate metabolism were recorded in all patients both pre- and postoperatively at 3-, 6-, 12-, and 24-month intervals. Early postoperative results show that the percentage of normal glucose metabolism decreased from 53.9% to 34%, latent diabetes mellitus diminished from 27.7% to 12.6%, clinical diabetes simultaneously increased from 18.4% to 53.4%, and there were very few changes during the late postoperative follow-up period (Fig. 1).

In the follow-up period of, on average, 5.5 years, we found a relatively high late mortality of 23.8% (Table 6). If we summarize these various causes of death, we find that 70% of the deaths were due to continued alcohol and nicotine abuse. The deaths from diabetic coma or cachexia were often related to self-neglect due to alcoholism. These patients did not seek continuous medical guidance and care.

Prospective Study Data. The results in all patients during the follow-up period were supported by the detailed data obtained on the 23 of 289 consecutively-treated patients from the prospective study group.

1. Endocrine Function. Detailed comparative analysis of preoperative and postoperative data (Figs. 2, 3) clearly reveal that endocrine pancreatic function (preoperative median, 50–65% lower normal limit) was immediately reduced by about 50% by partial pancreatic resection and there was no further impairment during the 36-month follow-up as a result of additional duct occlusion.

The frequency of insulin-dependent diabetes mellitus increased from 21.7% (5 of 23 patients) preoperatively to 43% (10 of 23 patients) postoperatively. In all 5 patients with chronic

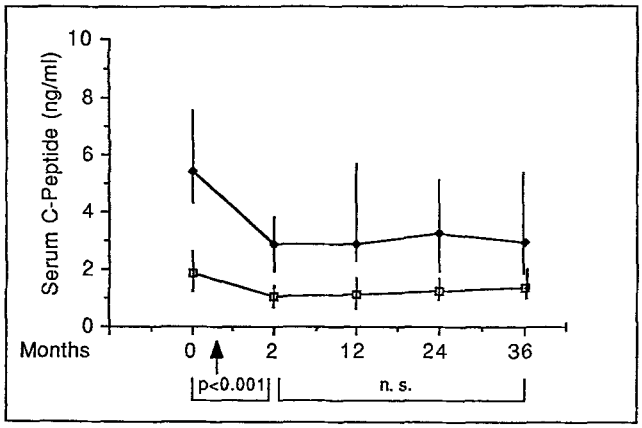

Fig. 3. Serum C-peptide concentrations under fasting conditions (●) and subsequent maximal combined β-cell stimulation (□). n.s. = not significant.

pancreatitis, insulin dependence developed immediately after partial pancreatic resection. The increase of 21.5% in this selected series, thus, corresponds to the overall increase in insulin dependence (26.3%) (Fig. 1) seen in the total of 286 partial duodenopancreatectomies combined with duct occlusion which were perfomed in our department.

2. Exocrine Pancreatic Function. Preoperative and postoperative long-term follow-up of exocrine pancreatic function [5] is summarized in Fig. 4. Preoperative pancreatic function was 10%–50% (median, 31%) of the lower normal limit. After partial pancreatitis plus duct occlusion, exocrine pancreatic function dropped significantly ($p < 0.001$) and constantly to between 2% and 10% (median, 6%) of the lower normal limit over a 2- to 36-month period. This indicates atrophy of exocrine pancreatic parenchyma by complete Ethibloc® occlusion of the remaining pancreatic duct system after partial pancreas resection.

3. Inflammatory Activity. Serum concentrations of trypsin (RIAgnost®-Trypsin [28]), which is representative of all exocrine pancreatic enzymes, were preoperatively abnormally high in most of the 23 patients with chronic pancreatitis. As shown in further detail in Fig. 5, partial duodenopancreatectomy plus intraoperative Ethibloc® duct occlusion resulted in a significant ($p < 0.001$) and constant reduction of serum trypsin concentrations, which indicated that inflammatory processes in all 23 patients had ceased.

Discussion

A new surgical concept was introduced in our surgical department in order to improve the poor early and late postoperative results in treatment of severe chronic cephalic pancreatitis. This consisted of a tailored surgical dissection to cope with the intensive scarring around the main vessels in combination with Ethibloc® duct occlusion.

The results of 289 consecutively-operated cases since 1978 show that this procedure has completely fulfilled our expectations: a significant reduction in operative mortality from 8.2% (before 1978) to 1.0% was achieved. The complete cessation of pancreas-specific inflammation, as documented in our prospective study of 23 consecutive patients, explains why 88.2% of patients became almost pain-free, and 10.8% had frequent minor complaints which they described as entirely different in quality and intensity from those experienced preoperatively. Most patients, especially those who stopped abusing alcohol, consider themselves to be in excellent or good physical condition, and 50% are back at work and leading normal, active lives.

The "wait-and-see" attitude of some gastroenterologists, who dispute that intractable pain is an indication for surgery (as found in 60.2% of our patients), and who prefer to allow the pancreatitis to burn out and complete exocrine atrophy to develop, condemns patients to about 8–10 years of incapacity and unrelieved pain. The pain of severe chronic pancreatitis is the subjective expression of numerous pathological changes (Table 1) which are typical for the complicated course of chronic pancreatitis. Total and lasting relief of pain is one of the major objectives of surgery for this condition.

As was to be expected from the earlier studies by Mering and Minkowski [7], Banting and Best [8], Little and associates [9], and the experimental animal studies by Gebhardt and Stolte [10] at our institution, Ethibloc® duct occlusion led to rapid (20–25 days) and complete atrophy of the exocrine parenchyma in all animals. This was also proven histologically by Tru-cut® needle biopsy taken from a small fibrosed pancreas in 3 patients who were relaparotomized for other reasons. The exocrine atrophy induced by Ethibloc® occlusion explains the very low rate of 2.1% (6 of 286 cases) of recurrent pancreatitis in this recent series; this is much lower than the frequency of 20%–25% reported in the literature for the Whipple operation [2].

We believe that our 6 recurrences occurred because complete filling of the ductal system with Ethibloc® was prevented by impacted ductal stones. If preoperative endoscopic retrograde cholangiopancreatography was performed, stones in the main pancreatic duct were identified and removed before injection of Ethibloc®. Otherwise, the main duct was probed after resection of the head of the pancreas to detect intraluminal and impacted stones. Complete filling by Ethibloc® is essential in order to achieve complete atrophy; this was shown in animal experiments [10].

The low leakage rate of the pancreaticojejunal anastomosis seemed to be another important advantage of Ethibloc® duct occlusion; erosion of the tissue at the site of the pancreatic anastomosis by active pancreatic juice was eliminated.

Delayed endocrine failure induced by diffuse scarring following Ethibloc® duct occlusion is a controversial topic; however, data from our prospective study—up to now, followed up for 3 years postoperatively—suggest that complete duct occlusion preserves postoperative endocrine pancreatic function in chronic pancreatitis by rapidly eliminating exocrine pancreatic parenchyma and thus halting the inflammatory process (Fig. 6). Moreover, complete duct occlusion itself has not reduced endocrine pancreatic function during the follow-up period, although it has induced formation of intralobular fibrosis [10, 29], which is related to impaired endocrine pancreatic function found in earlier investigations [11]. Confirmation of this finding, however, requires further follow-up of residual endocrine pancreatic function in these patients.

Follow-up of endocrine pancreatic function after partial duodenopancreatectomy without Ethibloc® duct occlusion has not

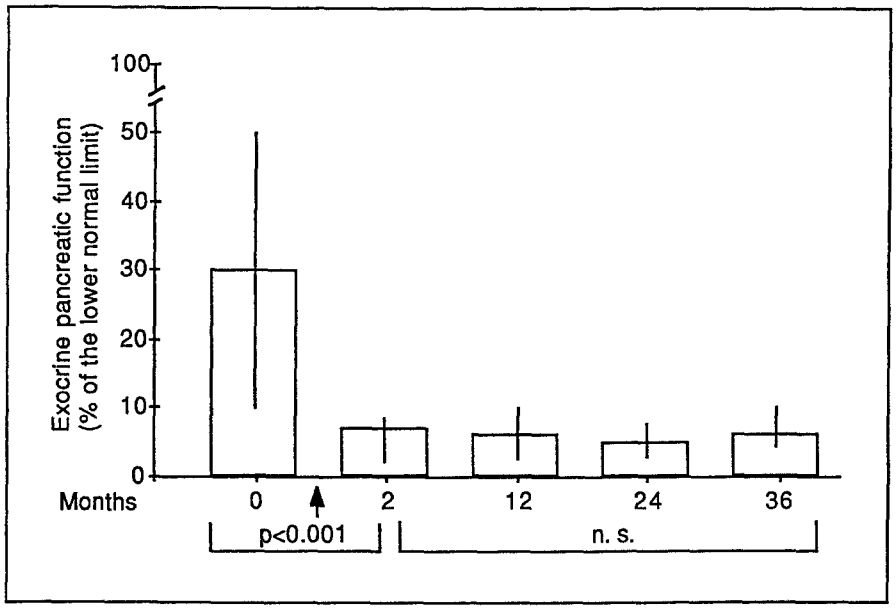

Fig. 4. Exocrine pancreatic function expressed as % of lower normal limit. n.s. = not significant.

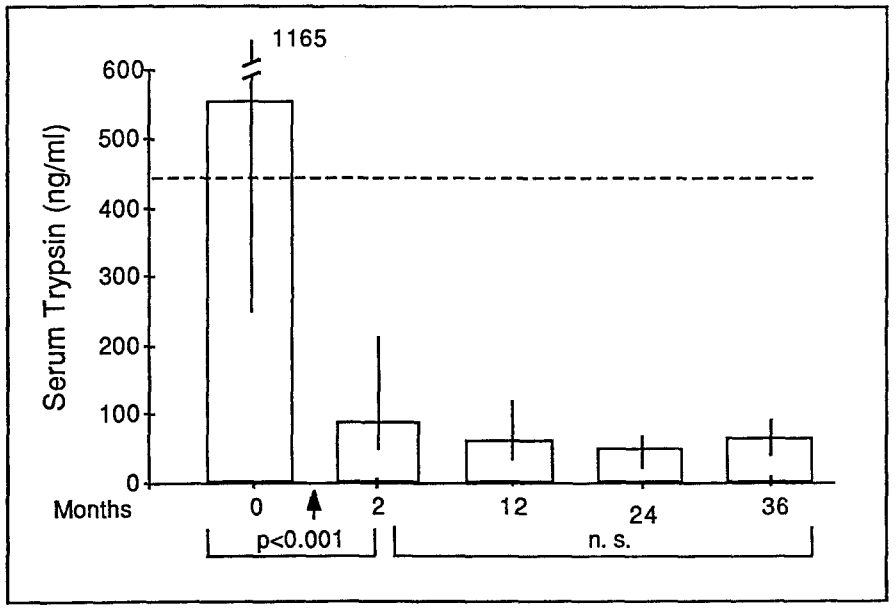

Fig. 5. Serum trypsin concentrations before and after partial duodenopancreatectomy and duct occlusion. n.s. = not significant.

been available throughout this study because since 1978; in our department partial pancreatic resection has always been combined with Ethibloc® occlusion in order to achieve a significant decrease in operative mortality and recurrence rate [30, 31]. Corresponding follow-up data obtained earlier by other groups are based on blood sugar profiles as well as oral glucose loads and are, thus, not directly comparable with our results of maximal combined β-cell stimulation [25, 32, 33]. In these investigations, postoperative development of insulin-dependent diabetes mellitus (median, 2.5 yr) ranged between 17% [25] and 36% [33] compared to 19.6% found immediately after partial pancreatic resection in our patient group.

A comparison of partial duodenopancreatectomy with or without intraoperative Ethibloc® duct occlusion with regard to the postoperative incidence of insulin-dependent diabetes mellitus cannot, however, be made at present. We have not yet established whether development of insulin dependency is related to partial pancreas resection or to progressive postoperative endocrine functional impairment in chronic pancreatitis patients not submitted to additional intraoperative pancreatic duct occlusion [25, 32, 33]. Partial pancreatic resection, unavoidable in the Whipple procedure, results in an immediate significant reduction of endocrine pancreatic function.

We have found the new concept of partial duodenopancreatectomy combined with Ethibloc® pancreatic duct occlusion to be very effective in reducing operative mortality, preventing

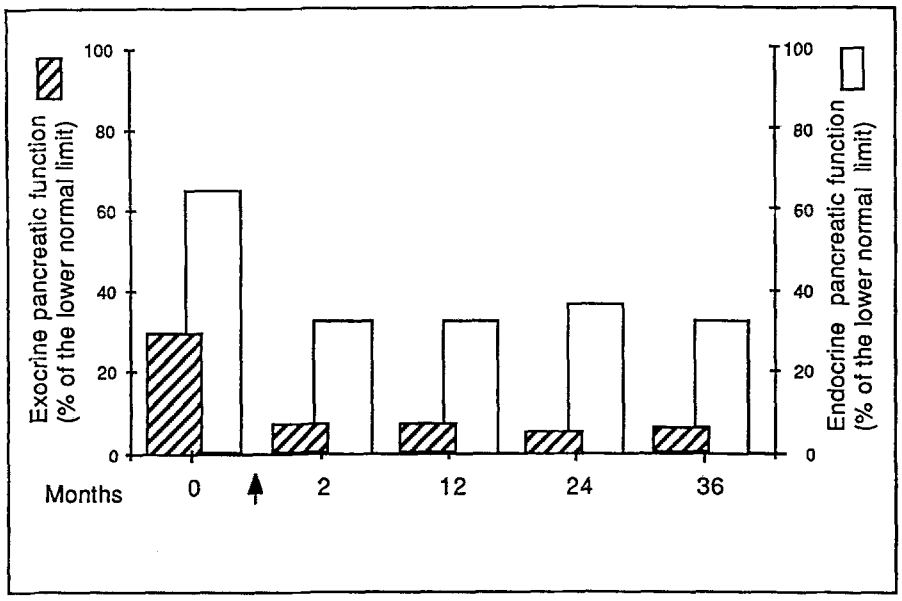

Fig. 6. Median values of exocrine and endocrine pancreatic function before and after partial duodenopancreatectomy and duct occlusion.

late relapses of chronic pancreatitis, and further deterioration of endocrine function. We consider this the procedure of choice in surgical treatment of severe chronic cephalic pancreatitis.

Résumé

La duodénopancréatectomie céphalique complétée par l'occlusion du canal de Wirsung avec la colle Ethibloc® pour induire une atrophie exocrine rapide du parenchyme restant dans la pancréatite chronique a été introduite dans notre département dès janvier, 1978. Depuis nous avons réalisé cette intervention chez 289 patients. La morbidité postopératoire était de 12.2% (5 fistules pancréatiques et 3 fistules biliaires). La mortalité postopératoire était de 1%; la récidive de pancréatite chronique a été observée dans 2.2% des cas, attribuée à un remplissage incomplet des canaux. La douleur a disparu chez 88.2% des patients; 10.8% continuaient à se plaindre faiblement. Une reprise de poids de 7.8 kgs en moyenne a été observée chez 85.9% des patients après l'intervention.

Nous concluons que l'occlusion par l'Ethibloc® est très efficace pour provoquer l'atrophie exocrine du parenchyme pancréatique, mettant fin au processus inflammatoire du pancréas et prévenant des récidives de pancréatite chronique, tout en évitant une aggravation de la fonction endocrine. Ceci a été démontré par des tests biologiques faits pendant 36 mois dans une étude prospective chez 23 des 289 patients.

Nos résultats sont similaires ou meilleurs qu'avec tout autre procédé chirurgical pour la pancréatite chronique de la tête du pancréas. Nous considérons que la duodénopancréatectomie céphalique avec occlusion du canal de Wirsung est un procédé de choix dans le traitement chirurgical de la pancréatite chronique céphalique.

Resumen

La duodenopancreatectomía con oclusión del sistema ductal remanente con Ethibloc® (para inducir la rápida atrofia del tejido exocrino) como modalidad de tratamiento de la pancreatitis crónica cefálica, fue introducida en nuestro departamento en enero de 1978. A partir de esa época este procedimiento ha sido realizado en un total de 289 pacientes. La tasa de mortalidad postoperatoria fue de 12.2%; se presentaron 5 fístulas pancreáticas y 3 biliares. La tasa de mortalidad postoperatoria fue de 1% y la de recurrencia de la pancreatitis de sólo 2.2%, debida a llenamiento incompleto de los canales con Ethibloc®. El 88.2% de los pacientes quedó libre de dolor y de sintomatología, y 10.8% manifestó quejas menores. El 85.9% ganó peso, 7.8 kg en promedio, en la fase postoperatoria.

Hemos concluído que la oclusión con Ethibloc® es altamente efectiva para inducir atrofia exocrina completa, con lo cual queda abolido el proceso inflamatorio y se logra la prevención de relapsos de la pancreatitis crónica y la conservación del tejido endocrino. Esto fue demostrado mediante determinaciones bioquímicas realizadas en un estudio prospectivo sobre 23 de 289 pacientes, en el curso de un período de seguimiento de 36 meses.

Nuestros resultados se comparan favorablemente, y realmente son superiores, a los de cualquier otro procedimiento operatorio utilizado en el tratamiento de la pancreatitis crónica cefálica. Nosotros consideramos la duodenopancreatectomía parcial combinada con oclusión de los canales pancreaticos con Ethibloc®, el procedimiento de escogencia en el tratamiento de la pancreatitis crónica cefálica severa.

References

1. Gall, F.P., Mühe, E., Gebhardt, C.: Results of partial and total pancreaticoduodenectomy in 117 patients with chronic pancreatitis. World J. Surg. *5*:269, 1981
2. Gebhardt, C.: Chirurgische Therapie der chronischen Pankreatitis. In Chirurgie des exokrinen Pankreas, C. Gebhardt, editor, Stuttgart, Georg Thieme Verlag, 1984, pp. 139–191
3. Andersen, B.N., Krarup, T., Pedersen, N.T., Faber, O.K., Hagen, C., Worning, H.: β-cell function in patients with chronic pancreatitis and its relation to exocrine pancreatic function. Diabetologia *23*:86, 1982
4. Domschke, S., Stock, K.P., Pichl, J., Schneider, M.U., Dom-

schke, W.: Betacell capacity in chronic pancreatitis. Hepato-Gastronenterol. *32*:27, 1985
5. Schneider, M.U., Meister, R., Domschke, S., Zirngibl, H., Strebl, H., Heptner, G., Gebhardt, C., Gall, F.P., Domschke, W.: Whipple's procedure plus intraoperative pancreatic duct occlusion for severe chronic pancreatitis: Clinical, exocrine and endocrine consequences during a 3-year follow-up. Pancreas *2*:715, 1987
6. Ammann, R.W., Akovbiantz, A., Largadier, F., Schueler, G.: Course and outcome of chronic pancreatitis. Gastroenterology *86*:820, 1984
7. Mering, J., Minkowski, O.: Diabetes mellitus nach Pankreasexstirpation. Arch. Exp. Pathol. Pharmacol. *26*:371, 1890
8. Banting, F.G., Best, C.H.: Internal secretion of the pancreas. J. Lab. Clin. Med. *7*:251, 1922
9. Little, J.M., Lauer, C., Hogg, J.: Pancreatic duct obstruction with an acrylate glue: A new method for producing pancreatic exocrine atrophy. Surgery *81*:243, 1977
10. Gebhardt, C., Stolte, M.: Pankreasgangokklusion durch Injektion einer schnell härtenden Aminosäurelösung. Langenbecks Arch. Chir. *346*:149, 1978
11. Klöppel, G., Bommer, G., Commandeur, G., Heitz, P.H.: The endocrine pancreas in chronic pancreatitis-immunocytochemical and ultrastructural studies. Virchows Arch. Pathol. Anat. *377*:157, 1978
12. Tympner, F., Domschke, S., Domschke, W., Classen, M., Demling, L.: Reproducibility of the response to secretin and secretin plus pancreozymin in man. Scand. J. Gastroenterol. *9*:377, 1974
13. Kaffarnik, H., Meyer-Bertenrath, J.G.: Zur Methodik und klinischen Bedeutung eines neuen Pankreaslipase Test mit Fluoresceindilaurinsäureester. Klin. Wochenschr. *47*:221, 1969
14. Ammann, R.W., Tagwerker, E., Kashiwagi, H., Rosenmund, H.: Diagnostic value of fecal chymotrypsin and trypsin assessment for detection of pancreatic disease. Am. J. Dig. Dis. *13*:123, 1968
15. Domschke, S., Heptner, G., Kolb, S., Sailer, D., Schneider, M.U., Domschke, W.: Decrease in plasma amino acid level after secretin and pancreozymin as an indicator of exocrine pancreatic function. Gastroenterology *90*:1031, 1986
16. Yalow, R.S., Berson, S.A.: Immunoassay of endogenous plasma insulin in man. J. Clin. Invest. *39*:1157, 1960
17. Beischer, W., Keller, L., Maas, E., Schiefer, E., Pfeiffer, E.F.: Human C-peptide. Part I: Radioimmunoassay. Klin. Wochenschr. *54*:709, 1976
18. Becker, V.: Chronische Pankreatitis: Klinische Morphologie. In Gastroenterologie und Stoffwechsel, Band 21, H. Barthelheimer, editor, Stuttgart, Georg Thieme Verlag, 1984
19. Stolte, M., Weiß, W., Volkholz, H., Rösch, W.: A special form of segmental pancreatitis: "Groove pancreatitis." Hepato-Gastroenterol. *29*:198, 1982
20. Frey, C.F., Bodai, B.J.: Surgery in chronic pancreatitis. Clin. Gastroenterol. *13*:913, 1984
21. Flautner, L., Tihanyi, T., Bock, G., Szécsény, A.: Komplikationen nach Duodenopankreatektomie bei chronischer Pankreatitis. Chirurg *55*:404, 1984
22. Trede, M.: Pankreaskopfresektion bei chronischer Pankreatitis. Langenbecks Arch. Chir. *362*:227, 1984
23. Taylor, R.H., Bagley, F.H., Braasch, J.W., Warren, K.W.: Ductal drainage or resection for chronic pancreatitis. Am. J. Surg. *141*:28, 1981
24. Leger, L., Lenriot, J.P., Lemaigre, G.: Five to twenty year follow-up after surgery for chronic pancreatitis. Ann. Surg. *180*: 185, 1974
25. Mangold, G., Neher, M., Oswald, B., Wagner, G.: Ergebnisse der Resektionsbehandlung der chronischen Pankreatitis. Dtsch. Med. Wochenschr. *102*:229, 1977
26. Moreaux, J.: Long-term follow-up study of 50 patients with pancreaticoduodenectomy for chronic pancreatitis. World J. Surg. *8*:346, 1984
27. Dohi, K., Tanaka, T., Asahara, T., Kodama, O., Matsayama, T., Takasugi, S., Marubayashi, S., Ezaki, H.: A comparison of pancreatectomy and pancreatic duct drainage in chronic pancreatitis. Hiroshima J. Med. Sci. *34*:119, 1985
28. Temler, R.S., Felber, J.F.: Radioimmunoassay of human plasma trypsin. Biochem. Biophys. Acta *445*:720, 1976
29. Lauer, E., Stolte, M., Zirngibl, H., Gebhardt, C., Schwille, P.O.: Ultrastructure of the islets of Langerhans after long-term occlusion of the pancreatic duct system. Z. Gastroenterol. *24*:700, 1986
30. Gall, F.P., Gebhardt, C., Zirngibl, H.: Chronic pancreatitis—Results in 116 consecutive partial duodenopancreatectomies combined with pancreatic duct occlusion. Hepato-Gastroenterol. *29*: 115, 1982
31. Steegmüller, K.W., Märklin, H.M., Fischer, R.: Die partielle Duodenopankreatektomie mit Pankreasgangokklusion. Vorläufige Ergebnisse. Z. Gastroenterol. *20*:617, 1982
32. Lankisch, P.G., Fuchs, K., Schmidt, H., Peiper, H.J., Creutzfeld, W.: Ergebnisse der operativen Behandlung der chronischen Pankreatitis mit besonderer Berücksichtigung der exokrinen und endokrinen Funktion. Dtsch. Med. Wochenschr. *100*:1048, 1975
33. Rosenberger, J., Stock, W., Altmann, P., Pichlmaier, H.: Spätergebnisse nach organerhaltenden und resezierenden Eingriffen wegen chronischer Pankreatitis. Leber Magen Darm *10*:22, 1980

Invited Commentary

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This series of 289 patients treated for chronic pancreatitis by a modified surgical procedure is another attempt to solve the difficult problem of pain control in this disease. The waiting game for the pancreas to "burn out" is frustrating and often unacceptable. Nonsurgical approaches (enzyme therapy, endoscopic manipulations) have not yet proven effective. The issue here is whether the new operation is better than its predecessors.

Before considering the surgery, one must consider the rationale and its relation to the mechanism of pain. If pain is due to ductal hypertension and distention, retrograde drainage (Puestow-type pancreatojejunostomy) should and probably does suffice [1, 2]. It is not clear whether the authors included patients with large dilated main pancreatic ducts suitable for a decompressive procedure. If pain is due to acquired abnormalities of the size and number of pancreatic sensory nerves [3], then the induction of exocrine failure might or might not add significantly to the resection performed. If the pain is due to obstruction of side ducts by protein precipitates or small stones, it seems unlikely that the Ethibloc® will do much more or anything different.

Next, the nature, extent, and consequences of the operation itself must be examined. The operation is a duodenopancreatectomy of the "Whipple" type, similar in every respect but one—the injection of Ethibloc® into the remaining main pancreatic duct—to the operation performed for chronic pancreatitis in many other centers. Although the authors compare their postoperative morbidity (12.2%) and mortality (1%) to advantage against older experiences, the current statistics from major centers including our own [4–6] report equally good mortality