# Organ-Preserving Surgery in Chronic Pancreatitis: The Duodenum Preserving Pancreatic Head Resection

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**Abstract**

*Chronic pancreatitis is a inhomogeneous disease of multifactorial genesis and a variable clinical course. Upper abdominal pain is the leading clinical symptom of the majority of the patients. The primary treatment of these patients is conservative, but if the treatment fails in pain relief or organ complications occur surgical treatment is indicated. The most common organ complications due to chronic pancreatitis are stenosis of the common bile duct and the pancreatic duct, duodenal stenosis, stenosis of the portal vein with portal hypertension, pancreatic pseudocysts and the development of pancreatic fistula. Due to the pathophysiological concept of an elevated duct pressure as a source of pain, duct decompression by drainage procedures is the favored surgical procedure by many surgeons. Nevertheless, even in patients with a dilated pancreatic main duct, only half of the patients will benefit from drainage operations. Long-term severe upper abdominal pain and complications of the neighboring organs due to an inflammatory mass in the head of the pancreas should be indicative for resective procedures which should be organ preserving as much as possible and take into account the endocrine function of the pancreatic gland. Simultaneous multiple organ resections like pylorus preserving partial duodenopancreatectomy or total pancreatectomy are not necessary for a benign disease and should be only performed in patients with proven malignancy. The aim of the surgical procedure is to reduce pain and frequency of relapsing pancreatitis without impairing the endocrine function of the pancreatic gland.*
Key words: Chronic pancreatitis, duodenum preserving pancreatic head resection, inflammatory mass, endocrine function.

**Riassunto**

*La pancreatite cronica è una patologia multifattoriale e disomogenea caratterizzata da un decorso clinico molto variabile. Un dolore addominale superiore è sicuramente il sintomo principale nella maggioranza dei pazienti. Il trattamento primario di questi pazienti è conservativo ma, in caso di fallimento della terapia del dolore o di complicazioni a carico di altri organi, esiste indicazione alla terapia chirurgica. Le più comuni complicazioni dovute alla pancreatite cronica sono: la stenosi del dotto biliare principale, la stenosi del dotto pancreatico, la stenosi duodenale e la stenosi della vena porta con ipertensione portale, la formazione di pseudocisti pancreatiche e lo sviluppo di fistole pancreatiche.*

*La decompressione mediante procedure di drenaggio del dotto pancreatico, basata sul concetto patofisiologico di un aumentata pressione intraduttale come sorgente del dolore nella pancreatite cronica è la tecnica chirurgica usata dalla maggior parte dei chirurghi. Ciò nonostante, anche nei pazienti con dotto pancretico dilatato l'intervento di drenaggio duttale sembra avere successo solo*

## Clinical symptoms

The leading clinical symptoms in the subgroup of patients with chronic pancreatitis and an inflammatory mass in the head is nearly untractable pain. The patients should be primarily treated conservatively. The hope for a reduction of pain due to a reduction of pancreatic parenchyma ("burning-out") has hold true only for a part of the patients (1). Lankisch et al. demonstrated that at least half of the patients suffered from pain after 5 and 10 years, respectively (2, 3). The cause of pain remains unclear, nevertheless there are at least two main factors (4-7). Bradley et al. could prove that the elevated pressure in the pancreatic duct and pancreatic parenchyma contributes to the pain in chronic pancreatitis (8, 9). Electron microscopical investigations of Bockman et al. revealed a specific pancreatitis associated neuritis in the pancreatic parenchyma of specimens of patients with inflammatory mass in the pancreatic head (10). According to the direct involvement of the nerves of the pancreas, elevated levels of neurotransmitters like SP (substance P) and CGRP (Calcitonin gene related peptide) contribute to the pain syndrome in chronic pancreatitis (11, 12).

## Morphologic alterations

A subgroup of 20-30% of the patients with chronic pancreatitis develop an inflammatory mass in the head of the pancreas. The cause of the favored location in the pancreatic head remains unclear so far. Molecular biologic investigations revealed elevated levels of growth factors like EGF, TGF-$\alpha$, aFGF and bFGF (13, 14). The morphological characteristics are areas of focal necrosis,

*nella metà dei casi. Il dolore addominale superiore di lunga data e le complicazioni a carico degli organi confinanti con il pancreas dovute ad una massa infiammatoria a carico della testa del pancreas dovrebbero essere considerate come indicazione ad una chirurgia resettiva del pancreas che dovrebbe preservare il più possibile l'organo e nello stesso tempo tenere in considerazione la funzione endocrina dell'organo stesso. Resezioni multiple simultanee come la cefalopancreasectomia con parziale resezione del duodeno o la pancreatectomia totale non sono necessarie per una patologia benigna come la pancreatite cronica e dovrebbero essere riservate solo a casi di provata malignità. Scopo delle tecniche chirurgiche è quello di ridurre il dolore e la frequenza degli attacchi di pancreatite acuta senza intaccare la funzione endocrina della ghiandola pancreatica.*
Parole chiave: Pancreatite cronica, cefalopancreasectomia con conservazione del duodeno, massa infiammatoria, fusione endocrina.

Tab. I – PATHOMORPHOLOGICAL CHANGES IN THE PANCREATIC HEAD WITH INFLAMMATORY MASS INTRAOPERATIVE FINDINGS IN 448 PATIENTS*

| | *Patients* | *%* |
|---|---|---|
| Calcifications of the parenchyma | 255 | 57 |
| Pseudocystic small cavities <1 cm | 110 | 25 |
| Large pseudocysts | 35 | 8 |
| Areas of focal necroses (>1 cm) | 40 | 9 |
| Pancreatic main duct stenosis | 166 | 37 |

*-4/1997, Department of General Surgery, University of Ulm

Tab. II – CHRONIC PANCREATITIS WITH INFLAMMATORY MASS IN THE HEAD OF THE PANCREAS. PREOPERATIVE MORBIDITY AND LOCAL COMPLICATIONS OF 448 PATIENTS*

| | *Patients* | *%* |
|---|---|---|
| Abdominal pain | 408 | 91 |
| Inflammatory mass in the head | 351 | 78 |
| Common bile duct stenosis | 215 | 48 |
| Duodenum stenosis | 114 | 25 |
| Vascular obstruction | 78 | 17 |

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calcifications and small pseudocystic cavities (Tab. I). The clinical picture is dominated by local complications due to the enlarged pancreatic head. According to the location of the distal common bile duct in the dorsal part of the pancreas a stenosis in this segment occurs in 48% of the patients. 75% of the patients have a stenosis of the main pancreatic duct in the prepapillary segment. A radiologically proven stenosis of the duodenum due to fibrotic ligaments is obvious in 25% of the patients. 17% of the patients develop a stenosis of the portal vein and/or the superior mesenteric vein in the region of the confluence (Tab. II). The majority of the patients are male, less than 40 years old and have a long history of alcohol consumption.

## Indications for surgery

A surgical treatment is indicated if the patients suffer from untractable pain combined with an enlarged pancreatic head and/or local complications of the surrounding organs. The most important local complications are the stenosis of the common bile duct and main pancreatic duct, the stenosis of the duodenum and the stenosis or occlusion of the portal vein eventually combined with portal hypertension. Other severe complications are the development of pancreatic pseudocysts which can not be treated by interventional procedures, pancreatic necroses and pancreatogenic ascites due to pancreatic fistula. Pancreatic duct stenosis which are not suitable for endoscopic treatment make surgical intervention necessary as well (15-17). Other reasons for surgery are pancreas divisum and benign tumors of the pancreas (Tab. III). The indication for surgery is also given in about 10% of the patients if malignancy of the tumor can not ruled out preoperatively by radiological means. The aims of the surgical treatment is reduction or complete abortion of pain, reduction of recurrent episodes of acute pancreatitis

Tab. III – DUODENUM PRESERVING PANCREATIC HEAD RESECTION INDICATION FOR SURGERY IN 478 PATIENTS*

| | *Patients* | *Mortality* |
|---|---|---|
| Chronic pancreatitis | 448 | 0.9% |
| Pancreas divisum | 17 | 0% |
| Cystadenoma in the pancreatic head | 10 | 0% |
| Endocrine tumor in the pancreatic head | 3 | 0% |

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Tab. IV – SURGERY IN CHRONIC PANCREATITIS: ULM EXPERIENCE OF 750 PATIENTS*

| | *Patients* | *%* |
|---|---|---|
| Duct drainage/ Pseudocyst drainage | 102 | 14 |
| Left resection | 81 | 11 |
| DPPHR2 | 448 | 60 |
| PPPHR3 | 58 | 8 |
| Whipple | 11 | 1 |
| Others | 50 | 7 |

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2DPPHR= Duodenum preserving pancreatic head resection
3PPPHR= Pylorus preserving partial duodenopancreatectomy

Fig. 1: Exposure of the head of the pancreas and banding of the pancreas at the level of the portal vein, the hepatic artery and the common bile duct.

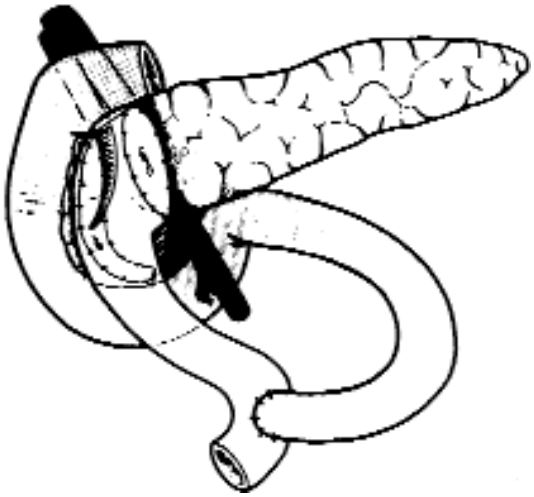

Fig. 3:Interposition of the first jejunal loop after resection with restoration of pancreatic flow.

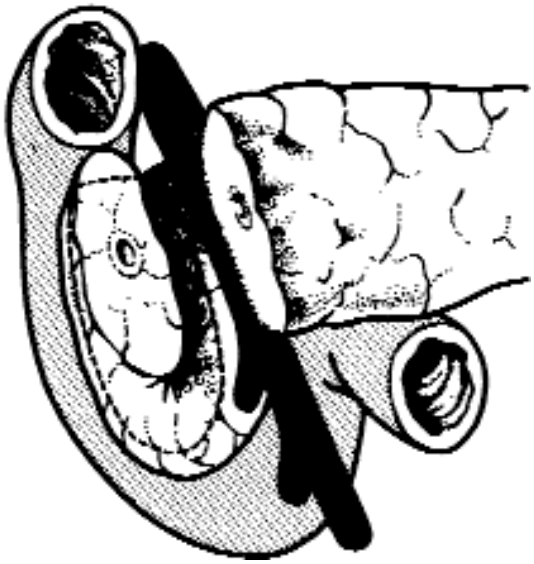

Fig. 2: Transsection of the pancreas between head and body and subtotal resection of the head of the pancreas.

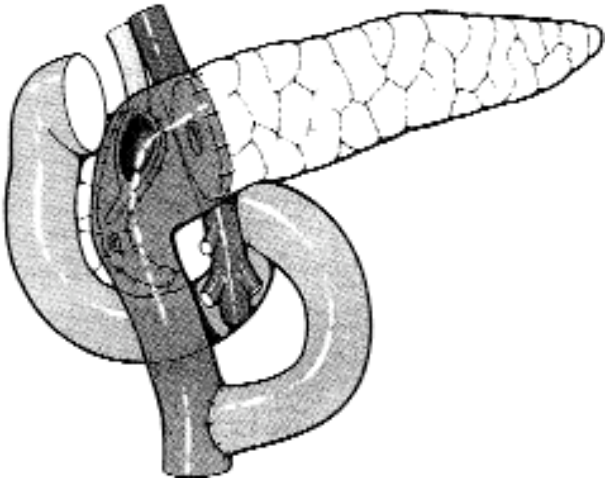

Fig. 4:In case of stricture of the common bile duct, an additional common bile duct jejunum anastomosis is necessary to restore bile flow in the upper intestine.

and treatment of the local complications due to the inflammatory mass in the pancreatic head with preservation of as much as possible of the endocrine and exocrine function. In order to avoid overtreatment the preservation of stomach, duodenum and common bile duct is necessary. According to pathophysiological causes of the morphological alteration, three main surgical principles are mostly performed. If there is only a dilatation of the main pancreatic duct, a drainage procedure of the ductal system is indicated. In case of a development of an inflammatory mass in the pancreatic head, the surgical therapy of choice should be the duodenum preserving pancreatic head resection. If the morphologic alteration is located mainly in the pancreatic corpus or cauda, a distal pancreatic resection with preservation of the spleen should be performed. The distribution of the different surgical procedures in the Department of General Surgery of the University of Ulm is shown in Table IV.

**Operative procedure**

The operative steps are shown in pictures 1-3. The first step is the exposure of the head of the pancreas by ventral dissection and dorsal mobilization by the Kocher maneuver. Before resection, a tunneling of the pancreas over the portal vein and the dissection of the common hepatic artery on the cranial border of the pancreas is necessary. The resection begins with the transsection of the pancreas over the portal vein. The pancreatic head must be subtotal resected from the right border of the portal vein towards the prepapillary common bile duct. A rim of pancreatic tissue (5 to 10 mm) remains between

Tab. V – EARLY POSTOPERATIVE RESULTS AFTER DUODENUM PRESERVING PANCREATIC HEAD RESECTION IN 448 PATIENTS*

| | | |
|---|---|---|
| Deterioration of endocrine function | 12 pts. | 3% |
| Improvement of endocrine function | 38 pts. | 8% |
| Relaparotomy | 27 pts. | 6% |
| Postop. Hospitalisation | 14.5 days | |
| Hospital mortality | 4 pts. | 0.9% |

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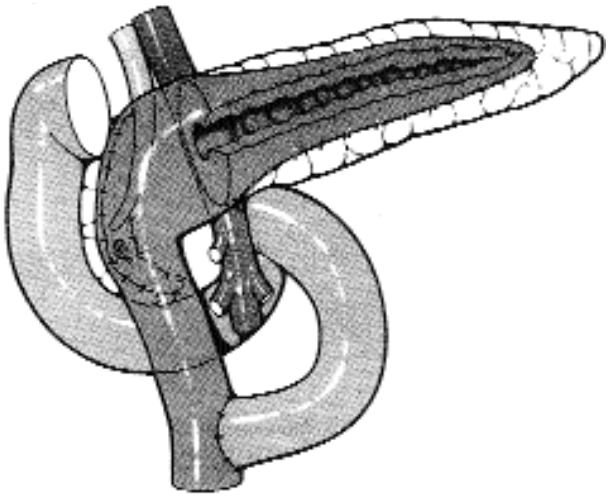

Fig. 5: In case of a dilated an stenosed pancreatic main duct in the left pancreas, a side-to-side anastomosis like the Puestow procedure is performed.

the wall of the duodenum and the common bile duct. The pancreatic juice is drained into a jejunal Roux-en-Y loop between the left side of the pancreas and the rim of the head of the pancreas. In case of stenosis of the common bile duct in the intrapancreatic segment, which can not be decompressed by resection of the pancreatic head, an additional biliary anatomosis is necessary (picture 4). The biliary anastomosis has to be done in 23% of the patients and should be combined with a cholecystectomy. In cases of multiple stenoses and dilatations of the pancreatic duct a longitudinal incision of the duct and a side-to-side pancreatico-jejunostomy has to be performed (picture 5). This variation is necessary in 7% of all patients. The duodenum preserving pancreatic head resection leads to a decompression of the portal vein in 13%. The decompression of the duodenum can be achieved by transsection of fibrotic ligaments, which caused a duodenal stenosis with gastric outlet syndrome in 6% of the patients (18-20).

## Early- and Late Results

The early-and late morbidity after duodenum preserving pancreatic head resection is low because only a local resection of the inflammatory pancreatic head is performed while the neighboring structures are preserved. 6% of the patients had to be reoperated because of complications like bleeding of the pancreatic anastomosis, anastomotic insufficiency or intraabdominal abscess. Only 2 patients developed an ischemia of the duodenum (21). The hospital mortality was 0.9% (Tab. V). Follow-up

Tab. VI – DUODENUM PRESERVING PANCREATIC HEAD RESECTION-LATE POSTOPERATIVE RESULTS

| | *1984 [19]*<br>*Follow-up: 2 years (median)*<br>*56 pts. [%]* | *1988 [20]*<br>*Follow-up: 3.6 years (median)*<br>*128 pts. [%]* | *1994 [23]*<br>*Follow-up: 6 years (median)*<br>*258 pts. [%]* |
|---|---|---|---|
| Pain (none or rare) | 92.8 | 84 | 88 |
| Recurrent AP | – | 11 | 10 |
| Professional rehabilitated | 85.7 | 67 | 63 |
| Late mortality | 3.6 | 4.7 | 8.9 |

Tab VII – CHRONIC PANCREATITIS: ENDOCRINE FUNCTION AFTER DUODENUM PRESERVING PANCREATIC HEAD RESECTION

| *Endocrine function* | *Preop. [2] (n = 128)* | | *Early postop. (n = 127)* | | *Late postop. (n = 109)[3]* | |
|---|---|---|---|---|---|---|
| Normal | 76 | 59.4% | 77 | 60.6% | 52 | 47. 7% |
| Latent | 27 | 21.1% | 24 | 18.9% | 28 | 25.7% |
| Insulin dependent | 25 | 19.5% | 26 | 20.5% | 29 | 26.6% |

[2]OGTT in 22 patients; profile of blood glucose in 81 patients
[3]OGTT in 29 patients; profile of blood glucose in 51 patients; patients with insulin dependent diabetes mellitus were not tested.

investigations after a median of 2, 3.6 and 6 years revealed absence of pain in 75-82% of the patients. Only 7% of the patients needed analgetic medication further on. 8-11% had to be treated again because of recurrent episodes of pancreatitis. The late mortality after duodenum preserving pancreatic head resection was 4%, 4.7% and 8.9%, respectively (Tab. VI). Early postoperative investigations demonstrate, that the endocrine function was unchanged in 89% of the patients compared to the preoperative situation. 8% of the patients showed an improvement of the glucose metabolism, only 3% had a deteriorated endocrine function (Tab. V). In the long term follow up the change of the endocrine function compared to early postoperative period was as follows: unchanged in 80.7%, deteriorated in 13.7% and improved in 5.5% of the patients (Tab. VII) (20).

## Conclusion

The duodenum preserving pancreatic head resection is indicated in patients with chronic pancreatitis, severe abdominal pain and enlarged pancreatic head of the pancreas. 40-70% of these patients reveal local complications due to the enlarged pancreatic head such as a stenosis of the common bile duct, pancreatic duct, duodenum and portal vein. The operation leads to a resection of 20-30% of the pancreas but preserves the duodenum, common bile duct and the stomach. Compared to the pylorus preserving partial duodenopancreatectomy, the operative trauma of the duodenum preserving pancreatic head resection is lower. A prospective randomized trial between both operative procedures revealed for patients operated with the duodenum preserving technique a better glucose metabolism, a greater increase of the body weight and less pain (22). The duodenum preserving resection combines the advantage of the preservation of the endocrine function with a high rate of patients without pain in the long term follow-up. The rate of late deaths is low compared with the natural course of the disease, where 22% of the patients die during a 10-years period (3). The duodenum preserving pancreatic head resection fulfills the criteria's of an organ preserving procedure with the advantage of a low postoperative morbidity and should be therefore the surgical procedure of choice in the group of patients with inflammatory mass in the pancreatic head (18).

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