

## “WIRSUNGECTOMY” FOR CHRONIC PANCREATITIS

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### ABSTRACT

**Purpose:** To evaluate a novel modification of the classic Partington-Rochelle procedure via comparing functional results between conventional surgery group and “wirsungectomy” group.

**Methods:** A retrospective analysis of the case histories of patients with CP and an enlarged ( $\geq 4$  mm) main pancreatic duct was carried out for the period from 2003 to 2009, which underwent surgical treatment of CP. The SF-36 and EORTC (QLQ) C30 questionnaires were used for assessment, visual analogue scale of pain. First group: wirsungectomy with lateral pancreatojejunostomy (PEA + WE) was performed - 5 patients; Second group: only lateral pancreatojejunostomy (PEA) was performed - 20 patients. Cross-tabulation analyses were performed to compare PEA and PEA + WE group as well as those groups in different time points using two-sided Student t-test. The significance level was set to  $p < 0.05$ .

**Results:** Groups were compared in terms of VAS and the EORTC (QLQ) C30 questionnaire before and 2 years after surgery using Student's t-test for unrelated values: statistically significant differences between the groups according to VAS as before ( $p = 0.757$ ) and after surgery ( $p = 0.696$ ) were not obtained. There were no significant differences ( $p > 0.05$ ) between the PEA and PEA + WE groups before and after surgery according to the EORTC (QLQ) C30 questionnaires, except for some items ( $p < 0.05$ ) Within the groups according to VAS and EORTC (QLQ) C30 (pain severity), in the PEA group ( $p = 0.000001$ ,  $p = 0.000109$ ) and in the PEA + WE group ( $p = 0.018$ ,  $p = 0.017$ ) after surgery, there was a statistically significant decrease in pain.

**Conclusion:** Wirsungectomy is justified in patients with multiple calcifications in pancreatic ducts of the 2nd and 3rd order, with long-lasting CP and severe fibrosis of the pancreas, thus allow decompression of both the pancreatic parenchyma and the Wirsung duct. More cases needed for evidence-based comparison.

**Keywords:** Pancreatitis, Chronic [C06.689.750.830]; Pancreas [A03.734]; Abdominal Pain [C23.888.592.612.054].

### INTRODUCTION

Pain in chronic pancreatitis (CP) can occur as a consequence of mechanical factors - intraductal hypertension, interstitial pressure, inflammatory and neuropathic pathological changes in the pancreas and / or surrounding organs, as well as a consequence of malabsorption [1].

When analyzing works devoted to mechanical factors, attention is drawn to the experimental study of Karanjia et al. [2]. In this study on a feline model of chronic obstructive pancreatitis, the authors came to the conclusion that it is not so much hypertension in the pancreatic duct system per se, as the occurrence of compartment syndrome of the pancreatic parenchyma with its ischemia leads

to pain and a decrease in pancreatic function. Fibrosis of the capsule of the pancreas and interlobular septa makes the pancreas "inextensible" and sharply increases the peripheral resistance to blood flow in the pancreatic parenchyma, which is further aggravated by ductal hypertension. This mechanism may explain pain relief and preservation of pancreatic function (assuming early intervention) in interventions aimed at decompression of the main pancreatic duct, as described by Amman et al. the phenomenon of "burnout" of pain in CP, when in some cases of terminal CP with complete exocrine insufficiency, the pain syndrome subsequently decreases significantly [3], which can be explained by the lack of increased blood flow to the pancreatic parenchyma when eating.

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Fibrosis in CP is most pronounced in the peryductal zone and, accordingly, around the main pancreatic duct and second and third order ducts [4].

Based on the hypothesis of the compartment syndrome in CP, as one of the causes of pain, pathogenetic intervention aimed not only at reducing the pressure in the main pancreatic duct, but also at reducing the stiffness of the pancreatic tissue can be "Wirsungectomy", first described by Vorobey et al. [5]. Wirsungectomy consists in dissection of the main pancreatic duct and subsequent excision of its wall using a special laser device. This should lead to better opening of the second and third order ducts and to a decrease in both ductal and intraparenchymal hypertension. It is not essential to perform wirsungectomy with a laser and can be performed using a combination of acute excision and hydro-preparation [6]. Excision of the Wirsung duct relieves the pancreatic parenchyma from a significant part of its fibrous stroma and, accordingly, will contribute to the resolution of the above-described compartment syndrome, while the effect of wirsungectomy is complemented by drainage or resection-drainage procedure on the pancreas, indications for which are formed based on the presence/absence of an inflammatory mass in the head.

Wirsungectomy should not be confused with the Izbicky procedure - "V-shaped excision of the main pancreatic duct" [7]. The Izbicky procedure is indicated for patients with the so-called "Small duct disease" [8, 9], in which the diameter of the Wirsung duct is  $\leq 3$  mm. The main difference from the "Wirsungectomy" is that the Izbicky procedure is aimed at reducing hypertension in the pancreatic parenchyma and resolving the compartment syndrome by longitudinal V-shaped excision of the parenchyma to ensure drainage of the 2nd and 3rd order ducts with narrow or completely "absent" Wirsung duct [10], while wirsungectomy is indicated for the same purposes in patients with CP with a wide main pancreatic duct. Pathohistological examination of the removed main pancreatic duct may be the reason for active follow-up or performing resection interventions to detect preneoplastic changes (PanIn) and early pancreatic cancer (T in situ, T1a), respectively [4].

## METHODS

A retrospective analysis of the case histories of patients with CP and an enlarged ( $\geq 4$  mm) main pancreatic duct was carried out for the period from 2003 to 2009, which underwent surgical treatment of CP. The primary endpoint of this analysis was pain control, secondary endpoints, quality of life, complications from adjacent organs, mortality, complications, and reoperations. The SF-36 and EORTC (QLQ) C30 questionnaires were used for assessment, visual analogue scale of pain (VAS) - from 0 to 100, no pain (0-4), mild pain (5-44), moderate pain (45-74), severe pain (75-100). Two groups of patients were singled out - 1) the group in which wirsungectomy with lateral pancreatojejunostomy (PEA + WE) was performed - 5 patients; 2) group in which only lateral pancreatojejunostomy (PEA) was performed - 20 patients. Statistical analysis was performed with IBM SPSS Version 22 (SPSS Inc, Chicago, IL) and R software. Continuous and categorical variables were expressed as median/range and absolute/relative frequencies, respectively. Cross-tabulation analyses were performed to compare PEA and PEA + WE group as well as those groups in different time points using two-sided Student t-test. The significance level was set to  $p < 0.05$ .

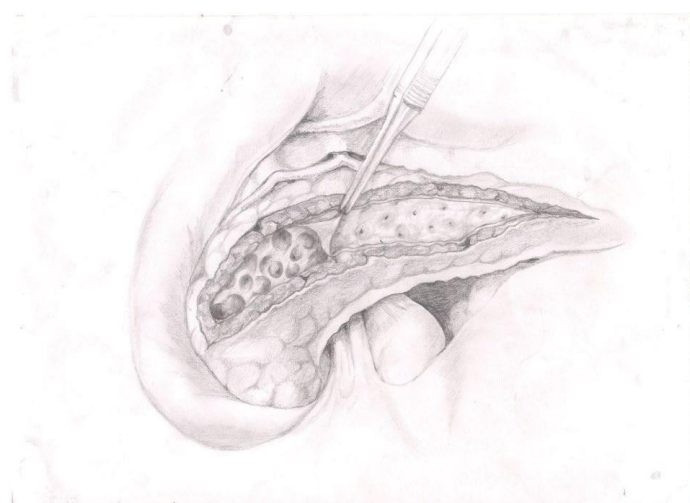
## Surgical Technique

After performing the upper-median laparotomy, the Kocher maneuver is performed. The gastrocolic ligament is then dissected and a longitudinal pancreatotomy is performed. After removal of calculi from the main pancreatic duct, the wall of the main pancreatic duct is removed (wirsungectomy) using hydropreparation with a solution of novocaine and scissors with tweezers. After removing the wall of the main pancreatic duct, calculi and "protein plugs" are removed from the pancreatic ducts of a smaller order. After that, a longitudinal pancreatojejunostomy with Roux-en-Y loop is performed. Pancreatojejunostomy was performed in both groups by Partington-Rochell technique [Figure 1].

## RESULTS

In the PEA + WE group, the age of patients varied within 32-54 years (median 35), in the PEA group - 18-67 years (median 39). Sex distribution: in the PEA + WE group - 1 woman and 4 men, in the PEA group - 6 women and 14 men. Pain assessment by VAS before surgery and 2 years post-op is shown in [Table 1]. EORTC (QLQ) C30 results were collected and evaluated before surgery and 2 years post-op, the data are summarized in [Table 2]. Quality of life according to SF-36 questionnaires was assessed as 2 years post-op. After transformation of the responses of patients on eight scales of the questionnaire into points of quality of life, they are given as means with standard deviations for groups in [Table 3].

The PEA and PEA + WE groups were compared in terms of VAS and the EORTC (QLQ) C30 questionnaire before and 2 years after surgery using Student's t-test for unrelated values: statistically significant differences between the groups according to VAS as before ( $p = 0.757547$ ) and after surgery ( $p = 0.696086$ ) were not obtained. There were no statistically significant differences ( $p > 0.05$ ) between the PEA and PEA + WE groups before and after surgery according to the EORTC (QLQ) C30 questionnaires (analysis data are summarized in Table 2), except for the best general physical status both before and after surgery in the PEA group, better cognitive function after surgery in the PEA group ( $p < 0.05$ ). From complications from adjacent organs, in the PEA group, stricture of the distal common bile duct was observed in 3 patients, which was an indication for staged treatment in the



**Figure 1:** Scheme of performing wirsungectomy: The removed wall of the Main Pancreatic Duct is lifted with tweezers; as the latter is removed, the lumens of the ducts of the 2nd and 3rd orders are visible.

**Table 1:** Pain score according to VAS (values, means with standard deviations  $\sigma$ )

Timepoint	PEA			PEA + WE		
	Quantity, range	Mean	$\sigma$	Quantity, range	Mean	$\sigma$
Before surgery	«no pain» N - «weak pain» N 3 (35-42) «moderate pain» N 13 (48-70) «strong pain» N 4 (78-85)	60,95	14,3	«no pain» N - «weak pain» N - «moderate pain» N 4 (46-70) «strong pain» N 1 (80)	63	12,8
2 years post-op	«no pain» N 11 (0) «weak pain» N 6 (10-41) «moderate pain» N 2 (50-61) «strong pain» N 1 (78)	37,8	5,39	«no pain» N 2 (0) «weak pain» N 2 (12-30) «moderate pain» N 1 (57) «strong pain» N -	33	22,64

**Table 2:** Assessment of the quality of life according to EORTC (QLQ) C30 before and 2 years after surgery (mean, standard deviations -  $\sigma$  - are indicated in brackets).

Scale	PEA (Before surgery)	PEA + WE (Before surgery)	p-value, t-test	PEA (2 years post-op)	PEA + WE (2 years post-op)	p-value, t-test
General physical status	77,35 (14,07)	37 (14,3)	p=0.000037	80,2 (7,64)	55 (9,3)	p=0.000044
Working ability	64,25 (12,53)	53,6 (16,33)	p=0.231	64,65 (17,92)	58,2 (14,54)	p=0.448
Cognitive function	65,5 (17,54)	58,2 (12,51)	p=0.337	71,1 (8,14)	61,2 (7,79)	p=0.032
Emotional functioning	62,95 (16,56)	68,2 (12,27)	p=0.474	63,6 (21,91)	65,6 (14,22)	p=0.820
Social functioning	53,6 (16,18)	50,8 (21,22)	p=0.805	58,2 (22,71)	65,8 (13,42)	p=0.380
Overall quality of life	55,45 (21,82)	48,4 (7,7)	p=0.276	71,85 (17,55)	67 (11,68)	p=0.501
Symptom Scales (The higher the score, the stronger the symptom is)						
Fatigue	35,5 (18,06)	26,6 (8,56)	p=0.149	25,6 (11,83)	23 (6,89)	p=0.559
Pain	55,4 (22,48)	70,4 (12,05)	p=0.072	31,95 (7,16)	41,4 (14,2)	p=0.208
Anorexia	30 (11,88)	33 (7,17)	p=0.512	24,45 (8,11)	29,4 (4,87)	p=0.120

**Table 3:** Assessment of the quality of life according to SF-36 2 years after surgery (mean with standard deviations)

Criterion	PEA		PEA + WE	
	Mean	$\sigma$	Mean	$\sigma$
Physical functioning	64.15	16.68	71.6	9.18
Role-based physical functioning	56.65	14.44	61.6	14.15
Pain score	55.7	22.16	65.6	9.71
General health	61.2	17.76	67.6	9.01
Vitality scale	58	17.52	58.8	33.1
Social functioning scale	69.15	18.66	73.8	11.43
Role-based emotional functioning	57.15	19.09	62	16.53
Psychological health	68.15	17.2	57	15.31

form of PTCd in 1 patient followed by hepaticojejunostomy, in 2 others transduodenal papillosphincterotomy was performed simultaneously. In the PEA + WEA group, 1 patient was preoperatively diagnosed with left-sided hydrothorax, pleural cavity drainage was performed, the study of effusion for amylase confirmed the diagnosis of pancreatopleural fistula, the latter finally resolved after the main operation. Early postoperative complications in the PEA group - bile leakage in 1 patient with laparoscopic PEA and cholecystectomy, eliminated by relaparoscopy, drainage of the abdominal cavity; Intra-abdominal bleeding, class A according to ISGPS, occurred in 1 patient – it was managed conservatively. In the PEA + WE group: 1 gastrointestinal bleeding from esophageal

varices was managed conservatively. There was no perioperative lethality.

The average operation time for PEA was 154 minutes (136-215), the average time for PEA with WE was 203 minutes (189-232).

## DISCUSSION

Considering the incomparable sample size (20: 5) and the small number of observations in the PEA + WE group, the comparison of these two groups was rather arbitrary: firstly, more observations of WE are required, and secondly, it should be taken into account that WE was performed in patients with obviously longer history

and more pronounced symptoms, with greater severity of local changes (multiple calcifications in small ducts, requiring their removal). When performing the Student's t-test within the groups according to VAS and EORTC (QLQ) C30 (pain severity), in the PEA group ( $p = 0.000001$ ,  $p = 0.000109$ ) and in the PEA + WE group ( $p = 0.018119$ ,  $p = 0.017004$ ) after surgery, there was a statistically significant decrease in pain - the main symptom in CP, which is a measure of the effectiveness of interventions.

## CONCLUSION

Performing pancreatojejunostomy and viersungectomy is justified in patients with multiple calcifications in pancreatic ducts of the 2nd and 3rd order, with prolonged CP and severe fibrosis of the pancreas stroma, thus allow decompression of both the pancreatic parenchyma and the Wirsung duct. This intervention is accompanied by a decrease in pain, but more observations are required to exclude the possible influence of modifying factors (intemperance from alcohol), as well as to compare patients comparable in severity and duration of CP.

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