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ORIGINAL ARTICLE

Arguments for an individualized closure of the pancreatic remnant after distal pancreatic resection

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Abstract

AIM: To analyze risk factors for postoperative pancreatic fistula (POPF) rate after distal pancreatic resection (DPR).

METHODS: We performed a retrospective analysis of 126 DPRs during 16 years. The primary endpoint was clinically relevant pancreatic fistula.

RESULTS: Over the years, there was an increasing rate of operations in patients with a high-risk pancreas and a significant change in operative techniques. POPF was the most prominent factor for perioperative morbidity. Significant risk factors for pancreatic fistula were high body mass index (BMI) [odds ratio (OR) = 1.2 (CI: 1.1-1.3), P = 0.001], high-risk pancreatic pathology [OR = 3.0 (CI: 1.3-7.0), P = 0.011] and direct closure of the pancreas by hand suture [OR = 2.9 (CI: 1.2-6.7), P = 0.014]. Of these, BMI and hand suture closure were independent risk factors in multivariate analysis. While hand suture closure was a risk factor in the low-risk pancreas subgroup, high BMI further increased the fistula rate for a high-risk pancreas.

CONCLUSION: We propose a risk-adapted and indication-adapted choice of the closure method for the pancreatic remnant to reduce pancreatic fistula rate.

Key words: Distal pancreatic resection; Postoperative pancreatic fistula; Body mass index

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INTRODUCTION

Distal pancreatic resection (DPR) is a standard operation for pathological processes of the pancreas located to the left of the mesentericoportal axis. It can be performed with a lower risk of serious complications than pancreatic head resection. The procedure for oncological indications usually includes a splenectomy but can also be extended to major multivisceral resections, including other organs like the adrenal gland, stomach, bowel or kidney. The main cause of morbidity is the development of postoperative pancreatic fistula (POPF), which prolongs hospital stay and can also lead to severe secondary complications. Therefore, various techniques have been described for secure dissection and closure of the pancreatic cut surface, comprising direct closure by hand suture, stapling, electrocautery and ultrasound devices, suture reinforcement with seromuscular patches and sealants, as well as anastomosis to the jejunum. However, so far no single method has been convincingly shown to be superior to others. Some patient-

derived risk factors for the development of pancreatic fistula after DPR have been identified[1-22]; most of them, however, cannot be influenced by the surgeon. The aim of this study was to analyze the impact of surgical technique and patient-side risk factors on pancreatic fistula rate and other measures of perioperative outcome after DPR.

MATERIALS AND METHODS

Operations and standard patient care

All patients in this study were operated in an open procedure *via* transverse laparotomy. The following techniques were used for closure of the pancreatic remnant: wedge-shaped incision of the cut surface, ligation of the main pancreatic duct and hand suture of the capsule (later on referred to as hand suture closure), transsection and closure with a stapling device (later on referred to as stapler closure), Roux-Y-pancreatojejunostomy (later on referred to as pancreatojejunostomy) without duct-to-mucosa anastomosis and covering of the cut surface with a seromuscular omega-loop jejunal patch after main pancreatic duct ligation (later on referred to as seromuscular patch). Occasionally, a fibrin sealant (TachoSil, Nycomed Pharma GmBH, Germany) was used for suture reinforcement. Before closure of the abdomen, peritoneal drains were placed in the vicinity of the pancreatic stump or anastomosis. All patients were transferred to the intermediate or intensive care unit for surveillance for at least 1 d. Drain amylase levels were routinely measured every day for at least 3 d postoperatively and the drains were removed on day 5 when clinically appropriate. Octreotide was administered routinely if drain amylase activity was elevated (1000 U/L). Abdominal computed tomography (CT) was performed on the basis of clinical course. Suspicious intraabdominal collections were preferably treated by CT-guided interventional drainage and amylase activity was measured in every drain fluid.

Statistical analysis

On the basis of a prospectively maintained database at our institution, retrospective risk factor analysis was performed. The primary endpoint was pancreatic fistula of grade B or C, as defined by the International Study Group for Pancreatic Surgery[23]. Secondary endpoints included surgical morbidity and overall mortality. Tests for statistical significance were performed with the SPSS 17.0 software (SPSS Inc., Chicago, IL) with a significance level of $P < 0.05$. Two-sided Mann-Whitney test, two-sided Fisher's exact test, Spearman rank correlation and binary logistic regression were used for comparison of rational variables, dichotomous variables, bivariate correlation analysis and uni- and multivariate risk factor analysis, respectively.

RESULTS

Patients

Patient characteristics and histopathological findings are shown in Table 1. From February 1994 to July 2009 at our institution, 863 patients received a pancreatic resection of whom 126 patients (77 women and 49 men) received a DPR. Patient age varied between 24 and 83 years (median 61 years), with a body mass index (BMI) ranging from 16 to 41 years (median 24 years). One-fifth of patients reported alcohol abuse (mainly patients with chronic pancreatitis) and about the same percentage was diabetic, with the need of oral antidiabetic medication or insulin substitution. Chronic pancreatitis (32%) and pancreatic adenocarcinoma (29%) were the most frequent histopathological findings and about one-third showed cystic neoplasms of the pancreas or neuroendocrine tumors. In detail, cystic neoplasms were usually serous cystic adenomas (11) or mucinous cystic neoplasms (6), while intraductal papillary mucinous neoplasms (2) and solid pseudopapillary neoplasms (2) rarely occurred in the pancreatic tail.

Operations

Median operation time was 270 min (120-570 min). About 21% of the DPR was part of a multivisceral resection and in less than 15% the spleen was preserved. Three specialized pancreatic surgeons performed over 80% of the operations. The most frequently employed methods for closure of the pancreas were hand suture (hand suture closure 37%) and anastomosis (pancreatojejunostomy 41%) (Table 1).

Risk factor analysis for pancreatic fistula

Univariate analysis disclosed a high BMI [odds ratio (OR) = 1.18 per unit, $P = 0.001$], pancreas closure by hand suture closure (OR = 2.88, $P = 0.014$), cystic neoplasm of the pancreas (OR = 3.00, $P = 0.029$) and more generally a "high-risk pancreas" (OR = 3.00, $P = 0.011$) as risk factors and pancreatic ductal adenocarcinoma (OR = 0.31, $P = 0.042$) as a protective factor for pancreatic fistula B/C. In multivariate analysis (binary logistic regression), BMI and direct closure by hand suture were the only independent risk factors (Table 1).

In order to obtain more information about the identified risk factors, we separately analyzed two groups of patients for POPF: high-risk *vs* low-risk pancreas (Table 2). High-risk pancreas was defined as pathology with OR > 1 for development of pancreatic fistula in univariate analysis (Table 1). Of note, this definition is in concordance with our previous risk factor analysis of pancreatoduodenectomies[24]. As shown in Table 2, only the low-risk group showed a significantly higher pancreatic fistula rate after direct hand suture closure, while in case of a high-risk pancreas, this elevation was not significant. BMI was an additional risk factor for pancreatic fistula in high-risk patients, but had no significant effect in the low-risk group.

Pancreatic fistula is the main source of perioperative morbidity after DPR

Overall rate of pancreatic fistula of grade B or C was 24%. As shown in Table 3, occurrence of pancreatic fis-

Table 1 Patients and operations, univariate and multivariate analysis of risk factors for the occurrence of postoperative pancreatic fistula B/C, median (range) *n* (%)

Parameter		No POPF (*n* = 96)	POPF (*n* = 30)	Odds ratio	*P* uni-variate	*P* multi-variate
Patients						
Age (yr)	61 (24-83)	61 (24-82)	61 (24-83)	1.002	0.859	
Sex (M:F)	49:77	38:58	11:19	0.884	0.775	
BMI (kg/m^2)	24 (16-41)	24 (16-34)	27 (17-41)	1.181	0.001	0.009
Diabetes	24 (19.0)	20	4	0.585	0.365	
Alcohol	23 (18.3)	19	4	0.623	0.427	
Crea (mg/dL)	0.80 (0.40-1.87)	0.80 (0.40-1.87)	0.80 (0.46-1.40)	0.806	0.827	
WBC (tsd/μL)	6.9 (2.6-18.5)	6.9 (2.6-18.5)	6.8 (3.2-17.7)	0.978	0.759	
Hb (g/dL)	13.2 (7.8-16.8)	13.1 (7.8-16.8)	13.4 (10.7-16.6)	1.189	0.174	
Bili (mg/dL)	0.6 (0.2-1.8)	0.6 (0.2-1.4)	0.6 (0.2-1.8)	0.635	0.545	
Operations						
Period 94-01	43 (34)	37	6	2.508	0.067	
Period 02-09	83 (66)	59	24			
OP time	270 (125-570)	270 (125-570)	269 (157-510)	0.996	0.154	
DC-HS	47 (37.3)	30	17	2.877	0.014	0.030
DC-S	18 (14.3)	16	2	0.357	0.188	
PJ	52 (41.3)	43	9	0.528	0.154	
SMP	9 (7.1)	7	2	0.908	0.908	
Splenectomy	109 (86.5)	84	25	0.714	0.561	
Multivisceral	26 (20.6)	23	3	0.353	0.111	
Histopathology						
PDAC	38 (28.6)	32	4	0.308	0.042	
CP	40 (31.7)	32	8	0.727	0.495	
CNP	21 (16.7)	12	9	3.000	0.029	
NET	16 (12.7)	12	4	1.077	0.905	
OTH	13 (10.3)	8	5	2.200	0.199	
High-risk	50 (39.5)	32	18	3.000	0.011	0.168

Univariate and multivariate analysis: binary logistic regression. POPF: Postoperative pancreatic fistula (International Study Group for Pancreatic Surgery definition); CI: Confidence interval; BMI: Body mass index; DC-HS: Direct closure hand suture; DC-S: Direct closure stapler; PJ: Pancreatojejunostomy; SMP: Seromuscular patch; PDAC: Pancreatic ductal adenocarcinoma; CP: Chronic pancreatitis; CNP: Cystic neoplasia of the pancreas; NET: Neuroendocrine tumor; OTH: Other pancreatic pathology. CNPs were: 2 intraductal papillary mucinous neoplasia, 2 solid pseudopapillary neoplasia, 11 serous cystic adenoma, 6 mucinous cystic neoplasia. High-risk pancreas is defined as pathology with odds ratio > 1 i.e., other than PDAC or CP, periods of time are 1994-2001 *vs* 2002-2009.

Table 2 Factors influencing postoperative pancreatic fistula rate in different risk groups *n* (%)

Technique	Low-risk pancreas[1]			High-risk pancreas[2]		
	POPF	CC	*P* value	POPF	CC	*P* value
Hand suture	8/26 (30.8)	0.296	0.009	9/21 (42.9)	0.122	0.400
PJ	4/36 (11.1)	-0.122	0.295	5/16 (31.3)	-0.068	0.639
Stapler	0/11 (0)	-0.178	0.124	2/7 (28.6)	-0.062	0.667
SM patch	0/3 (0)	-0.088	0.451	2/6 (33.3)	-0.021	0.888
Risk factor						
BMI (kg/m^2)	24 (17-30) *vs* 23 (16-32)[3]	0.178	0.125	29 (21-41) *vs* 25 (17-34)[3]	0.349	0.013

CC: Correlation coefficient; POPF: Postoperative pancreatic fistula (Grade B or C of the International Study Group for Pancreatic Surgery definition); BMI: Body mass index, high-risk pancreas defined as pathology with odds ratio > 1 (see Table 1); PJ: Pancreatojejunostomy; SM: Patch seromuscular patch. [1]POPF rate: 12/76 (15.8%); [2]POPF rate: 18/50 (36.0%); [3]Median (range) in POPF *vs* no POPF. The analyses were carried out for each risk group separately. *P* value given for correlation with occurrence of POPF (two-sided Spearman rank test).

tula B/C correlated significantly with morbidity (overall, surgical and severe morbidity), intraabdominal abscess, reoperation and longer hospital stay (Table 2). Postpancreatectomy hemorrhage and sepsis were more frequent in patients with pancreatic fistula, but constituting a non-significant trend. Overall mortality was below 2% and not significantly associated with pancreatic fistula. Indications for reoperation in the patients with pancreatic fistula were erosion bleeding due to pancreatic fistula (3) and intraabdominal abscess not amenable to sufficient interventional drainage (5). Reoperations in patients without pancreatic fistula were necessary because of anastomotic leakage after multivisceral resection involving the stomach (2), postoperative colonic ischemia (2), postoperative splenic ischemia (1), programmed lavage after DPR for pancreatic abscess (1), bleeding after fenestration of a liver cyst during DPR (1), abdominal abscess in absence of pancreatic fistula (2) and insufficiency of the fascia

Table 3 Postoperative pancreatic fistula is the main factor of perioperative morbidity after distal pancreatic resection

Parameter description for all patients (n = 126)		Groups		Correlation	
Parameter	**n (%)**	**No POPF (n = 96)**	**POPF (n = 30)**	**Coefficient**	***P* value**
POPF	30 (23.8)	96	30	1.000	NA
Overall morbidity	76 (60.3)	46	30	0.453	< 0.001
Surgical morbidity	55 (43.7)	25	30	0.635	< 0.001
Severe morbidity	19 (15.1)	11	8	0.181	0.043
Inta-abdominal abscess	17 (13.5)	5	12	0.434	< 0.001
Septic shock	3 (2.4)	1	2	0.157	0.079
PPH	8 (6.3)	4	4	0.160	0.073
Reoperation	18 (14.3)	10	8	0.198	0.026
Overall mortality	2 (1.6)	1	1	0.078	0.385
Hospital stay (d), median (range)	15 (8-143)	14 (8-143)	32 (11-108)	0.552	< 0.001

POPF: Postoperative pancreatic fistula of Grade B or C [International Study Group for Pancreatic Surgery (ISGPS) definition]; PPH: postpancreatectomy hemorrhage (ISGPS definition), severe morbidity includes complications leading to sepsis, reintubation or reoperation. Septic shock is defined as sepsis with iv catecholamin requirement. Correlations derived from two-sided Spearman's rank correlation test. NA: Not applicable.

Table 4 Distal pancreatic resection - changing indications, demographics and operative techniques n (%)

Parameter	1994-2001 (n = 43)	2002-2009 (n = 83)	*P* value
Patients			
Age (yr, median)	51	64	0.001
BMI (kg/m^2, median)	25	24	0.713
Histology			
PDAC	8 (19)	28 (34)	0.097
CP	22 (51)	18 (22)	0.001
CNP	3 (7)	18 (22)	0.044
NET	5 (12)	11 (13)	1.000
Other	5 (12)	8 (10)	0.762
High-risk pancreas	13 (30)	37 (45)	0.129
Operations			
Multivisceral resections	9 (21)	17 (21)	1.000
Hand suture closure	13 (30)	34 (41)	0.252
Pancreatojejunostomy	30 (70)	22 (27)	< 0.001
Stapler closure	0 (0)	18 (22)	< 0.001
Seromuscular patch	0 (0)	9 (11)	0.027
Perioperative parameters			
POPF B/C	6 (14)	24 (29)	0.078
OHS (d)	13	15	0.036

POPF: Postoperative pancreatic fistula of Grade B or C (International Study Group for Pancreatic Surgery definition); BMI: Body mass index; PDAC: Pancreatic ductal adenocarcinoma; CNP: Cystic neoplasia of the pancreas; NET: Neuroendocrine tumor; OTH: Other pancreatic pathology, high-risk pancreas defined as not PDAC or CP; OHS: Overall hospital stay, *P* value given for two-sided Fisher's exact test.

closure (1). Postoperative mortality occurred due to pulmonary embolism after reoperation for pancreatic fistula with erosion bleeding (1) and shock after colon perforation due to postoperative acute myocardial infarction (1).

DPR - changing indications, patient characteristics and operation techniques

The number of DPRs performed per year has increased substantially. There were 43 DPR from 1994 to 2001 (n = 43) but 83 from 2002 to 2009 (Table 4). We recognized significant differences when comparing these two time periods. Median patient age increased by over 10 years (51 years *vs* 64 years, P = 0.001) and the indications changed. The number of DPRs performed for chronic pancreatitis strongly decreased (51% *vs* 22%, P = 0.001), whereas there was an increase in patients operated on for cystic neoplasms of the pancreas (7% *vs* 22%, P = 0.044). This translated into a higher number of operations on a "high-risk" pancreas and a tendency for a higher pancreatic fistula rate (14% *vs* 29%, P = 0.078), as well as a significantly longer overall hospital stay (13 d *vs* 15 d, P = 0.036). Regarding the operations, there were also significant changes in the preferred method of pancreatic stump closure. Pancreatojejunostomy was performed less frequently while stapler closure and seromuscular patch were only performed in the last 8 years.

DISCUSSION

DPR was first performed successfully by Trendelenburg in 1882[25] and has since long become a standard procedure widely performed with very low mortality. However, perioperative morbidity remains substantial from the very first reported cases[25,26] to the most recent large series[1,3-5,16], the most important cause being pancreatic fistula. This is highlighted also by our present study, as we show that most of the perioperative morbidity, including severe complications and reoperations, are strongly associated with pancreatic fistula.

Several large series have identified patient-side risk factors for the development of pancreatic fistula. Among those are male gender[1,2], younger age[3], obesity[2,4-6], soft pancreatic texture[7] and smoking[1], whereas preoperative diabetes has been described as protective against pancreatic fistula[1]. In the present study, we could confirm BMI as the only independent patient-side factor influencing pancreatic fistula rates. It may be argued that a soft "fatty pancreas" is prone to pancreatic fistula development after DPR in the same way as shown for pancreatoduodenectomy by us and others[8,9,24].

Concerning the indications for DPR, trauma to the

pancreas was identified by others to constitute a risk factor for pancreatic fistula[1,10,24]. We found that the risk of pancreatic fistula is significantly higher for cystic neoplasm of the pancreas and significantly lower for pancreatic ductal adenocarcinoma. This seems reasonable given that the pancreas is usually fibrotic in pancreatic carcinoma but healthy and soft in cystic neoplasm. In general, we could define a "high-risk pancreas" comprising of several pathologies and confirm it as a risk factor with a 3-fold elevated risk of pancreatic fistula in univariate analysis. Of note, the increased pancreatic fistula rate in the high-risk pancreas group was further exaggerated by a higher BMI.

With respect to the extent of the resection, the following risk factors for pancreatic fistula have been described: extended resection to other organs[11], extended lymphadenectomy[3], extended pancreatic resection of more than 8 cm[5], splenectomy[7], high blood loss[5] and long operation time[12]. Extension to multivisceral resections is relatively common in DPR, with reported rates of 15%-36% in the largest series[2,12,27]. However, only one of these series did identify multivisceral resection as a risk factor for POPF. Our study did not show an influence of operation time, splenectomy or multivisceral resection on pancreatic fistula rates. A possible reason is that extended procedures are usually not performed for the high-risk gland according to our definition, but rather in the setting of pancreatic cancer.

Our study comprised four methods of pancreatic stump closure. The method with the lowest POPF rate was stapler closure, closely followed by PJ and seromuscular patch. As a whole, these techniques performed significantly better than hand suture.

Many investigators have attempted to find the safest method with the lowest pancreatic fistula rate. By far the most frequently performed techniques are direct hand suture or stapler closure. The most recent randomized controlled trial examining the value of those two techniques is the DISPACT trial, which for the primary endpoint of the trail, the development of pancreatic fistula, showed no differences between stapling or suturing the pancreas[13,14]. Several studies found stapled closure to be superior in terms of lower pancreatic fistula rates[10,11,15-17] and both large meta analyses conducted on this topic found a non-significant trend in favor of stapler closure over hand suture closure[18,22]. As far as the technique of the hand suture closure, it has been noted by several authors that ligation of the main pancreatic duct (main pancreatic duct) can reduce pancreatic fistula rates[3,19-21]. Our own data demonstrate hand suture closure as an independent risk factor for pancreatic fistula, even although main pancreatic duct ligation was part of the standard procedure.

Interestingly, the pancreatic fistula rate after hand suture was significantly higher in patients with a low-risk pancreas, while this difference was less pronounced in the high-risk group. A possible explanation may be that in the usually fibrotic low-risk pancreas, flow of pancreatic secretions to the duodenum may be compromised by narrowing of the main pancreatic duct and therefore a drainage procedure like pancreatojejunostomy or a broad-based staple closure can be advantageous over hand suture closure. As we cannot provide sufficient retrospective data on proximal pancreatic duct configuration here, the latter concept still needs to be proven.

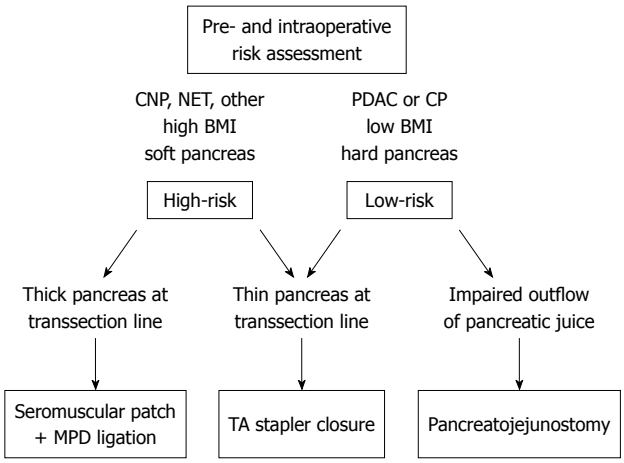

Figure 1 Risk-adapted choice of closure techniques for the pancreatic remnant after distal pancreatic resection. CNP: Cystic neoplasm of the pancreas; NET: Neuroendocrine tumor; PDAC: Pancreatic ductal adenocarcinoma; CP: Chronic pancreatitis; BMI: Body mass index, MPD: Main pancreatic duct.

The relatively good results of pancreatojejunostomy are also noteworthy: This technique is only rarely performed in other large series but in 43 patients in our series. In other series, a significant reduction of pancreatic fistula compared to main pancreatic duct ligation and simple suture has been reported in analogy[28]. A marked decrease in pancreatic fistula rates by gastric wall covering has been reported in one study from Japan[29]. This is noteworthy given the better results of pancreatogastrostomy *vs* pancreatojejunostomy after pancreatoduodenectomy[30,31].

As our study comprised a long period of 16 years, we aimed to analyze possible bias and evolutions over time. POPF rates did not change significantly between the first and second study periods, ruling out a strong learning curve bias. On the contrary, we noted an increase in the rate of POPF. We attribute this mainly to changing indications leading to a higher percentage of high-risk glands. Especially cystic neoplasms of the pancreas are more frequently diagnosed and treated operatively. In addition, patient age increased by more than 10 years in median, accompanied by a longer hospital stay, probably due to a longer recovery period after surgery.

There was a significant change in the techniques used for closure of the pancreatic remnant. While hand suture was performed at an equal frequency, PJ has been displaced by stapler closure or seromuscular patch. This reflects the attempt to simplify and improve closure techniques.

On the basis of our analysis, we propose an individualized approach to DPR (Figure 1) to meet the aforementioned challenges. It is usually possible to assign patients to a high-risk and a low-risk category regarding the risk of pancreatic fistula. This can be done preoperatively and

confirmed intraoperatively on the basis of pancreatic texture, as already shown for pancreatic head resection[24].

Stapler closure needs virtually no learning curve, is safe and might therefore be the preferred technique in general. At our institution, the Ethicon Proximate Stapler® is used for stapling the pancreas. The theoretical advantage of the TA closure principle is an equal and slow adaption of the whole suture line at once. We do not use GIA stapling devices (sideways running blade and stapling) because of the risk of insufficient closure of the distal suture when tissue is pushed along the suture line. Importantly in this context, laparoscopic DPR with stapler closure has been shown to significantly reduce hospital stay[32-37] and offers the advantages of minimally invasive surgery and stapler closure. The laparoscopic approach has already been shown to reduce perioperative morbidity in DPR[38].

If stapler closure is not technically feasible, for example due to a very thick pancreas or transsection close to the pancreatic head, closure methods may be chosen depending on risk category: for a healthy and soft pancreas we propose seromuscular patch closure with main pancreatic duct ligation. This might also be done in case of a hard and fibrotic gland. However, in cases of impaired pancreatic juice outflow to the duodenum, as might be the case in chronic pancreatitis, drainage by pancreatojejunostomy may be the procedure of choice.

In summary, while serious morbidity and mortality are low after DPR, changing indications and patient demographics contribute to a constantly high pancreatic fistula rate and pose a challenge to the surgeon. Risk-adapted and indication-adapted use of closure techniques for the pancreatic stump and laparoscopic surgery are options to encounter this problem in the future.

COMMENTS

Background

Distal pancreatic resection (DPR) is performed for benign and malignant lesions of the pancreatic tail. Mortality of the procedure is very low. However, postoperative pancreatic fistula (POPF) is the main reason for postoperative morbidity, prolongation of hospital stay and increased health care costs.

Research frontiers

The authors present the results DPRs performed at a single center over 16 years, with special regard to POPF, risk factors for POPF and closure techniques for the pancreatic stump.

Innovations and breakthroughs

The authors propose a risk-adapted and indication-adapted choice of the closure method for the pancreatic remnant to reduce pancreatic fistula rate.

Applications

By risk- and indication-adapted choice of closure technique, it may be possible to decrease the rates of POPF after DPR.

Terminology

DPR: removal of the distal part of the pancreas, i.e., to the left of the mesentericoportal axis. In case of malignancy, the spleen is usually included *en-bloc*. Multivisceral resections extending to neighboring organs (suprarenal gland, stomach, colon or kidney) are possible. POPF: leackage of pancreatic juice from the closed pancreatic stump or pancreatoenteric anastomosis. An international consensus definition has been published by the International Study Group for Pancreatic Surgery.

Peer review

Based on a great cohort from a single institution the authors analyse their experience with PF following DPRs, with special respect to the influence of the surgical procedure of closure and present some interesting new aspects.

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