

Anatomy at Pancreatic Transection Point in Predicts Occurrence of Postoperative Pancreatic Fistula

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ABSTRACT

Introduction Postoperative pancreatic fistula is a dreaded complication following pancreatic head resections. There are many variables which predict occurrence of pancreatic fistula we analysed the anatomical factors at the pancreatic transection to predict occurrence of pancreatic fistula. **Materials and Methods** It is a prospective observational study done from 2014 July to 2015 December. Eighty patients were included, intraoperatively we measured the anteroposterior thickness, cranio caudal thickness and thickness anterior, posterior, cranial and caudal to duct. We correlated these anatomical factors with postoperative complications. **Results** POPF was seen in 19 patients (23.75%) of which clinically significant fistula was seen in 5 patients (6.25%) and biochemical fistula is seen in 14 patients (17.5%). As the parenchymal thickness cranial to duct increased the chance of POPF increased (mean±SD-15.26±3.03mm, p=0.014). As the thickness anterior to duct increases (7.18±1.50mm, p=0.023) and mean thickness posterior to duct decreases (5.34±3.32mm, p=0.036) chance of POPF increased. Clinically relevant fistula was significantly seen to be related with thickness anterior to duct, at a thickness >6.5mm sensitivity of occurrence of fistula 68.4% and specificity was 74%. **Conclusions** At the transection point when the thickness anterior to duct increases chances of clinically relevant fistula increases. As the thickness anterior to duct increases duct would be positioned more posteriorly creating difficulty while placing sutures.

INTRODUCTION

Anastomotic leak complicates in 0-30% of pancreatico-intestinal anastomosis following PD (pancreaticoduodenectomy) [1-3]. Anastomotic leak initiates subsequent complications like intraabdominal abscess, sepsis, erosion into surrounding vessels requiring further intervention [4]. Mortality was increased when a reoperation was required, a biliary-enteric leak occurred, or an intra-abdominal abscess developed [4]. In a Japanese survey of 3109 patients mortality was 13% in patients with anastomotic leak [2]. With the advancement in surgical techniques and critical care management, mortality was decreased but morbidity is high even in high volume centers [5]. Risk factors include preoperative patient related factors, gland related (texture, size of the main pancreatic duct diameter), intra operative factors. Hard texture, pancreatic fibrosis, diameter of the pancreatic duct >3mm, good anastomotic technique were associated with decreased incidence of pancreatic fistula [5-8].

Anatomical features vary greatly at the transection point among the, in the present study we analyzed the anatomy at the transection point in relation to clinically significant pancreatic fistula.

METHODS

From July 2014 to December 2015 eighty consecutive patients undergoing PD (Pancreaticoduodenectomy) were prospectively enrolled in department of surgery at Post graduate institute of medical education and research Chandigarh. Patients who refused consent and underwent duodenum preserving pancreatic head resections, central pancreatectomy, distal pancreatectomy were excluded from the study. Patients were evaluated for demographic, biochemical and radiological parameters. Biliary drainage (endoscopic / percutaneous) was done either in the presence of cholangitis, nutritionally depleted state and if serum bilirubin >15 mg/dl. All patients underwent PD with standard lymphadenectomy, single loop reconstruction using child's method.

Intra operative assessment

During the procedure after transection of the pancreas, pancreatic stump was evaluated by measuring the duct diameter using a catheter which snugly fits in to the pancreatic duct. Thickness cranially, caudally, posteriorly and anteriorly by using vernier calipers in millimeters, the relative location of the duct antero-posteriorly and craniocaudally were also noted. In our study we defined eccentrically placed and posteriorly placed duct. Eccentrically placed duct was defined as parenchymal thickness cranial to duct >2/3rd of the cranio-caudal thickness (**Figure 1**). Posteriorly placed duct was defined when the duct was placed more than two third of the thickness from the anterior margin of the total anteroposterior thickness **Figure 1**. Dilated duct was defined as main pancreatic duct diameter >3mm and nondilated duct as main pancreatic duct diameter <3mm. The pancreaticojejunal anastomosis was completed using duct to mucosa technique. Post operatively all the patients were monitored for POPF (postoperative pancreatic fistula) as

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Anatomy at pancreatic transection point; Pancreaticoduodenectomy;
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per ISGPF classification [7], along with POPF other complications were also noted.

Statistical analysis

Continuous parametric data was expressed as mean \pm standard deviation; categorical data was expressed in numbers and percentages. To compare two independent groups for a continuous parametric variable an independent t-test was done and Mann-Whitney U test for non-parametric variable. Analysis of variance (ANOVA) was applied to compare more than two independent groups of a continuous parametric variable. To compare two independent groups of categorical variable, the chi-square test was applied. Receiver Operator Curve analysis was performed and sensitivity and specificity were assessed based on Youden's method. P value < 0.05 was taken as statistical significance for all the analyses.

RESULTS

Preoperative characteristics

A total of 80 patients were included in the study, of which 28 were females and 52 were males, mean age was 52.9 ± 11.1 years. Preoperative tissue diagnosis was present in 33(41.25%) patients with most common etiology being adenocarcinoma seen in 22(66%). Other demographic and operative details were given in the **(Table 1)**.

Intra operatively parenchymal thickness at the transection point in relation to the duct was noted, 33(41.25%) patients had dilated ducts and 47(58.75%) patients had non dilated duct, eccentrically placed ducts were seen in 21(26.3%) and posteriorly placed ducts were seen in 39(48.8%) patients. In patients with dilated ducts, ducts were posteriorly placed in 23(28.75%) and ducts were eccentrically placed in 13(16.25%). In patients with non-dilated, ducts were posteriorly placed in 16(20%) and eccentrically placed in 8(10%) patients. It was observed that duct was seen more posteriorly when it was dilated ($p=0.008$). Mean pancreatic diameter was 3.53 ± 1.55 mm, texture of the pancreas was soft in 24(30%) patients, firm to hard in consistency in 56(70%) patients. Mean thickness anterior to duct, posterior to duct, cranial to duct, caudal to duct were 6.03 ± 2.54 mm, 4.46 ± 2.61 mm, 13.58 ± 3.46 mm, 12.5 ± 4.24 mm respectively. Mean anteroposterior and craniocaudal thickness were 14.08 ± 3.41 mm, 29.63 ± 5.36 mm respectively.

Parenchymal thickness in relation to dilated ducts

In patients with dilated ducts mean anteroposterior, craniocaudal parenchymal thickness were 14.24 ± 3.37 mm, 29.78 ± 5.55 mm respectively. Mean thickness cranial to duct, caudal to duct, anterior to duct, posterior to duct were 13.47 ± 3.49 mm, 11.41 ± 3.76 mm, 5.14 ± 2.44 mm, 3.74 ± 2.18 mm respectively. Mean pancreatic duct diameter in dilated duct group was 4.97 ± 1.31 mm.

Parenchymal thickness in relation to non-dilated ducts

In patients with non-dilated ducts mean anteroposterior and craniocaudal thickness were 14.02 ± 2.37 , $29.5 \pm$

5.29 mm respectively. Mean thickness anterior, posterior, cranial and caudal to duct were 6.66 ± 2.44 mm, 4.97 ± 2.72 mm, 13.66 ± 3.46 mm and 13.36 ± 4.41 mm respectively. Mean pancreatic duct diameter was 2.52 ± 0.42 mm **(Table 2)**.

Postoperative complications

Postoperative pancreatic fistula was seen in 19(23.75%) patients, biochemical fistula in 14(17.5%) and clinically significant fistula in 5(6.25%) patients, delayed gastric emptying was seen in 60% of the patients (Grade A -28.75%, B-25%, C-6.25%). Postoperative hemorrhage was seen in 5(6.25%), organ space infections in 7 (8.75%), superficial surgical site infections in 25(31.25%) of the patients.

Comparison of anatomical factors in relation to postoperative pancreatic fistula

Parenchymal thickness in patients with postoperative pancreatic fistula Mean pancreatic duct diameter in this group was 2.71 ± 1.03 mm ($p=0.001$), texture of the pancreas was soft in 11(13.75%) and firm in 8(10%) patients. It was observed that, as the thickness increases cranially and anteriorly chances of occurrence of postoperative pancreatic fistula increases and also as the thickness posterior to duct decreases chances of occurrence of postoperative pancreatic fistula increases. Mean thickness cranial, anterior and posterior to duct at which fistula occurred were 15.26 ± 3.03 mm, 7.18 ± 1.50 mm and 5.34 ± 3.32 mm respectively. It was found that at a thickness of 5.7 mm posterior to duct sensitivity was 39% and specificity was 79% **Figure 2**, at a thickness of 6.5mm anterior to duct sensitivity was 68.4% and specificity was 74% **Figure 3** and at a thickness of 15.5 mm cranial to the duct sensitivity at which fistula occurred was 52.6% and specificity of 79% **Figure 4**. Eccentrically placed ducts were seen in 3(3.75%) and posteriorly placed ducts were seen in 8(10%) patients with pancreatic fistula but the difference was not significant.

Parenchymal thickness in patients without postoperative pancreatic fistula

Mean pancreatic duct diameter in this group was 3.79 ± 1.60 mm, texture was soft in 13(16.25%) and firm to hard in 48(60%) patients. Mean anteroposterior and craniocaudal diameter were 13.73 ± 3.49 mm and 29.13 ± 5.56 mm respectively. Mean thickness anterior to duct, posterior to duct, cranial and caudal to duct were 5.67 ± 2.70 , 4.19 ± 2.32 mm, 13.06 ± 3.43 mm and 12.29 ± 4.19 mm respectively. Eccentrically placed ducts were seen in 18 and posteriorly placed ducts were seen in 13 patients and the difference was not significant ($p=0.193$).

Comparison of parenchymal thickness in relation to biochemical and clinically significant fistula

on comparing the anatomic factors in relation to biochemical and clinically significant fistula it was observed that as the thickness anterior to duct increases the rate of clinically significant fistula increased. Mean thickness anterior to duct at which fistula occurred was 8 ± 1.22 mm. thickness posterior to duct and thickness cranial to duct were not significantly associated with occurrence of

clinically significant fistula but the thickness posterior to duct at which clinically significant fistula occurred was 3 ± 2.34 mm (**Table 3**).

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