ORIGINAL ARTICLE

Management of a delayed post-pancreatoduodenectomy haemorrhage using endovascular techniques

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Abstract

Background: A delayed post-pancreatoduodenectomy haemorrhage is associated with a significant increase in peri-operative mortality. Endovascular techniques are frequently used for a delayed haemorrhage. However, limited data exists on the short- and long-term outcomes of this approach. A retrospective review over a 10-year period at a quaternary-referral pancreatic centre was performed.

Methods: Between 2002–2012, 1430 pancreatoduodenectomies were performed, and 32 patients had a delayed haemorrhage (occurring >24 h post-operatively) managed by endovascular techniques. The clinicopathological variables related to a haemorrhage were investigated.

Results: A total of 42 endovascular procedures were performed at a median of 25 days, with the majority of delayed haemorrhages occurring after 7 days. There were four deaths (13%) with three occurring in patients with a grade C haemorrhage. Seven patients (22%) experienced rebleeding, and two patients developed hepatic abscesses.

Conclusion: A delayed haemorrhage post-pancreaticoduodenectomy can be managed by endovascular techniques with acceptable morbidity and mortality. Rebleeding and hepatic abscesses may occur and can be managed non-operatively in most cases. The association of a delayed haemorrhage with a pancreatic fistula makes this a challenging clinical problem.

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Introduction

The peri-operative mortality after a pancreatoduodenectomy (PD) at high-volume centres in contemporary series is < 3%.[1,2] While mortality has decreased, peri-operative complications including delayed gastric emptying, a pancreatic fistula and abscesses remain common. In contrast, a post-pancreatectomy hemorrhage (PPH) occurs less frequently but has been associated with a significant increase in mortality.[3] To facilitate standardized reporting and study of this complication, the International Study Group for Pancreatic Surgery (ISGPS) has proposed a classification system for PPH.[4] The definitions distinguish an early haemorrhage as occurring within 24 h of the index operation and a late haemorrhage beyond 24 h. Several recent studies have evaluated the classification system.[5–7] These studies indicate that haemorrhage after a PD may occur in as many as 6–8% of patients. Importantly, there appear to be clear differences in patient outcomes depending on the timing and severity of bleeding. For example, in one study, patients with delayed extraluminal grade C PPH had a mortality of 41%.[6] The studies to date underscore the fact that delayed bleeding after a PD represents one of the most challenging and potentially life-threatening post-operative complications.

In recent years, a delayed post-operative haemorrhage has been preferentially treated with endovascular techniques. The use of coil embolization for a gastroduodenal artery stump haemorrhage and the use of hepatic artery stents are well described. While these methods are considered highly effective and avoid the morbidity of a laparotomy, there are limited data evaluating the potential complications and long-term

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outcomes. Given the paucity of data on patients managed by endovascular techniques for a delayed PPH, we focused specifically on this population. The aims of this study were two-fold. First, we sought to identify patients with a delayed PPH managed with the endovascular approach to assess short- and long-term outcomes. Second, given the significant increase in morbidity and mortality, we evaluated potential risk factors for Grade B and C PPH.

Patients and methods

A retrospective review of a prospectively maintained database of vascular interventional procedures after pancreatoduodenectomies between January 2002 and November 2012 was performed at a quaternary-referral pancreatic surgery centre. Patients undergoing other pancreatic operations including enucleation, a total pancreatectomy and a distal pancreatectomy were excluded. ISGPS definitions and grading system for PPH were used. A delayed PPH was defined as a haemorrhage occurring beyond 24 h post-operatively. Patients with grade A PPH were clinically well and did not require therapeutic intervention. Patients with a grade B PPH had a mild, late intra- or extraluminal haemorrhage requiring intervention that may include transfusion of blood, intermediate care or intensive care unit, endoscopy, embolization or relaparotomy for early PPH. Patients with grade C PPH had severe bleeding, were critically ill requiring embolization, endoscopy, or a laparotomy and intensive care unit care. All identified cases of post-PD haemorrhage managed by interventional radiology (IR) occurred after 24 h, therefore, by ISGPS definition would be considered a delayed haemorrhage. Pancreatic fistula was defined and graded per ISGPS. Cases in which drain amylase was not available but clinical notes documented a pancreatic leak and/or management of a leak was described were deemed grade B or C leaks as appropriate. Clinical variables associated with bleeding and postoperative management were reviewed. Operative reports were reviewed; estimated blood loss and operative time were extracted from the anaesthetic record. Pathology reports were reviewed to determine the final pathologic diagnosis.

This study was approved by the Mayo Clinic Institutional Review Board.

Table 1 Patient and operative factors

Variable	*n* (%)
Patients	32
Demographics	
Median age	63 (36–82)
Male	21 (66%)
Body mass index	28 (21–36)
Operation, *n* (%)	
Open PD	22 (69%) 22/1197 (1.8%)[a]
Laparoscopic/Robot assist PD	10 (31%) 10/233 (4.3%)[b]
Operative time (minutes), mean	389 (218–696)
Vein resection	3 (9%)
Duct to mucosa anastomosis	24 (77%)
Gland texture, *n* (%)	
Soft	18 (56%)
Firm	8 (25%)
Unknown	6 (19%)
Duct	
Small (<5 mm)	24 (75%)
Dilated (>=5 mm)	3 (9%)
Unknown	5 (16%)
Median duct size, mm (range)	3 (1–10)
Intra-operative blood loss, median	500 (100–3100)
Pathology (%)	
Adenocarcinoma other (ampullary, duodenum and CBD)	10 (28%)
PDAC	10 (28%)
Other	12 (38%)
Grade B/C Pancreatic fistula	23 (72%)
Fistula risk score (mean)	5 (2–9)
Use of pancreatic stent	14 (45%)
Use of operative drain	25 (81%)

PD, pancreatoduodenectomy; PDAC, pancreatic ductal adenocarcinoma; CBD, common bile duct.
[a]Number (%) of open PD with a post-pancreatectomy haemorrhage managed by endovascular techniques.
[b]Number (%) of laparoscopic/robotic-assisted PD with a post-pancreatectomy haemorrhage managed with endovascular techniques.

Results

Between 2002 and 2012, 1430 pancreatoduodenectomies were performed. Thirty-two patients (2%) required endovascular management of a delayed haemorrhage. The median age of patients undergoing endovascular management for bleeding was 62.5 years, and 66% were males (Table 1). The median body mass index (BMI) was 27.9. Sixty-nine per cent of the patients underwent an open PD with the remaining undergoing a laparoscopic or robot-assisted PD. All patients underwent a pancreaticojejunostomy with 77% of these being performed as a duct-to-mucosa reconstruction. The remaining patients underwent an end-to-side invaginating or dunking pancreaticojejunostomy. The mean operative time was 389 min. Most patients had a drain placed at the time of operation (81%). Nine per cent of patients underwent concomitant vein resection. The pancreatic gland texture was soft in 56% of the patients. Only 28% of the patients presented with pancreatic ductal adenocarcinoma and the majority of the pancreatic