HPB, 2008; 10: 363–370

informa
healthcare

ORIGINAL ARTICLE

Post pancreaticoduodenectomy haemorrhage: outcome prediction based on new ISGPS Clinical severity grading

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Abstract

Objective & background data. Mortality following pancreatoduodenectomy (PD) has fallen below 5%, yet morbidity remains between 30 and 50%. Major haemorrhage following PD makes a significant contribution to this ongoing morbidity and mortality. The aim of the present study was to validate the new International Study Group of Pancreatic Surgery (ISGPS) Clinical grading system in predicting the outcome of post pancreaticoduodenectomy haemorrhage (PPH). *Material and methods*. Between January 1998 and December 2007 a total of 458 patients who underwent Whipple's pancreaticoduodenectomy in our department were analysed with regard to haemorrhagic complications. The onset, location and severity of haemorrhage were classified according to the new criteria developed by an ISGPS. Risk factors for haemorrhage, management and outcome were analysed. *Results*. Severe PPH occurred in 14 patients (3.1%). Early haemorrhage (<24 hours) was recorded in five (36%) patients, and late haemorrhage (>24 hours) in nine (64%) patients. As per Clinical grading of ISGPS 7 (50%) belongs to Grade C and 7 (50%) belongs to Grade B. Haemostasis was attempted by surgery in 10 (71%) patients; angioembolisation was successful in two (14%) and endotherapy in one (7%) patient. The overall mortality is 29%($n=4$). Age >60 years ($p=0.02$), sentinel bleeding ($p=0.04$), pancreatic leak ($p=0.04$) and ISGPS Clinical grade C ($p=0.02$) were associated with increased mortality. *Conclusion*. Early haemorrhage was mostly managed surgically with better outcome when endoscopy is not feasible. Late haemorrhage is associated with high mortality due to pancreatic leak and sepsis. ISGPS Clinical grading of PPH is useful in predicting the outcome.

Key Words: *pancreaticoduodenectomy, haemorrhage, embolisation, pancreatic surgery, complications*

Introduction

With the development of specialist centres, mortality following pancreatoduodenectomy (PD) has fallen below 5%. Despite progress, procedures such as PD are still associated with a morbidity rate of 30–40% [1–6]. The common complications after PD are delayed gastric emptying (DGE), pancreatic leakage, intraabdominal abscess and haemorrhage [3]. Severe haemorrhage occurs in less than 10% of patients [8,9] and accounts for 11–38% of overall mortality [6–8].

A consistent objective clinical grading of the severity of post pancreatectomy haemorrhage (PPH) seems essential to determine the impact of occurrence of PPH on the clinical course and its outcome. The International Study Group of Pancreatic Surgery (ISGPS) developed an objective, definition for PPH based on three parameters: onset, location, and severity. The onset is either early (≤ 24 hours after the end of the index operation) or late (>24 hours), the location is either intraluminal or extraluminal and the severity of bleed may be either mild or severe. Based on these three different grades of PPH, i.e.grades A, B, and C have been defined [10].

Mild haemorrhage is usually managed conservatively. Severe haemorrhage needs interventions like endoscopy, angioembolisation or surgical interventions to control the bleed. Early haemorrhage following surgery is often due to technical failure (nonsecured vessel) [11]. Haemorrhage in the late postoperative phase may be from an ulcer, eroded

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(Received 20 March 2008; accepted 12 May 2008)

ISSN 1365-182X print/ISSN 1477-2574 online
DOI: 10.1080/13651820802247086

vessel, pseudoaneurysm or dehiscence of an anastomotic suture line [12,13]. Other factors predisposing to PPH are pancreatic leak, bile leak, intraabdominal abscess and intraoperative vascular injury [8,14].

Severe bleed after PD may present initially as an intermittent minor haemorrhage, or "sentinel bleed" [14]. Most post PD haemorrhage were diagnosed and treated only after the occurrence of severe bleeding. The cause, diagnosis and best treatment options for post PD haemorrhage are still not clear [11,14]. Although encouraging results have been reported after embolisation [15], since detection rate of pseudoaneurysm by angiography is low and a concomitant septic complication would require surgical management most patients are still managed surgically [20].

The study aims to retrospectively analyse the clinical presentation, identify the risk factors and to validate the new ISGPS Clinical grading system in predicting the outcome of PPH in a single institution over the past 10 years (Table I).

Methods

A total of 458 patients who underwent pancreaticoduodenectomy between January 1998 and December 2007 were included in a prospective database and were analysed with regards to severe postoperative haemorrhage. The parameters that were included for analysis were age, gender, postoperative interval between PD and bleeding, sentinel bleeding, cause and source of bleeding, risk factors for bleeding, clinical grading of severity according to ISGPS definition, management and outcome.

There were 14 patients (3.1%) who developed severe postoperative haemorrhage. There were nine men and five women whose age range from 43 to 69 years (median 56.21 ± 7.59 years). The indications for pancreaticoduodenectomy were periampullary malignancy in nine patients and adenocarcinoma of the head of pancreas in five patients. All patients had a standard Whipple's pancreaticoduodenectomy with lymphadenectomy, the pancreatic remnant was anastomosed to the stomach. Gastrojejunostomy and hepaticojejunostomy was performed on the same jejunal loop, two drains were placed to drain the biliary and pancreatic anastomosis.

Severe PPH was defined as a major bleed from the drains and or the gastrointestinal tract requiring transfusion of at least 4U of packed cells within 24 hours, a fall in haemoglobin level by 3 g/dl or more or a need for invasive treatment [10]. Sentinel bleeding was considered as a minor blood loss via the abdominal drains, wound or nasogastric tube several hours preceding a major haemorrhage [13]. Source of bleeding was described as intraluminal when the patient present with haematemesis, malena, or bleeding through nasogastric tube and extraluminal when blood loss through drainage, abdominal wound or internally [10] (Table II).

Table I. Proposed classification of PPH: clinical condition, diagnostic and therapeutic endoscopy consequences (10).

Grade	Time of onset, location, severity and clinical impact of bleeding		Clinical condition	Diagnostic consequence	Therapeutic endoscopy consequence
A	Early, intra or extraluminal mild		Well	Observation, blood count, USG and, if necessary CT	No
B	Early, intra or extraluminal severe	Late, intra or extraluminal, mild	Often well/intermediate Very rarely life-threatening	Observation, blood count, USG, angiography, CT endoscopy	Transfusion of fluid/blood, ICU, therapeutic embolisation relaparotomy for early PPH
C		Late intra or extraluminal, severe	Severely impaired life-threatening	Angiography, CT endoscopy	Localisation of bleeding, angiography and embolisation, (endoscopy) or relaparotomy, ICU

Table II. Patients characteristics of severe post pancreaticoduodenectomy haemorrhage (PPH).

		(*n*)	(%)
Severe PPH[a]		14/458	3.1
Patient characteristics			
Mean age (range)	56±7 (43–69)		
Gender (male/female)	9/5		
Pathology of index operation			
Periampullary cancer		9	64
Pancreatic head cancer		5	36
Time of onset			
Early (<24 hours)		5	36
Late (>24 hours)		9	64
Location			
Extraluminal PPH		8	57
Intraluminal PPH		6	43
Pancreatic leak		8	57
No. of patients with sepsis		3	21
Sentinel bleeding before PPH		8	57

[a]Severe PPH was defined as a major bleed from the drains and or the gastrointestinal tract requiring transfusion of at least 4U of packed cells within 24 hours, a decrease in haemoglobin level by 3 g/dl or more or need for invasive treatment.

Clinical grading of severity was assessed according to ISGPS definition as Grade A, B, C based on time of onset, location, and severity of the haemorrhage, and considering the cumulative overall risk and clinical severity of haemorrhage [10]. Pancreatic leak was defined, as drain output of any measurable volume of fluid on or after third postoperative day with amylase content greater than three times the serum amylase activity (ISGPF definition) [21]. Sepsis was defined in the presence of fever (>38°C) and leucocytosis (white blood cell count (>10,000/l) for more than five days following surgery [8]. An intraabdominal abscess was considered when patient had fever and abdominal pain with complicated fluid collection on abdominal CT. Operative mortality was defined as death occurring during the hospital stay or as a consequence of a postoperative complication.

Statistical analysis

Demographic factors, such as onset/sentinel bleeding; Risk factors, such as clinical severity grading/management options were compared using Pearson Chi-square test, Yates corrected Chi-square test where applicable to identify the factors predicting the outcome. $P<0.05$ was taken as statistically significant. Statistical analysis was performed using SPSS 11.5 version.

Results

Onset and location

Four hundred and fifty-eight patients underwent pancreaticoduodenectomy during the study period. Severe intraabdominal, or gastrointestinal haemorrhage occurred following surgery between day 1 and day 40 in 14 patients (3.1%). Early haemorrhage occurred in five (36%) and late haemorrhage in nine (64%) patients. The source of bleed was intraluminal in six (43%) and extraluminal in eight (57%) patients. Of the five patients who had an early haemorrhage (36%) the source was from the pancreatic stump (due to technical failure to secure haemostasis). Late haemorrhage occurred usually between postoperative days 10 and 20 (6/9) and the common source is from psueudoaneurysms of peripancreatic arteries and all had a pancreatic leak. One patient had bleed from the anastamotic site and in other the source could not be identified. The latter succumbed despite aggressive resuscitation (Table III).

Pseudoaneurysms

Seven (50%) of the 14 patients had pseudoaneurysms, three in common hepatic artery, two in gastroduodenal artery and one each in hepatic artery and spleenic artery. Eight (57%) of the 14 patients with massive bleed had a sentinel bleed eight hours to three days prior to the major haemorrhage. Three from the abdominal drain one each from abdominal wound and sinus and in four from the gastrointestinal tract. Each sentinel bleed was preceded by severe abdominal pain. Eight-seven percent (7/8) of the patients with sentinel bleed had psueudoaneurysms of peripancreatic vessels and pancreatic leak.

Pancreatic leak and sepsis

Eight (57%) patients had postoperative pancreatic leak associated with haemorrhage. All had a sentinel bleed and the source of bleed was from a psueudoaneurysm in six patients. Four of these eight patients presented with sentinel bleed through drain as the

Table III. Source of bleeding, diagnostic procedures and clinical grading of severity (14/458).

	(*n*)	(%)
Source of bleeding		
Pseudoaneurysms	7	50
Common hepatic artery (3)		
Gastroduodenal artery (2)		
Hepatic artery (1)		
Spleenic artery (1)		
Artery in pancreatic parenchyma	5	36
Anastomotic site	1	7
Diagnostic procedures		
Gastrointestinal endoscopy	3	21
Angiography	3	21
Ultrasonography	6	43
Computed tomography	5	36
Clinical grading of severity		
Grade B	7	50
Grade C	7	50

drainage tube was retained for longer duration in pancreatic leak. Three of the eight patients with pancreatic leak had intraabdominal sepsis. Two had relaparotomy to control the bleed and the third one underwent angioembolisation. All the three died of sepsis and multiorgan failure.

Diagnostic procedures and therapeutic interventions

Upper gastrointestinal endoscopy was performed in three patients. Haemostasis was secured in one with a bleed from anastamotic site using argon plasma coagulation. The source of bleed could not be identified in two due to active bleed. After resuscitation patients who are stable underwent contrast-enhanced computerised tomography (CECT). Pseudoaneurysms were identified in three patients; two in common hepatic artery and one in spleenic artery. These patients were submitted for interventional angiography. Transcatheter arterial embolisation (TAE) was successful in two of the three patients with pseudoaneurysms.

Nine (64%) patients with severe bleed had an emergency laparotomy because of unstable haemodynamics despite multiple blood transfusions. Following failed angioembolisation one had relaparotomy. The median number of units of packed red blood cell (PRBC) concentrate transfused was 8.5 units (4–15U). During surgery the anastomotic sites were checked for integrity. If the source of bleed was intraluminal a gastrotomy was performed to inspect the pancreatic stump and anastomotic sites without disturbing the pancreaticogastrostomy. In five (36%) bleed was from the pancreaticogastrostomy stump and from the retroportal pancreatic lamina. Haemostasis was achieved by suture ligation. In patients with late haemorrhage pseudoanerysm was excised and the bleeding vessels were suture ligated. Pancreatic leak and sepsis were adequately drained. Completion pancreatectomy was performed in one patient (Table IV).

Table IV. Management and outcome.

	(*n*)	(%)
Observational monitoring	1	7
Interventional endoscopy (Attempted in three)	1	7
Angio Embolisation (Attempted in three)	2	14
Surgical haemostasis	10	71
Gastrotomy and vessel ligation (3)		
Vessel ligation (retroportal) (2)		
Excision of pseudoaneurysms and vessel ligation (5)		
Completion pancreatectomy (1)		
PPH-associated mortality		
Overall	4	29
Result of uncontrolled bleeding	1	7
Result of sepsis	3	21

Intraoperative vascular injury occurred in one patient who had pseudoaneurysm in common hepatic artery; this patient developed pseudoaneurysms at the site of injury. Postoperative acute severe abdominal pain was present in eight of the 14 patients prior to the massive haemorrhage, seven of them had pseudoaneurysms (Table V).

Pathologic review

All pathology specimens were reviewed to determine the site of the primary tumour, margin status, lymph node status, and overall pathologic staging. Resection margins were considered positive if the tumour cells were present at the final pancreatic neck, uncinate process, bile duct, or retroperitoneal soft-tissue margin which was inked and submitted for microscopic examination. On final pathologic analyses of the resected specimens there were eight (57%) patients with American joint committee on cancer (AJCC) stage I disease and six (43%) patients with stage II disease. Margin status was positive for two (14%) patients with pancreatic cancers at the retroperitoneal resected margin.

Morbidity

The overall morbidity in this series was 64%. Three patients (21%) had persistent intraabdominal sepsis, pancreatic fistula developed in two patients (14%), wound infection in two patients (14%), DGE in one patient (7%), and pulmonary complication in one patient (7%).

Clinical grading of severity

Based on ISGPS definition of clinical grading of severity 7 belonged to Grades B and C. Of the 14 patients with severe bleeding four died, three after reoperation because of uncontrolled infection and subsequent multiple organ failure. One patient died due to uncontrolled index bleed. The overall mortality rate was 29% (four patients). Late haemorrhage was associated with high mortality (4/4) in all the four patients belonging to Grade C. Statistically significant factors which predicted a poor outcome were age >60 years ($p=0.02$), sentinel bleeding ($p=0.04$), pancreatic leak ($p=0.04$), and clinical severity grading ($p=0.02$) (Table VI).

Discussion

Severe haemorrhage after pancreaticoduodenectomy is a major complication with the procedure-related mortality rates ranging from 14– to 38% [6–9]. In our study the incidence of haemorrhage was 3.1% with a mortality rate of 29%. The present study confirms that haemorrhage after PD with pancreaticogastrostomy is an uncommon but a severe complication. The

Table V. Characteristics of patients with post pancreaticoduodenectomy haemorrhage (PPH).

S. No.	Age	Sex	Pathology	Stage	Margin +ve	Interval (POD)	Sentinel bleeding	Presentations	Bleeding site	Risk factors	Clinical grading	PRBC transfusions	Management	Morbidity	Outcome
1	43	F	Periamp.Ca	T3N1	No	14	Drainage	Extraluminal	CHA PA	Pancreatic leak and sepsis	C	12	Surgery	Intra. Abd. Abscess	Death
2	53	M	Pan.Ca	T2N0	No	1		Intraluminal	Pan.Stump		B	5	Surgery		Alive
3	54	F	Periamp.Ca	T2N0	No	19	Drainage	Extraluminal	SA PA	Pancreatic leak	C	6	Angio embolisation	Pancreatic fistula	Alive
4	57	M	Periamp.Ca	T2N0	No	1		Extraluminal	Pan.Stump		B	8	Surgery		Alive
5	69	M	Pan.Ca	T3N1	Yes	20	Drainage	Extraluminal	CHA PA	Pancreatic leak and sepsis	C	9	Angio embolisation	Intra. Abd. Abscess	Death
6	50	F	Periamp.Ca	T2N0	No	12	Wound	Extraluminal	HA PA	Pancreatic leak	C	13	Surgery	Wound infection	Alive
7	58	M	Pan.Ca	T2N1	No	40	Sinus	Extraluminal	CHA PA	Pancreatic leak and vascular injury	B	8	Surgery	DGE	Alive
8	64	M	Pan.Ca	T2N1	No	10	NG Tube	Intraluminal	Unknown	Pancreatic leak	C	10	Unstable		Death
9	52	M	Periamp.Ca	T2N0	No	17		Extraluminal	GDA PA	Pancreatic leak	C	11	Surgery	Pancreatic fistula	Alive
10	65	M	Periamp.Ca	T1N0	No	1		Intraluminal	Pan.Stump		B	6	Surgery	Wound infection	Alive
11	48	F	Periamp.Ca	T2N0	No	8	NG Tube	Intraluminal	Anastomotic		B	4	Endotherpy		Alive
12	54	M	Periamp.Ca	T2N1	No	1		Intraluminal	Pan.Stump		B	7	Surgery	Pneumonitis	Alive
13	67	M	Pan.Ca	T3N1	Yes	17	Drainage	Extraluminal	GDA PA	Pancreatic leak and sepsis	C	15	Surgery	Intra. abd. abscess	Death
14	53	F	Periamp.Ca	T2N0	No	1		Intraluminal	Pan.Stump		B	7	Surgery		Alive

Note: POD, post operative day; PA, pseudo aneurysm; CHA, common hepatic artery; GDA, gastro duodenal artery; HA, hepatic artery; SA, splenic artery; NG tube, naso gastric tube; PRBC transfusion, packed red blood cell transfusion; DGE, delayed gastric emptying.

high mortality observed is similar with the literature [9,11] and emphasises that haemorrhage must be considered as a critical complication of PD, which requires an alert and judicious intensive care and an optimal management [14]. Early haemorrhage is often due to a technical mishap or vasospasm of unknown small vessels in the pancreatic cut surface that tends to get relieved in the postoperative period [11]. In our series the main site of bleed in early haemorrhage was from the pancreaticogastrostomy stump and from the retroportal pancreatic lamina. All the early cases required surgery to secure haemostasis.

Wente et al. [17], describe eight of 458 patients who underwent PD over a four-year period and had developed major early haemorrhage (<72 hours after surgery) from the pancreatic anastomosis with an aggressive surgical approach with no mortality. Thomas Blanc et al. [20] support routine reoperation for early haemorrhage to avoid delay and to limit the risk of massive transfusion. In their series 11 patients were reoperated for early bleeding; 10 had bleeding from surgical site, and all of them were survived. Our results are also similar with no associated mortality and suggest that surgery still remains a major tool in the management of this early haemorrhage.

Rumstadt et al. [11] support routine endoscopy for slightest suspicion of gastrointestinal bleeding following pancreaticoduodenectomy. We have attempted endoscopy in three patients who had intraluminal bleeding only in one case bleeding site identified at anastomotic site and endoscopically controlled. Tien et al. [8] describe post pancreaticoduodenectomy leak in 61 (15%) of 402 patients with massive bleed in 10 (18%) patients with 4-associated mortality. Our series showed a positive correlation between intraabdominal haemorrhage and pancreatic leakage. Postoperative pancreatic leak was associated with haemorrhage in eight (57%) patients. All had sentinel bleed and the bleeding source is from psueudoaneurysms in six patients with 4-associated mortality ($p=0.04$).

In Choi et al. [14] series of 500 Pancreaticoduodenectomy, delayed haemorrhage occured in 22 patients (4.4%), and four of the 22 died (18.2%). There were nine (2%) patients with late haemorrhage in our series with 29% mortality rate. The source of bleed was from arterial pseudoaneurysms on a background of pancreatic leak and sepsis. Various pathophysiological mechanisms that have been suggested for late haemorrhage include erosion of arterial vessels secondary to intraabdominal contamination of enteric, pancreatic, or bile juice from a leaking anastomosis and local infection and abscess formation in the intraabdominal cavity. The inflammatory process leads to arterial erosion or a dehiscence of the anastomosis with bleeding from the exposed suture line. Also pancreatic leak can lead to a pseudocyst formation. When pancreatic enzymes from a pseudocyst erodes into an adjacent arterial vessel, a pseudoaneurysm results which in turn can rupture and lead to haemorrhage [12]. Intraoperative vascular injury during extensive lymphatic dissection makes these vessels more vulnerable to the erosive enzymes. In our series seven of the nine patients with late haemorrhage had pseudoaneurysms and six of them had a pancreatic leak. Intraoperative vascular injury was present in one.

Encouraging results have been reported after arterial embolisation, in patients with pseudoaneurysms with a success rate ranging from 63 to 79% [15]. Few decisive factors have to be taken into account while managing these patients. First, not all cases of haemorrhage are caused by a ruptured pseudoaneurysm; the detection rate of pseudoaneurysm by angiography is low since the bleed is intermittent. Finally, a concomitant septic complication would require surgical management.

In Yekebas recent series of 1524 pancreatic surgeries, although 43 of 83 patients (52%) were subjected to angiography, 33 patients (40%) underwent primary surgical relaparotomy, 27 were relaparotomied as rescue treatment after the failure of interventional radiology [19]. In our series three patients with intermittent bleeding were submitted for angiography with successful embolisation in two (14%) patients (Table VII). Identification of risk factors for massive bleeding after a pancreatic leak

Table VI. Analysis of factors predicting the outcome.

	Alive (n)	Dead (n)	Significance (p value)
Age grouping			
<60	9	1	
>60	1	3	$P=0.02$
Sex			
Male	6	3	
Female	4	1	$P=0.59$
Onset			
Early	5	–	
Late	5	4	$P=0.08$
Sentinel bleed			
Yes	4	4	
No	6	–	$P=0.04$
Presentation			
Extraluminal	5	3	
Intraluminal	5	1	
Pseudoaneurysm	5	3	$P=0.39$
Source			
Pancreatic stump	4	–	$P=0.31$
Anastomotic site	1	1	
Pancreatic leak			
Yes	2	4	
No	8		$P=0.04$
Clinical grading			
B	7		
C	3	4	$P=0.02$
Management			
Surgery	8	2	
Angio embolisation	1	1	$P=0.30$
Endotherapy	1	1	

Table VII. Results of severe postpancreatectomy haemorrhage.

Lead author	Incidence (%)	Early (%)	Late (%)	Sentinel bleed	Pancreatic leak (%)	Surgery (%)	TAE (%)	Mortality rate (%)
Rajarathinam[a] 2008	3.1 (14/458)	36	64	57	57	71	15	29
Yekebas et al. [19]	3.3 (51/1524)	61	39	33	39	72	52	16
Blanc et al. [20]	7 (27/411)	41	59	15	75	85	4	11
Decastro et al. [12]	2.3 (23/1010)		All	78	65	69	9	22
Sato et al. [15]	12.3 (10/81)		All	100	90	20	80	40

[a]Present series.

and close monitoring of patients with these ominous signs like severe abdominal pain and sentinel bleeding might lead to early detection of bleeding, i.e. at the stage of sentinel bleed with timely angiography; the latter will provide an optimal strategy to treat this serious and sometimes fatal complication.

Shankar and Russell [13] reported nine patients with major bleeding after pancreatic resection and referred this as preliminary warning bleed, which preceded a major haemorrhage by six hours to 10 days. Brodsky and Turnbull [18] also emphasised the importance of "sentinel bleed" as a prelude to arterial haemorrhage in their series of five cases. In this series 88% of patients with late haemorrhage had sentinel bleeding of which 75% were associated with pancreatic leak and severe abdominal pain. In Sato et al. [15] series of five visceral post pancreaticoduodenectomy pseudoanerysms complicated by haemorrhge, all had sentinel bleeds and were treated by angioembolisation. De Castro et al. [12] showed that sentnel bleed was not followed by delayed massiive haemorrhage in the absence of postoperative septic complications. The coincidence of sentinel bleed prior to late haemorrhage was associated with a mortality of more than 50% [19] as experienced in our series also ($p = 0.04$). If sentinel bleed is detected in patients with septic complications and pancreatic leak, angiography should be performed to identify the source, and subsequently embolisation is performed. Laparotomy is indicated in haemodynamically unstable patients or when angioembolisation fails to stop the bleeding [16].

In our series most patients who required intervention belong to clinical grading of severity B and C. All the patients who belong to Grade B were alive and mostly managed surgically, except one who was managed endoscopically All the four mortality in patients with Grade C suggest ISGPS definition on Clinical grading of severity, accurately predicting the outcome ($p = 0.02$) in patients with post pancreaticoduodenectomy haemorrhage. Other factors that were associated with increased mortality were age > 60 years ($p = 0.02$), sentinel bleed ($p = 0.04$) and pancreatic leak ($p = 0.04$).

In summary, alertness towards an anticipated postoperative bleed is essential. A protocol similar to ISGPS definition on Clinical grading of severity is essential for management of PPH. Postoperative sepsis should be managed with great care. When post PD patient presents with severe abdominal pain and sentinel bleed, the surgeon should seriously consider the possibility of an imminent severe haemorrhage and exclude pseudoaneurysm and septic collections by CECT and an emergency angiography if indicated. If embolisation fails, the management is aggressive surgery.

In conclusion despite major advances in technology and surgical expertise the mortality after PPH remains high. Early haemorrhage when managed surgically results in better outcome when endoscopy is not feasible. Late haemorrhage is associated with high mortality due to pancreatic leak and sepsis. ISGPS Clinical grading of PPH is useful in predicting the outcome. Identification of risk factors for massive bleeding and close observation postoperative leak and sepsis might prompt earlier diagnosis.

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