Overview of pancreatic resections: postoperative management

Pancreatic resections are currently performed at specialist units in the UK. They involve complex decision-making, dissection, reconstruction and are associated with significant peri- and postoperative complications. It is important for trainees to be well informed about the nomenclature of pancreatic resection and reconstruction, as covered in the first part of this article (Dasari et al, 2015). This second part discusses associated complications and the postoperative management of patients undergoing pancreatic surgery.

Approach to postoperative management

The risk of general postoperative complications such as chest infections, deep vein thrombosis, pulmonary embolism and myocardial infarction following pancreatic resection is in the order of 4–19% (Halloran et al, 2002). Complications such as postoperative pancreatic fistula, anastomotic leak, intra-abdominal abscess, bleeding and delayed gastric emptying are surgery specific and will be discussed in detail. Some preoperative factors associated with perioperative morbidity include older age (>65 years) (Sukharamwala et al, 2012), male gender (Mann et al, 2010; Greenblatt et al, 2011), obesity, dependent functional status, chronic obstructive pulmonary disease, hypertension, elevated serum creatinine levels and hypoalbuminaemia (Mann et al, 2010; Greenblatt et al, 2011).

General principles of postoperative care such as early mobilization, thromboprophylaxis, prompt removal of invasive monitoring devices, judicious use of intravenous fluids and blood tests remain an integral part of postoperative management. With the increased introduction of enhanced recovery programmes, there is a move to remove epidurals, urinary catheters and surgical drains sooner, and to early introduction of dietary intake (Lassen et al, 2012).

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Complications

Postoperative pancreatic fistula

Postoperative pancreatic fistula is the major complication of concern after any form of partial pancreatectomy. The incidence is reported to be higher following distal pancreatectomy (30–35%) than pancreatoduodenectomy (20–25%), and is associated with mortality rates of up to 5% (Hackert et al, 2011). The International Study Group on Pancreatic Fistula defined a postoperative pancreatic fistula as 'output through an operatively placed drain or a subsequently placed percutaneous drain, of any measurable volume of drain fluid on or after postoperative day 3, with an amylase content greater than three times the upper normal serum value' (Bassi et al, 2005; Butturini et al, 2008). Clinical presentation and management of a pancreatic fistula depends on the extent and severity of the leak. Pancreatic fistulas are graded as A, B and C on this basis. A patient's risk of postoperative pancreatic fistula can be calculated using preoperative data (body mass index and pancreatic duct width as measured on computed tomography scan) (Roberts et al, 2014).

Thus amylase-rich drain fluid defines postoperative pancreatic fistula. An abdominal computed tomography scan helps in the diagnosis and quantification of an anastomotic leak. The presence of extraluminal gas or gas bubbles, peri-anastomotic free fluid or free fluid in the abdomen and pelvis are all indicators of a leak. Contrast studies along the drains are sometimes useful in a patient with a persistent high output fistula in order to determine the position of the tip of the drain. Under ultrasound or computed tomography image guidance, percutaneous drains can be placed within un-drained collections.

Management of a patient with a postoperative fistula depends on the patient's clinical condition although basic principles of fistula management are observed:

1. Treat sepsis through percutaneous drainage of collections (send for culture together with blood culture samples) and targeted use of intravenous antimicrobials after discussion with the local microbiology team
2. Limit pancreatic secretions by administering somatostatin analogues and avoiding gastric or pancreatic stimulation by using nasojejunal feeding or total parenteral nutrition
3. Providing safe nutrition, fluid and electrolyte requirements (Hackert et al, 2011).

Type A and B fistulae often resolve within 2–4 weeks of such conservative management (Hackert et al, 2011). Completion pancreatectomy is an option to control the leak from a pancreatico-enteric (gastric or jejunal) following pancreatoduodenectomy if the leak fails to settle. Such management strategies show considerable inter-unit variation.

Postoperative haemorrhage

Postoperative bleeding occurs in 3–13% of patients and mortality can be as high as 50% (Ho et al, 2005; Wente et al, 2007b). Bleeding can occur as a result of inadequate haemostasis at the time of surgery, delayed primary bleeding as a result of a slipped ligature, bleeding from an anastomosis or from the small bowel mesentery (Ho et al, 2005); these causes are typically apparent within the first day or two of the procedure while the patient is in a high dependency ward. The much more dangerous scenario

typically occurs in the setting of postoperative pancreatic fistula where the combination of infection and pancreatic enzymes can erode blood vessels, in particular the sutured stump of the gastroduodenal artery, resulting in pseudoaneurysm formation. This in turn may rupture and result in severe delayed postoperative haemorrhage. Local sepsis as a result of a pancreatic fistula is the most important risk factor identified in most series although it is not possible to predict the timing of bleeding following an anastomotic leak (Yekebas et al, 2007; Ricci et al, 2012).

A computed tomography angiogram may be able to identify the bleeding vessel in a patient with active bleeding, and will show the location of a haematoma. For patients with significant bleeding, interventional angiography helps not only in localizing the bleeding point but also allows stent placement or coiling of the culprit vessel. Intraluminal bleeding is often controlled by endoscopic intervention. In the presence of ongoing sepsis, radiological intervention forms an important means of managing post-pancreatectomy haemorrhage and can often lead to avoidance of surgery altogether, a beneficial scenario in a patient with sepsis (Puppala et al, 2011). A management algorithm for patients with post-pancreatectomy haemorrhage is outlined in *Figure 1*. Delayed postoperative bleeding as a result of pseudoaneurysm formation should always be dealt with via angiographic means where possible. Morbidity and mortality of these procedures is low (Fankhauser et al, 2011) while operative intervention 2 weeks or more following surgery is fraught with difficulty (Chiesa et al, 2005).

Delayed gastric emptying

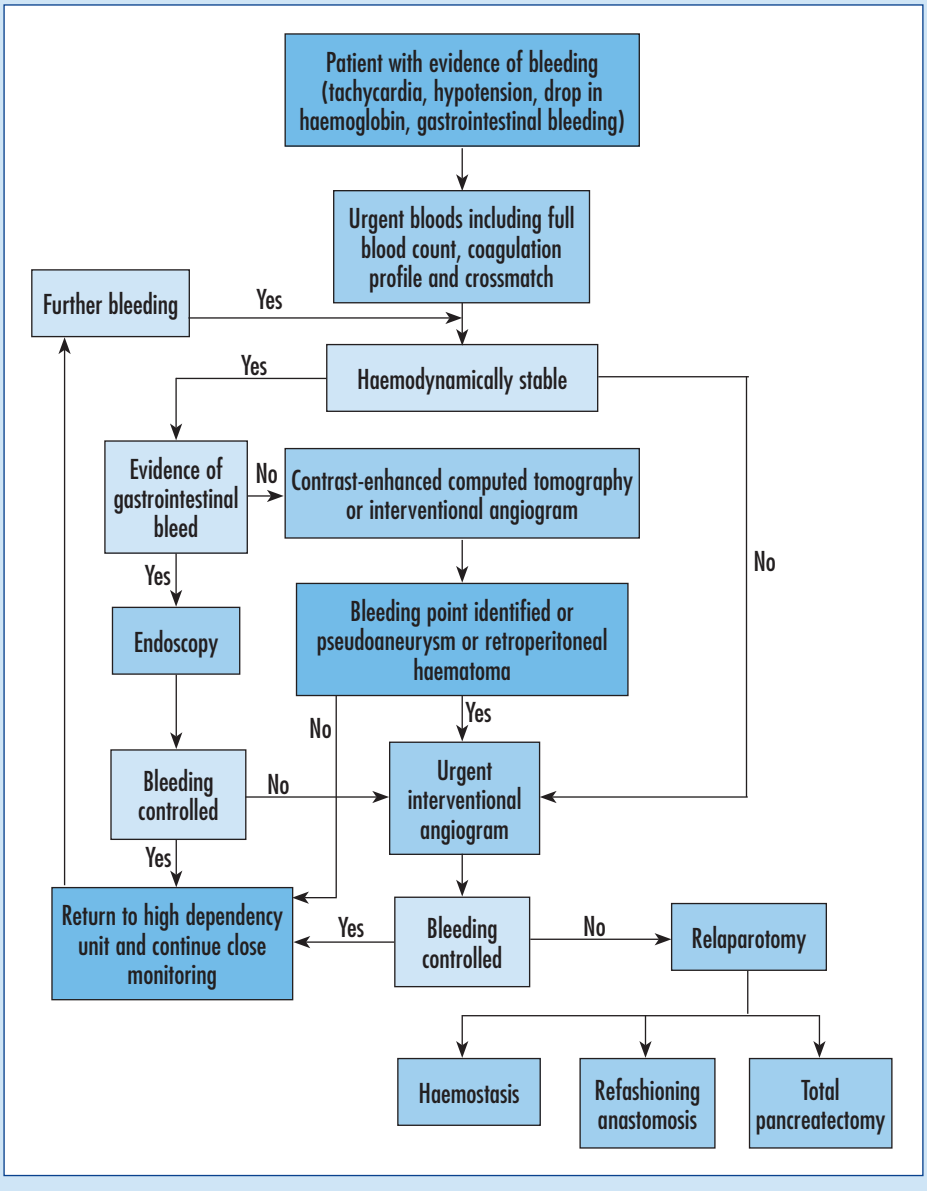
Various definitions have been used for this common and troublesome condition that has a prevalence of 30–40% (Wente et al, 2007a; Kurahara et al, 2011). Multiple factors have been proposed to cause delayed gastric emptying (Kurahara et al, 2011; Nikfarjam et al, 2012). Neuro-hormonal factors include loss of gastric pacemaker activity as a result of removal of the interstitial cells of Cajal (Goonetilleke and Siriwardena, 2006), pylorospasm caused by disruption of the vagal nervous system, and impairment of the vascular supply to the antropyloric region. Local inflammatory factors such as peri-pancreatic inflammation as a result of pancreatic fistula or intra-abdominal abscess formation also contribute to the problem. Mechanical factors such as angulation or torsion of the gastroenterostomy or duodenoenterostomy have been the reason for investigation of a variety of configurations of anastomoses. Significant oedema or a kink at the afferent or efferent limbs of the anastomoses may also be a factor in the development of delayed gastric emptying (Kurahara et al, 2011; Nikfarjam et al, 2012). It can cause significant discomfort, nausea, vomiting and prolonged hospital stay, with increased costs and a reduced quality of life (Wente et al, 2007a).

Management of delayed gastric emptying includes exclusion of a co-existing anastomotic leak or intra-abdominal abscess. Treatment consists of nasogastric decompression, use of prokinetic agents, correction of fluid and electrolyte imbalances, and nutritional support. Laparotomy with refashioning of the anastomosis may occasionally be required for patients with persistent or complete obstruction.

Chyle leak

Chyle leak is a less common but well-recognized postoperative complication following pancreatic surgery (1–5%) (Winter et al, 2006; Kuboki et al, 2013) caused by disruption of the cisterna chyli or one of its major tributaries. A milky, white amylase-

Figure 1. Management algorithm for postoperative haemorrhage following pancreatoduodenectomy.



poor drain effluent of ≥100 ml/day with a triglyceride level ≥110 mg/dl is considered evidence of a chyle leak. More often it is a contained chyle leak rather than diffuse chylous ascites. Patients with diffuse chylous ascites have a protracted clinical course and a worse long-term survival (van der Gaag et al, 2008). In general, conservative management is the mainstay of treatment, and chyle leaks are successfully managed with dietary measures, involving a high protein, low fat, medium-chain-triglyceride containing diet with input from a dietician. If this fails total parenteral nutrition may be considered (van der Gaag et al, 2008).

Management

Pre- and postoperative nutrition

Consuming complex clear carbohydrate-rich drinks 2 hours before surgery has been shown to reduce hunger, thirst, anxiety, postoperative insulin resistance and is consequently used in most enhanced recovery programmes. Early postoperative oral intake in this patient group has been shown to be feasible and safe (Lassen et al, 2008). A multicentre randomized controlled trial in patients undergoing major upper gastrointestinal surgery including pancreatoduodenectomy concluded that early return to oral intake is safe and that enteral tube feeding did not confer benefit (Lassen et al, 2008). Patients who cannot tolerate an oral diet as a result of any major complications will require enteral or parenteral nutritional support (Lassen et al, 2012). However, enteral feeding via nasogastric or nasojejunal tubes following pancreatoduodenectomy is still frequently practiced (Goonitelleke and Siriwardena, 2006).

Management of surgical drains

No consensus guidelines exist regarding the routine use of drains and there is much debate as to the optimal time for their removal if indeed they are used. Studies suggest that there is no advantage of routine intra-peritoneal drainage following pancreatoduodenectomy and drainage is in fact associated with longer hospital stay, a higher morbidity and increased readmission rates (Mehta et al, 2013; Correa-Gallego et al, 2013; van der Wilt et al, 2013). When used, it is advisable to remove the drain 3 days after resection to prevent development of fistulae (Bassi et al, 2010).

Anti-secretory medications

Octreotide is a somatostatin analogue that inhibits pancreatic exocrine secretions (Ho et al, 2005). The value of somatostatin analogues in the treatment of established pancreatic fistulae as well as its prophylactic role in pancreatic surgery is not clear. A Cochrane review has shown reduced perioperative complications including a decreased incidence of postoperative pancreatic fistula in patients receiving prophylactic somatostatin analogues although there was no difference in the perioperative mortality. Based on this evidence, routine use of somatostatin analogues in patients undergoing pancreatic resection is recommended (Gurusamy et al, 2013). The authors use subcutaneous octreotide 100 μg twice a day until the patient resumes oral intake.

Conclusions

The junior trainee must be able to appreciate the surgical procedure undertaken, and the number and type of anastomoses performed in order to accurately assess a postoperative patient. Awareness of possible complications will allow quick and appropriate alerting of senior staff in this challenging dynamic subgroup of general surgical patients. There are variations in the kinds of anastomoses performed, and in the use of somatostatin analogues, nutrition and drains between surgical units. It is important for the surgical trainee to understand the reason for such variations in practice and adapt to local protocols. **BJHM**

KEY POINTS

- Patients with postoperative pancreatic fistulae require percutaneous drainage of intra-abdominal collections, systemic antibiotic therapy as required, as well as fluid, electrolyte and nutritional support.
- Identify the 'sentinel bleed', investigate promptly and deal with postoperative haemorrhage by radiological or surgical intervention as appropriate.
- Patients with delayed gastric emptying require prolonged supportive care with nutritional, fluid and electrolyte management.
- Management of surgical drains, use of somatostatin analogues and early oral nutrition vary according to the individual unit's preferences.

Conflict of interest: none.

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