Commentary

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In general, our approach to surgery for pancreatic carcinoma is very similar to that described by the authors; however, there are a number of differences in the details of our management.

5.1 Staging

We prefer a high-quality, multi-phase contrast-enhanced CT as the principal modality for radiologic staging of pancreatic carcinoma. Our radiologic criteria for resection are as described but in addition, we utilize staging laparoscopy plus laparoscopic ultrasonography (L/LUS) much more frequently. Laparoscopic assessment for pancreatic cancer can be useful in selected patients by demonstrating small volume peritoneal or hepatic disease and may also be utilized in assessment of venous involvement. We have found, however, that in patients with low serum levels of the tumour marker Ca19-9, the rate of positive L/LUS is very low, and therefore we use L/LUS selectively based on Ca19-9 values. If the pre-operative Ca19-9 is greater than 150 kU/l in the absence of jaundice, or >300 kU/l in the presence of jaundice (bilirubin > 35 μmol/l), we recommend L/LUS preoperatively, as long as there are no other contra-indications to laparoscopy. In the presence of a markedly increased serum Ca19-9, L/LUS identifies radiologically undetected evidence of unresectability in approximately 20 % of patients.

In addition, we have recently commenced a trial of the role of PET-CT in the pre-operative staging of pancreatic cancer. It is possible that PET-CT will detect evidence of small volume metastatic disease that would otherwise not be detected pre-operatively.

5.2 Carcinoma of the Pancreatic Head/Periampullary Region

5.2.1 Operative Technique

Our preferred option for lesions within the head of the pancreas is the pylorus-preserving pancreatoduodenectomy as described. Initial mobilization consists of wide Kocher manoeuvre of the duodenum and opening of the lesser sac. Rather than dividing the gastro-colic omentum, however, we prefer to separate this from the transverse colon along the anatomic plane. Mobilization of the hepatic flexure of the colon is usually necessary in order to obtain adequate access to the duodenum.

The superior mesenteric vein and inferior border of the pancreas are then exposed, allowing early assessment of the degree of venous involvement, followed by exposure of the portal vein at the superior border of the pancreas above the pancreatic neck as described.

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After exposure of the gastroduodenal artery cephalad to the neck of the pancreas, patency of the common hepatic artery is checked by temporary occlusion of the gastroduodenal artery with a small vascular clamp or bulldog clip to ensure that the liver is not reliant on retrograde flow through the gastro-duodenal artery secondary to celiac artery compression. If, after occlusion, there remains flow through the hepatic artery, then we divide the gastroduodenal artery.

The proximal duodenum is transected with a linear stapling device and the gallbladder separated from the liver. The cystic artery is divided, but the cystic duct is ligated in continuity so that it remains connected to the resection specimen. The common hepatic duct is transected just cephalad to the cystic duct insertion; however, contrary to the practice of the authors, we prefer not to clamp the stump as this could potentially lead to ischaemic damage to the common hepatic duct stump. Instead, we merely place a swab over the cut end. Leakage of a small amount of bile is thus contained and does not cause any clinically important problems.

The first jejunal loop is then transected with a linear stapler and mobilized as described, and we would agree that use of the harmonic scalpel for this manoeuvre speeds the process. After mobilization, the distal duodenum and proximal jejunum are passed behind the superior mesenteric vessels to the right side of the patient and the pancreatic neck can then be divided between stay sutures. Our preference is to use diathermy to perform this division, and we have not encountered any problems in terms of pathologic assessment using this technique. Any tumour cells within 1 mm of the resection margin are deemed to represent a positive resection margin.

After transection of the pancreatic neck, the retro-pancreatic tissues are divided as close to the superior mesenteric artery as possible by serial ligation and division of the numerous small vessels in this area. If the tumour is particularly adherent to the vein, a limited vein resection may be performed; we have found bovine collagen vein patches to be useful for reconstruction in this situation.

We do not send samples routinely for frozen section analysis; however, if the surgeon is suspicious of the presence of residual tumour tissue, then further specimens may be sent for frozen section and a further resection considered. This approach is particularly pertinent for mucinous cystic lesions or main-duct IPMN, where there may be high-grade dysplasia within the residual pancreatic duct such that a further pancreatic resection may be entertained.

The pancreatic anastomosis is performed using either the Cattell-Warren technique, as described, or the Blumgart technique, using four 3-0 PDS, mattress sutures through the pancreatic body approximately 1 cm away from the cut margin and taking the jejunum both anteriorly and posteriorly to buttress the sutures. The pancreatic duct is treated in the same way as for the Cattell-Warren technique using 4-0 PDS. In both techniques, we utilise a fine-bore, paediatric feeding tube as a pancreatic duct stent. This stent is cut to a length of approximately 10 cm and placed across the pancreatic anastomosis to discourage stricture formation.

The hepaticojejunostomy is performed using a single layer of interrupted, 4-0 PDS. The duodenojejunostomy is constructed in an antecolic position with 3-0 monocryl or 3-0 PDS, again as a single layer of interrupted sutures. Interrupted sutures are preferred to a continuous layer because of the risk of ischaemia with the latter (Fig. 5.1).

In the event that a pylorus-preserving procedure is not possible due to proximity of the tumour to the pylorus and proximal duodenum, then reconstruction of the gastro-jejunostomy is performed using a Roux-en-Y loop in order to reduce bile reflux into the stomach (Fig. 5.2).

We place two simple, corrugated, "passive" drains adjacent to the anastomosis. We prefer not to use suction drains in proximity to bowel due to the risk of injury to the bowel wall.

5.2.2 Additional Medication and Procedures

All patients receive antibiotic prophylaxis with cefuroxime and metronidazole and octreotide, 100 μg subcutaneously, 3 times a day for 7 days, commencing on the evening before surgery.

All patients are admitted routinely to a postoperative critical care unit for the first night post-

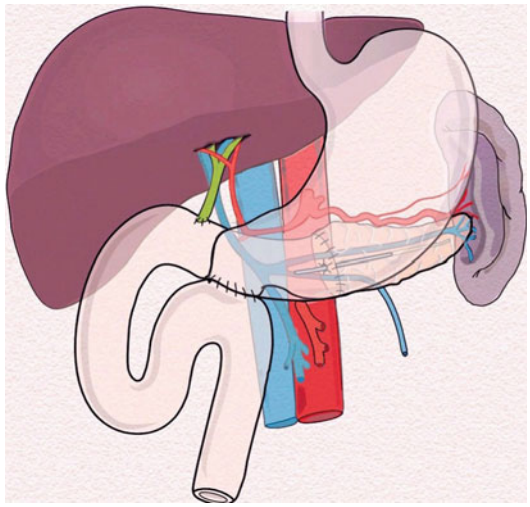

Fig. 5.1 Reconstruction after standard, duodenum-preserving pancreatoduodenectomy. Retrocolic pancreatojejunostomy with 4-0 PDS, hepaticojejunostomy with 4-0 PDS and antecolic duodenojejunostomy with 3-0 PDS or monocryl (Copyright University of Liverpool (2003)

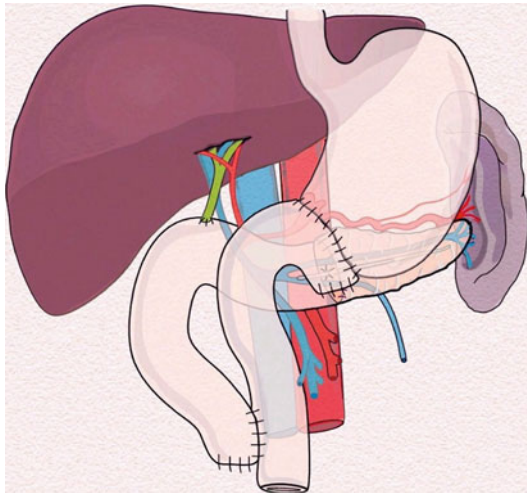

Fig. 5.2 Roux-en-Y reconstruction following a classic Kausch-Whipple pancreatoduodenectomy with removal of the pylorus. Retrocolic pancreatojejunostomy with 4-0 PDS, and hepaticojejunostomy with 4-0 PDS and antecolic gastrojejunostomy with 3-0 PDS or monocryl, and jejunojejunostomy with linear stapler plus 3-0 PDS or monocryl. *Note* the separate Roux limb for the gastrojejunostomy (Copyright University of Liverpool (2003)

operatively, but transferred to the Pancreatic Enhanced Recovery Unit the following day, where they remain until fit for discharge on day 7-10.

Table 5.1 Patients with carcinoma of the pancreatic head/periampullary region undergoing pancreatic resection 2007–2008

Parameter	Number	%
Patients	151	100
In-hospital mortality	3	2
Hospital stay – days (median, range)	17.5	(4–84)
Reoperation	5	3
Classic Kausch-Whipple	20	13
Pylorus-preserving pancreatoduodenectomy	118	78
Total pancreatectomy	9	6
Pancreas-preserving duodenectomy	3	2
Tumour stage (UICC)	112	
Ia	3	3
Ib	3	3
IIa	17	15
IIb	63	63.4
III	12	11
IV	6	5
R0 resection	84	56
R1 resection	64	42
R2 resection	3	2
Vascular resection	11	7
Complications	85	56
Bleeding	3	2
Delayed gastric emptying	10	7
Pancreatic fistula	10	7
Biliary fistula	2	1
Wound infection	41	27
Collection requiring drainage	9	6

A nasogastric tube is routinely left in situ postoperatively but is not used routinely for supplemental feeding; instead we encourage early introduction of fluids – sips of water may be taken as soon as the patient has recovered sufficiently from the anaesthetic – and oral intake is increased gradually over the next few days until the patient is taking solids by day 4. Early mobilization is encouraged.

The drains are shortened gradually, commencing on day 3 provided the output is not excessive, and there is no clinical suspicion of an anastomotic leak.

Our data for resections of tumours of the pancreatic head 2007/2008 is presented in Table 5.1.

5.3 Carcinoma of the Body/Tail of Pancreas

5.3.1 Operative Technique

Our approach to the pancreatic body/tail is very similar to that described by the main authors. Initial exposure of the pancreas proceeds as for a pancreatoduodenectomy with separation of the greater omentum from the transverse colon, although for a left-sided resection, this separation is continued all the way across to the splenic flexure.

The duodenum is Kocherized in the same way as we would for a pancreatic head resection in order to allow control of the superior mesenteric and portal veins if necessary. This manoeuvre is particularly important if the pancreas is to be transected formally across the neck. For more distal lesions, it sometimes possible to transect the pancreas further to the left, however, adequate access for control of the veins is still essential before dissection of the pancreas commences.

After mobilisation of the pancreatic neck in a manner similar to that employed for a pancreatic head resection (although preserving the gastroduodenal artery and right gastroepiploic vessels) the splenic artery is ligated and divided and the pancreatic neck divided. Transection of the pancreas may be performed using a stapling device as described, or using diathermy as we described above for the pancreatic head resection. In the latter case, the stump must be oversewn with 4-0 PDS, taking care to identify and close the pancreatic duct separately. The splenic vein is then ligated and divided behind the body of the pancreas, and the pancreatic body mobilised as described, continuing the dissection around the spleen and taking the short gastric vessels with the harmonic scalpel or ligatures depending on circumstances.

Postoperative care is similar to that for pancreatoduodenectomy, although often only a single corrugated drain is required.

Our data for resections of tumours of the pancreatic body/tail for 2007/2008 is presented in Table 5.2.

Table 5.2 Patients with carcinoma of the body/tail of pancreas undergoing pancreatic resection 2007–2008

Parameter	Number	%
Patients	23	100
In-hospital mortality	0	0
Hospital stay – days (median, range)	19.5	(8–57)
Reoperation	0	0
Left pancreatectomy	20	87
Total pancreatectomy	3	13
R0 resection	20	87
R1 resection	3	13
R2 resection	0	0
Vascular resection	1	4
Complications	14	61
Bleeding	1	4
Pancreatic fistula	1	4
Wound infection	1	4
Collection requiring drainage	6	26