

An audit of pathology lymph node dissection techniques in pylorus preserving Kausch–Whipple pancreatoduodenectomy specimens

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Abstract

Aims—To determine whether or not identifying recognised anatomical groupings of lymph nodes (LNs) improves LN yield in pancreatoduodenectomy resection specimens.

Methods—All the pathology reports from pancreatoduodenectomy resection specimens between January 1997 and September 1999, for one specialist pathologist at the Royal Liverpool University Hospital, were examined retrospectively. The total number of LNs found in each specimen was determined and the method of identifying LNs established for each case. LNs were found using either (1) the UICC TNM anatomical groupings, termed “grouped”; (2) the Japanese Pancreatic Society classification, termed “numbered”; or (3) neither the “grouped” nor “numbered” classification, termed “non-grouped”.

Results—A total of 50 reports (45 neoplastic, five chronic pancreatitis) were studied, 11 with non-grouped LNs, 14 with grouped LNs, and 25 with numbered LNs, including the five inflammatory cases. A median of 7.0 LNs was found in non-grouped cases, a significantly lower number than in the grouped cases (median, 12.0; Mann–Whitney U, $p < 0.039$) and numbered cases (median, 17.0; $p < 0.0001$). There was no significant difference in the LN yield between grouped and numbered cases ($p = 0.1066$). LNs were found most frequently in the inferior, posterior pancreaticoduodenal, and infrapyloric regions.

Conclusions—A detailed knowledge of the anatomical distribution of LNs in pancreatoduodenectomy resection specimens significantly improves LN yield. It is suggested that illustrations of LN sites in resection specimens should be included in pathology guidelines/proformas to improve LN detection and, therefore, pathological prognostic data.

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After the success of a two stage pancreatoduodenectomy for carcinoma of the ampulla of Vater performed by Kausch in 1912,¹ and subsequently by Whipple in 1934,² Brunschwig extended the use of the resection to the

treatment of ductal adenocarcinoma of the head of the pancreas in 1937.³ The one stage pancreatoduodenectomy, used in current surgical practice, was eventually described by Whipple in 1946.⁴ This one stage procedure is now the operation of choice for patients with carcinoma of the head of the pancreas, ampulla of Vater, distal bile duct, or proximal duodenum. Fifty years on, 85% of patients with pancreatic carcinoma still have inoperable disease at the time of presentation and a three year mortality rate of more than 95%.⁵ Potentially curative resection for pancreatic carcinoma improves the five year survival rate to 5–25%.^{6–10}

Numerous studies investigating potential prognostic factors have shown that, for pancreatic carcinoma, tumour grade, tumour stage, and resection margin status all affect clinical outcome.^{11–13} In ampullary carcinoma, the metastatic/disseminated lymph node (LN) ratio is an independent prognosticator on multivariate analysis.¹⁴ Multivariate analysis has also shown that LN involvement is a negative prognostic indicator in pancreatic carcinoma,^{15–19} with patients with a single group of involved LNs surviving significantly longer than those with multiple groups of involved LNs.²⁰ This is reflected in the UICC TNM classification of malignant tumours,²¹ where pathological nodal (N) staging is dependent upon the total number of involved LNs in the surgical resection specimen. Therefore, knowledge of the anatomical location of LNs in the pancreatoduodenectomy resection specimen is crucial for LN yield and accurate pathological nodal staging. The aim of our study was to determine whether or not identifying recognised groupings of LNs improves LN yield in pancreatoduodenectomy resection specimens.

Materials and methods

All the pathology reports from pylorus preserving Kausch–Whipple pancreatoduodenectomy resection specimens (which include the head of pancreas, duodenum, distal bile duct, and gall bladder) between January 1997 and September 1999, for one specialist pathologist in the department of pathology at the Royal Liverpool University Hospital, were examined retrospectively. The total number of LNs found in each specimen was determined from each

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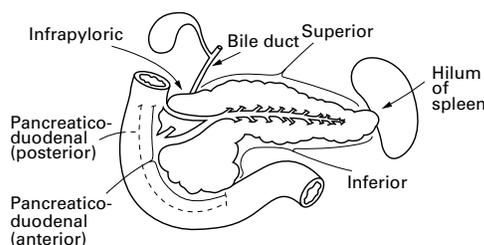


Figure 1 UICC TNM classification for regional lymph nodes of the pancreas and ampulla of Vater.²¹

report and the method of identifying LNs for each case established by reviewing the paraffin wax block taking records. LNs were identified either according to (1) the UICC TNM anatomical groupings,²¹ termed “grouped”; (2) the Japanese Pancreatic Society classification system,²² termed “numbered”; or (3) neither the “grouped” nor “numbered” methods, termed “non-grouped”.

Before 1998, LNs were sampled from the resection specimens without specific knowledge of the lymphatic drainage of the pancreas (termed “non-grouped” LNs). “Grouping” of LNs was introduced in 1998, following the update of the UICC TNM classification of malignant tumours.²¹ In this classification, regional LNs, for the head of the pancreas and ampulla of Vater, are subdivided into: (1) superior to the head and body of the pancreas; (2) inferior to the head and body; (3) anterior, including anterior pancreaticoduodenal, pyloric, and proximal mesenteric; and (4) posterior, including posterior pancreaticoduodenal, common bile duct, and proximal mesenteric LNs (fig 1).

In 1999, the Japanese Pancreatic Society LN numbering system²² was introduced, at the request of the surgeons in the Royal Liverpool University Hospital. In this rather complex system, 18 different groups of LNs are identified (table 1), many of which have further subdivisions.

All the resection specimens studied included the head of the pancreas but not the body or tail of the pancreas. None of the patients had undergone previous abdominal surgery and there was no history of preoperative radiotherapy or chemotherapy. Lymph nodes had been dissected from the specimens after formalin fixation.

Table 1 The numbering of regional lymph nodes (LNs) of the pancreas according to the Japanese Pancreatic Society classification system²²

1	Right cardiac LNs
2	Left cardiac LNs
3	LNs along the lesser curvature of the stomach
4	LNs along the greater curvature of the stomach
5	Suprapyloric LNs
6	Infrapyloric LNs
7	LNs along the left gastric artery
8	LNs around the common hepatic artery
9	LNs around the coeliac trunk
10	LNs at the hilum of the spleen
11	LNs around the splenic artery
12	LNs of the hepatoduodenal ligament
13	Posterior pancreaticoduodenal LNs
14	LNs around the superior mesenteric artery
15	LNs along the middle colic artery
16	Para-aortic LNs
17	Anterior pancreaticoduodenal LNs
18	Inferior LNs

Table 2 Numbers of lymph nodes detected by the “non-grouping”, “grouping”, and “numbering” methods

	Non-grouped	Grouped	Numbered
No. of cases	11	14	25
Median	7.0*¶	12.0*§	17.0¶§
Range	5–12	3–30	6–22

Mann-Whitney U: *p < 0.039; ¶p < 0.0001; §p = 0.1066.

Table 3 Comparison of total lymph node (LN) yields for each LN location using the UICC TNM classification²¹ and the Japanese Pancreatic Society (JPS) system²²

Lymph node group	Total numbers of LNs		
	JPS (25 cases)	UICC TNM (14 cases)	Combined total
Infrapyloric/superior	76	43	119
Portal	48	35	92
Cystic duct	9		
PPD above	41	41	128
PPD below	46		
Inferior	121	34	155
APD above	15	26	66
APD below	25		
SB mesentery	12	12	24

PPD above/below, posterior pancreaticoduodenal, above/below ampulla of Vater; APD above/below, anterior pancreaticoduodenal, above/below ampulla of Vater; SB mesentery, small bowel mesentery.

In the cases with grouped or numbered LNs, the sites of the most frequently found LNs were also determined. Statistical analyses were performed using the Mann-Whitney U test for non-parametric data.

Results

In total, 50 pathology reports were studied (45 resections for neoplasia, five resections for chronic pancreatitis), 11 with non-grouped LNs, 14 with grouped LNs, and 25 with numbered LNs. The LNs were numbered in all five cases of chronic pancreatitis.

The median lymph node count in the non-grouped cases was 7.0 LNs. There was a significant increase in the lymph node yield in both grouped cases (median, 12.0 LNs) and numbered cases (median, 17.0 LNs) compared with the non-grouped cases; p < 0.039 and p < 0.0001, respectively (table 2). Although the LN yield for numbered cases was higher than that for the grouped cases, this was not significant (p = 0.1066). The LN yield in inflammatory cases (median, 15.0 LNs) was not significantly different from that found in the neoplastic resections with numbered LNs (median, 17.5; p = 0.5170).

In the 39 resections in which the LNs were either grouped or numbered, LNs were found most commonly in the inferior, posterior pancreaticoduodenal, and infrapyloric regions (table 3).

Discussion

In this retrospective audit, we have shown that identifying peripancreatic LNs, either by anatomical groupings, proposed by the UICC TNM classification,²¹ or by the LN numbering system of the Japanese Pancreatic Society,²² significantly increases the LN yield from

pylorus preserving Kausch–Whipple pancreatoduodenectomy specimens (table 2). We have also shown that LNs are most frequently found in the inferior, infrapyloric, and posterior pancreaticoduodenal regions (fig 1; table 3).

The number of LNs detected in a resection specimen depends upon the anatomical differences between patients, the type of surgical excision, and the diligence of the pathologist in recovering LNs from the resection specimen. Different surgical procedures will produce specimens with different LN groups and subgroups and, therefore, different numbers of LNs.²³

In our study, all patients underwent the same surgical procedure, a pylorus preserving Kausch–Whipple pancreatoduodenectomy (resection of head of pancreas, duodenum, distal bile duct, and gall bladder), with en bloc removal of anterior pancreaticoduodenal LNs, posterior pancreaticoduodenal LNs, hepatoduodenal ligament (bile duct) LNs, LNs around the superior mesenteric vessels, superior head/infrapyloric LNs, and small bowel mesentery LNs. Separately sent common hepatic artery and para-aortic LNs were not included in our analysis.

Although our overall average LN yield of 15.2 LNs in the 39 grouped and numbered cases is less than the average of 33 LNs found by Cubilla *et al* in eight Whipple resections,²⁴ their resection specimens included a partial gastrectomy and pancreatic body resection with LNs from the lesser and greater curves of the stomach, and from the body of the pancreas, included in their average number. These differences highlight the need for standard definitions of surgical procedures,²³ to allow objective comparisons of morbidity, mortality, and prognostic data between institutions.

Fat clearance techniques could have been used to increase LN yield. However, a detailed knowledge of the anatomical locations of peripancreatic LNs improved the yield significantly. Before the introduction of LN grouping and subsequently numbering, the median LN yield (7.0 LNs) was less than the UICC TNM recommended minimum of 10 LNs, required for an adequate pathological assessment of LN status in carcinomas of the pancreas and ampulla of Vater.²¹ Although most of the LNs in our specimens were visible macroscopically, embedding the anterior and posterior pancreaticoduodenal groove fat and the inferior margin of the specimen resulted in microscopic and intrapancreatic LNs being found at these sites. Increasing dissection experience acquired by the surgeons and pathologist during the retrospectively analysed period of study will probably also have contributed to the increase in LN yields. However, the significant increase in LN yield with grouping compared with the initial non-grouping method, and the subsequent lack of a significant difference between grouping LNs and the most recent method of numbering LNs (the method with the highest number of cases studied) suggests that knowledge of the anatomical locations of LNs was

more influential than increasing dissection experience.

The Japanese Pancreatic Society²² LN numbering system is complex but, in practice, only further subdivides the groupings of the UICC TNM system.²¹ It is more time consuming to identify the Japanese Pancreatic Society numbered LNs separately, but one would not expect to identify any more LNs with this method. Therefore, the lack of a significant difference between the numbers of LNs found in the numbered cases (median, 17.0) and the grouped cases (median, 12.0) suggests that the maximum number of LNs that can be found in a specimen has been achieved. Now that the Japanese numbering system is our standard protocol for LN sampling, it would be interesting to re-audit LN yields in the future to see if any further increase occurs. However, awareness that LN yield will be re-audited (one aspect of the Hawthorne effect) could influence the results.

In conclusion, we have shown that a detailed knowledge of the anatomical locations of peripancreatic LNs significantly increases the pathologist's LN yield in pancreatoduodenectomy resection specimens. We suggest that illustrations of LN sites in resection specimens should be included in pathology guidelines/proformas to aid and improve LN detection and, therefore, improve pathological prognostic data.

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