

Clinical Science

Preoperative hematologic markers as independent predictors of prognosis in resected pancreatic ductal adenocarcinoma: neutrophil-lymphocyte versus platelet-lymphocyte ratio

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Neutrophil-
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Prognosis;
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Abstract

BACKGROUND: The objective of this study was to investigate whether the preoperative hematologic markers, the platelet-lymphocyte ratio (PLR), or the neutrophil-lymphocyte ratio (NLR) ratio are significant prognostic indicators in resected pancreatic ductal adenocarcinoma.

METHODS: A total of 84 patients undergoing pancreatoduodenectomy for pancreatic ductal adenocarcinoma over a 10-year period were identified from a retrospectively maintained database.

RESULTS: The preoperative NLR was found to be a significant prognostic marker ($P = .023$), whereas PLR had no significant relationship with survival ($P = .642$) using univariate Cox survival analysis. The median overall survival in patients with an NLR of ≤ 3.0 ($n = 55$) was 13.7, 17.0 months in those with an NLR of 3.0 to 4.0 ($n = 17$) and 5.9 months in patients with a value of >4.0 ($n = 12$) (log rank, $P = .016$). The NLR retained its significance on multivariate analysis ($P = .039$) along with resection margin status ($P = .001$).

CONCLUSION: The preoperative NLR represents a significant independent prognostic indicator in patients with resected pancreatic ductal adenocarcinoma, whereas PLR does not.

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Ninety percent of pancreatic tumors are malignant ductal adenocarcinomas involving the head. Only 10% to 20% of individuals present with potentially operable disease, and despite resection with curative intent, the median survival remains between 12 and 18 months.^{1,2} The overall 5-year

survival with and without resection is 15% to 20%³ and 2% to 3%,⁴ respectively.

After resection of pancreatic cancer, prognosis has been found to be dependent on several histologic factors^{5–10} including tumor size and differentiation,¹¹ lymph node involvement,⁶ and resection margin status.¹² Most of these are only determined after surgery.

Therefore, it is useful to search for a potential prognostic indicator, which would be available before surgery. Previous studies have suggested that C-reactive protein levels,¹³

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thrombocytosis,¹⁴ and lymphocytopenia^{15,16} may represent potential prognostic markers in resected pancreatic cancer.

More recent studies have shown the neutrophil-lymphocyte ratio (NLR) to be a significant prognostic indicator in resected colorectal cancer¹⁷ and the platelet-lymphocyte ratio (PLR) in resected pancreatic cancer.¹⁸ The objective of this study was to identify if any of the previously tested preoperative variables (neutrophil count, lymphocyte count, platelet count, NLR, and PLR) were useful independent prognostic indicators for patients undergoing resection for pancreatic adenocarcinoma in our series.

Methods

Retrospective data were collected for patients undergoing classic Kausch-Whipple resection from June 1998 to June 2008. Only patients with histologic confirmation of pancreatic ductal adenocarcinoma were included in the study. Patient demographics, preoperative full blood count (FBC), operative details, intervention for biliary decompression, and standard histologic tumor characteristics were recorded. Pancreatic cancer specimens were processed and reported according to the Royal College of Pathologists' guidelines (5th edn International Union Against Cancer [UICC] TNM classification) that define a positive margin to include at least 1 cancer cell within 1 mm of any resection

Table 1 Demographics and preoperative hematology results from patients with resected pancreatic ductal adenocarcinoma

Demographics	
Number of patients identified	84
Male/female	48:36
Median age (IQR)	65 y (51–79)
Overall mean survival (95% CI)	22 mo (17–28)
Preoperative stenting	
Yes	68
Number	16
Adjuvant chemotherapy	
Yes	30
Number	54
Number of cases jaundice preoperatively (Bilirubin >35 μ mol/L)	
Present	23
Absent	61
Preoperative FBC available	84
Median NLR (IQR)	2.4 (.76–4.04)
Median PLR (IQR)	110 (100–120)
Median timing of preoperative FBC (IQR)	3 (1–6.25)
Neutrophilia (>7.5/mL $\times 10^6$ /mL) (%)	9 (11)
Lymphocytopenia (<1.0/mL $\times 10^6$ /mL) (%)	6 (7)
Thrombocytosis (>400/mL $\times 10^6$ /mL) (%)	16 (19)

No patients received neoadjuvant chemotherapy.
IQR = interquartile range.

Table 2 The median survival according to the PLR, the NLR, histologic subtypes, and biliary stenting

	Number of patients	Median survival	P (log rank)
Preoperative PLR			
≤ 100	35	14.4 (12.6–16.3)	.630
100–200	39	10.3 (7.5–13.1)	
>200	10	8.0 (.8–15.2)	
Preoperative NLR			
≤ 3.0	55	13.7 (12.2–15.2)	.016
3.0–4.0	17	17.0 (4.6–29.4)	
>4.0	12	5.9 (1.4–12.0)	
Preoperative NLR			
≤ 4.0	71	14.0 (13.0–15.8)	.004
>4.0	13	7.1 (1.4–12.9)	
Tumor size			
≤ 20 mm	6	34.0 (1.0–100.6)	.017
>20 mm without invasion	20	26.8 (5.6–48.0)	
>20 mm with invasion	45	10.5 (8.9–12.1)	
Adjuvant chemotherapy			
Yes	30	10.3 (6.3–14.3)	.258
Number	54	14.6 (1.0–31.0)	
Nodal involvement			
Negative	29	30.7 (25.5–36.0)	<.001
Positive	55	9.8 (7.8–12.0)	
Tumor differentiation			
Moderate	60	13.5 (11.3–15.7)	.947
Poor	24	10.0 (5.2–14.8)	
Resection margin status			
Negative	49	23.2 (9.3–37.0)	<.001
Positive	35	7.1 (3.6–10.7)	
Preoperative stent			
Number	16	15.2 (8.8–16.1)	.561
Yes	68	12.5 (3.6–10.7)	

IQR = interquartile ratio.

margin. Both hospital records and general practitioner databases were used to accurately identify the length of survival. Patients with ongoing infection (active respiratory or urinary tract infection) at the time of FBC measurement and those surviving for less than a month were excluded from the study.

Statistical analysis

Continuous data were analyzed using median, interquartile range, and 95% confidence intervals (CIs). Chi-square or Fisher exact tests were used for comparative analysis of categorical data. Survival data were analyzed using log-rank testing for univariate analysis and Cox proportional hazards for multivariate analysis. Corrected log rank *P* values were quoted for univariate survival where continuous prognostic data were dichotomized. All patients who died within 30 days of surgery were excluded from survival analysis, and a *P* value of $\leq .05$

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