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Predictive Values of Neutrophil-to-lymphocyte, Neutrophil-to-platelet, and Platelet-to-lymphocyte Ratios for In-hospital Mortality in Patients with Bacterial Bloodstream Infections

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Introduction

- Bloodstream infection (BSI) remains a leading cause of sepsis and septic shock, with high mortality rates.
- Neutrophil-to-lymphocyte ratio (NLR), neutrophil-to-platelet ratio (NPR), and platelet-to-lymphocyte ratio (PLR) were found to be the simple and inexpensive indicators of developing poor outcomes in the sepsis population.
- However, few studies have validated the value of these CBC-derived markers for prognostication of mortality in Vietnamese settings.
- This study aimed to investigate the roles and prognostic performance of NLR, NPR, and PLR in predicting in-hospital mortality among adult BSI patients in Vietnam

Methods

- We retrospectively reviewed a total of 1293 patients with bacterial blood culture in a tertiary hospital from June 2024 to June 2025 in Vietnam. Eventually, 192 adult patients with culture-confirmed BSI were included for analysis
- Demographic, clinical, and laboratory data were retrieved from the patients' electronic medical records.
- The primary outcome of this study was in-hospital mortality, defined as all-cause death occurring during hospitalization
- ROC analysis and multivariate logistic regression were used to determine independent predictors and their optimal cut-off values.

Results

Table 1. Characteristics of patients on admission

Parameter	Total (n = 192)	Survivor (n=147)	Death (n=45)	p-value
Age				0.522
≤ 60 years	63 (32.8)	50 (34.0)	13 (28.9)	
> 60 years	129 (67.2)	97 (66.0)	32 (71.1)	
Gender				
Male	109 (56.8)	82 (55.8)	27 (60.0)	0.617
Female	83 (43.2)	65 (44.2)	18 (40.0)	
Comorbidity				
Diabetes	66 (34.4)	49 (33.3)	17 (37.8)	0.583
CKD	27 (14.1)	21 (14.3)	6 (13.6)	0.914
Hypertension	73 (38.2)	49 (33.6)	24 (53.3)	0.017
Chronic ischemic heart disease	25 (13.2)	18 (12.4)	7 (15.9)	0.549
Chronic heart failure	15 (7.9)	7 (4.8)	8 (18.2)	0.004
History of stroke	26 (13.7)	19 (13.1)	7 (15.6)	0.676
COPD*	8 (4.2)	4 (2.8)	4 (9.1)	0.087
Gout	16 (8.3)	10 (6.8)	6 (13.3)	0.165
Site of primary infection				
Urinary tract*	40 (20.8)	36 (24.5)	4 (8.9)	0.034
Abdomen	31 (16.1)	25 (17.0)	6 (13.3)	0.558
Lung	33 (17.2)	22 (15.0)	11 (24.4)	0.140
Skin and soft tissues	21 (11.0)	16 (10.9)	5 (11.1)	0.966
Central nervous system*	7 (3.7)	1 (0.7)	6 (13.3)	0.001
Unknown origin	60 (31.2)	47 (32.0)	13 (28.9)	0.696
NLR	1.65 (0.76-3.59)	1.11 (0.71-2.47)	4.36 (3.60-6.38)	<0.001
NPR	0.065 (0.044-1.112)	0.059 (0.036-0.084)	0.116 (0.097-0.183)	<0.001
PLR	258.0 (147.4-398.3)	238.1 (130.0-364.0)	344.0 (205.7-472.0)	0.002

Data were presented as n, (%) or median, IQR (Q1-Q3);
* Results were analyzed by Fisher's exact test.
Abbreviations: CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; NLR, neutrophil-to-lymphocyte ratio; NPR, neutrophil-to-platelet ratio; PLR, platelet-to-lymphocyte ratio.

Figure 1. Pathogens of BSI in the study patients.

- Escherichia coli — 56.2
- Klebsiella pneumoniae — 15.6
- Staphylococcus aureus — 10.4
- Acinetobacter baumannii — 4.2
- Pseudomonas aeruginosa — 4.2
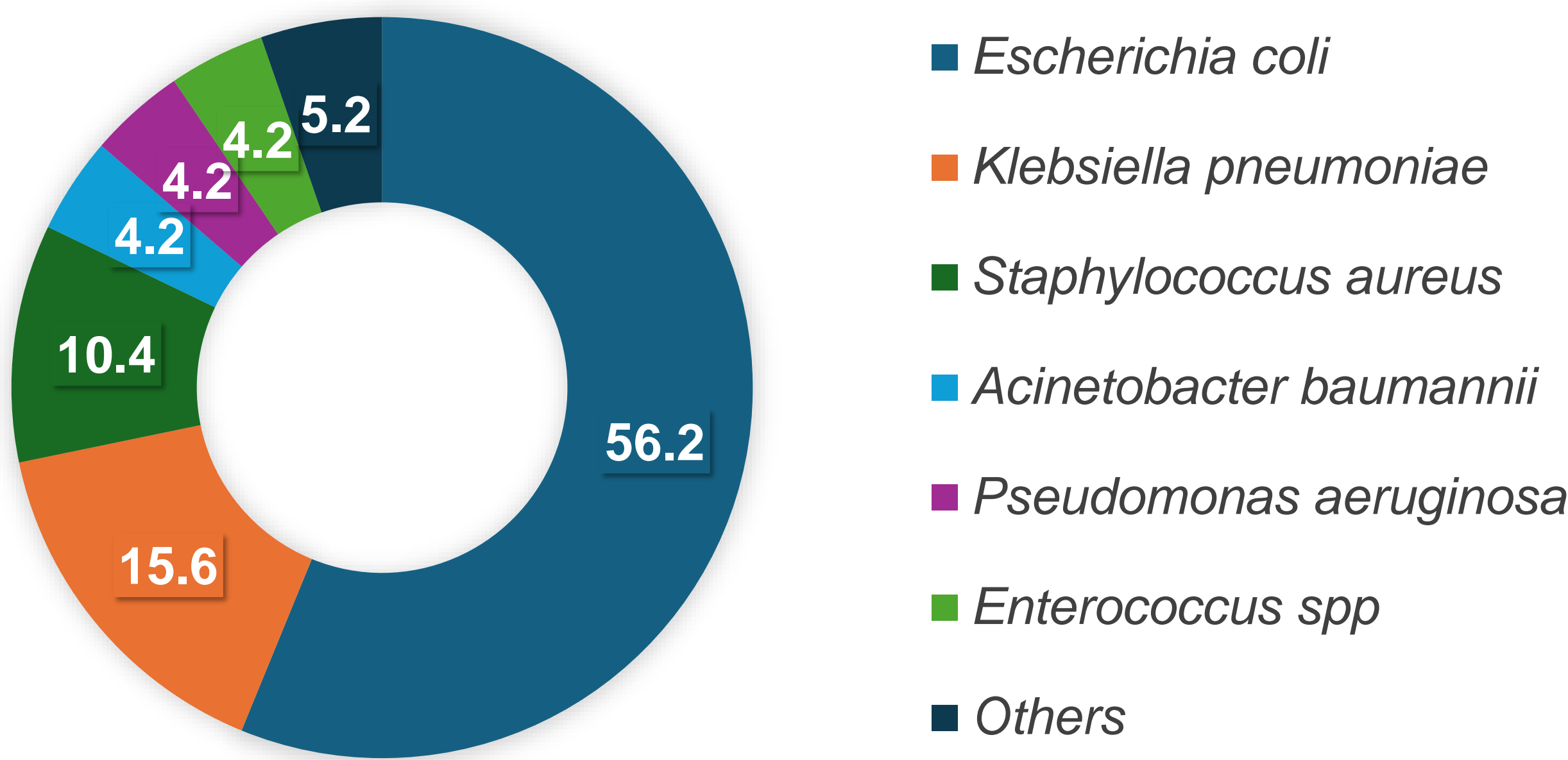- Enterococcus spp — 4.2
- Others — 5.2

Table 2. Univariate and multivariate logistic regression analysis of NLR, NPR, and PLR in predicting in-hospital mortality (n=192)

Parameter	In-hospital Mortality			
	Model 1		Model 2	
	aOR (95%CI)	p-value	aOR (95%CI)	p-value
NLR	1.089 (1.061-1.117)	<0.001	1.111 (1.070-1.153)	<0.001
NPR	16.368 (1.627-64.641)	0.018	14.484 (2.402-49.628)	0.007
PLR	1.002 (1.001-1.003)	0.010	1.003 (1.001-1.004)	0.012

Model 1: Simple logistic regression model
Model 2: Multiple logistic regression model

Table 3. Cut-off values of NLR, NPR, and PLR and their performance to predict mortality in BSI patients

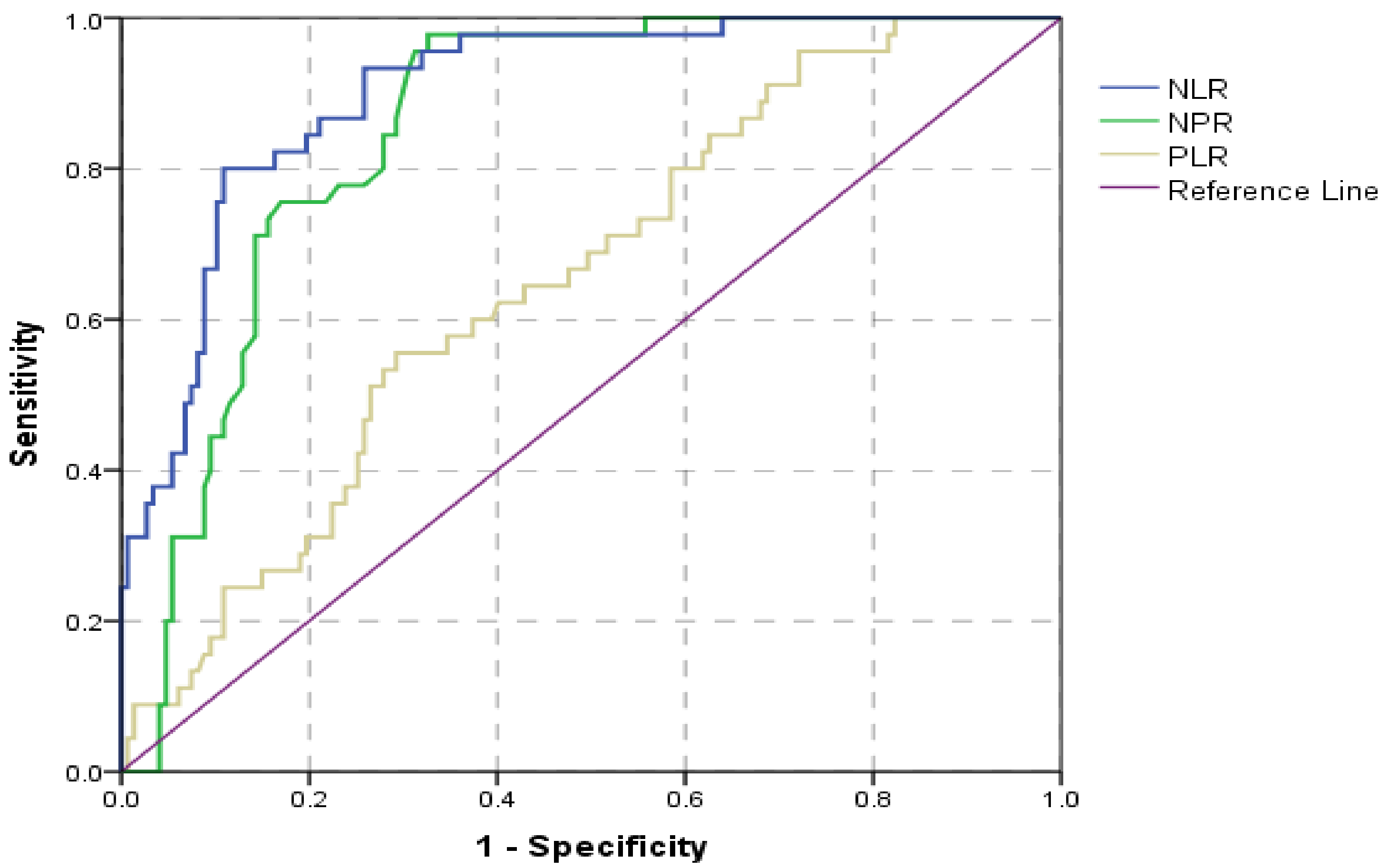| Parameter	In-hospital Mortality			
	Cut-off value	AUC	95%CI	p-value
NLR	3.387	0.902	0.857-0.948	<0.001
NPR	0.068	0.854	0.801-0.907	<0.001
PLR	334.6	0.650	0.565-0.736	0.002

Figure 2. The area under the curves of NLR, NPR, and PLR to predict in-hospital mortality in patients with BSI.

Conclusion

Our study revealed that NLR, NPR, and PLR could serve as early prognostic indicators of in-hospital mortality in adult Vietnamese patients with BSI

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