

Neutrophil lymphocyte ratio and platelet lymphocyte ratio as a predictor of postoperative complications after major oncosurgeries: A retrospective study in a tertiary cancer centre

Joona P, Jashma C, Roopesh Sureshan, Sonali Openja, Namaratha Divakaran

Assistant Professor, Malabar Cancer Centre, Moozhikkara P.O, Kodyeri, Thalassery, Kannur, India

ABSTRACT

Introduction: Neutrophil Lymphocyte Ratio (NLR) and Platelet Lymphocyte Ratio (PLR) have been found to be prognostic indicators for several solid tumours. Our study aims to find out whether NLR and PLR can predict postoperative complications after major oncosurgeries.

Aim: To assess the ability of NLR and PLR in predicting postoperative complications.

Materials and Methods: Complete blood count done on the day of surgery preoperatively was recorded for 200 patients and NLR and PLR were calculated. Patients were followed up for 30 days postoperatively and analysed for complications.

Results: Postoperative wound infection, sepsis, incidence of cardiovascular and renal complications, need for vasopressor use, duration of ICU stay and postoperative hospital stay are significantly high in patients with high preoperative NLR and high preoperative PLR. But there is no significant association with 30 day mortality in both groups.

Conclusion: NLR and PLR are two simple and cost effective indices to predict postoperative complications after major oncosurgeries.

Key words: neutrophil lymphocyte ratio, platelet lymphocyte ratio, postoperative complications, major oncosurgeries, diagnostic indicators

INTRODUCTION

Postoperative complications after major onco-surgery increases the length of hospital stay, adds on to the financial burden and is also associated with poor long term survival [1]. Identifying the systemic inflammatory status of the patient in the perioperative period helps to reduce the postoperative complications which may improve overall survival of the patient [2].

Neutrophil lymphocyte ratio and platelet lymphocyte ratio are two widely used indicators of systemic inflammatory status [3-5]. Increase in circulating platelets helps in the formation of tumour cell embol [6]. Surgery in such patients promotes the formation of platelet clumps around the emboli which prevents NK cell mediated tumour cell clearance [7]. High NLR accelerates neutrophil mediated inflammation and prevents lymphocyte mediated tumour suppression [8, 9].

NLR and PLR have been found to be prognostic indicators for several solid tumours [10-12]. However whether these indices can predict postoperative complications remains uncertain. Our study aims to find out whether NLR and PLR can predict postoperative complications after major oncosurgeries.

METHODOLOGY

After obtaining permission from the institutional review board/ institutional scientific committee, this retrospective cohort study evaluated data of 200 patients who underwent major oncosurgeries in our institute, a tertiary cancer centre from July 2020 to December 2021. Patient details were collected from the hospital medical records and data was analysed retrospectively.

Patients who were more than 18 years of age, undergoing major oncosurgery as described in definition and whose case records having relevant details for the study were included.

Patients undergoing emergency surgeries, patients with pre-existing inflammatory conditions, autoimmune or haematological diseases, patients on corticosteroid therapy and those undergoing head and neck and breast surgeries were excluded from the study.

Demographic characteristics like age, sex, Body Mass Index (BMI), American Society of Anaesthesiologists (ASA) score, co-morbidities, neoadjuvant treatment status, type of surgery, duration of surgery, mean blood loss, need for vasopressors during intraoperative period were recorded. Patients were followed up for 30 days postoperatively. Complete blood count done on the day of surgery preoperatively was recorded. NLR and PLR were

Address for correspondence:

Joona P, Assistant Professor, Malabar Cancer Centre,
Moozhikkara P.O, Kodyeri, Thalassery, Kannur, India-670103,
Email: drjoonap@gmail.com

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calculated from the data.

Results were compared in terms of postoperative complications like anastomotic leakage, wound site infection, sepsis, pulmonary complications, cardiovascular and renal complications, need for vasopressor support, need for prolonged postoperative ventilation, and duration of ICU stay, postoperative hospital stay and 30 day mortality.

Major surgery is defined as those surgeries lasting more than three hours but less than 5 hours and or requiring one to three blood product transfusions and more than 500 ml but less than 1500 ml blood loss and which may include multi-organ resection.

Multi-organ resection includes resection of additional organs which otherwise would not be resected as part of resection except in suspected involvement.

Anastomosis leakage was defined as deterioration in the integrity of the anastomosis documented by the combination of clinical, radiological and operative tools.

Wound infection was defined as superficial or deep incisional surgical site infection according to the definition of the Centres for Disease Control (CDC).

Hypotension was defined as reduction in mean arterial pressure >20% from the baseline. Sepsis was defined as the presence of 2 or more systemic inflammatory response syndrome criteria. Neutrophil lymphocyte ratio was defined as the absolute neutrophil count divided by the absolute lymphocyte count.

Platelet Lymphocyte Ratio was defined as the platelet count divided by the absolute lymphocyte count.

The total blood count was measured by an automated haematology analyser (Beckman Coulter-LH 780).

RESULTS

In total, 200 patients were enrolled in the study. Characteristics of patients are summarized in table 1. Out of the 200 patients, 70 patients (35%) were males and 130 patients (65%) were females. The mean age of the study population was 56.98 (SD 10.636) years.

Among the patients who have taken preoperative chemotherapy, who had intraoperative transfusion, who had intraoperative bleeding more than one litre, majority had high preoperative NLR/ PLR but association was not statistically significant. Details are shown in table 2.

Among the patients with duration of surgery >3 hours, majority had high NLR (statistically not significant) and high PLR. High PLR had statistically significant association with prolonged duration of surgery.

Intraoperative events like hypotension, vasopressor use, arrhythmias, ECG changes etc. were significantly high among those with high preoperative NLR. Occurrence of these events was high among those with high preoperative PLR, but the association is not statistically significant.

Postoperative complications were compared between the patients according to their PLR and NLR status using χ^2 test or Fishers exact test (Tables 3 and 4).

Among the postoperative complications, hypotension and need for vasopressor use was the most common. It was significant in patients with high preoperative NLR and also among those with high preoperative PLR. Cardiovascular complications are the second most common and it was significantly high in those with high NLR. In high PLR group cardiovascular complications are high but not statistically high.

Tab. 1. Distribution of study participants according to various factors

	Factors		Count
	Sex	Male	Female
ASA	1	2	56 134
	3	4	10 NIL
	NIL	IHD	58 36
	CVA	HTN	1 69
Comorbidity	DM	CKD	86 17
	Thyroid abnormality	COPD	21 0
	Open gyn	Lap gyn	80 3
	Open GE	Lap GE	81 36
	nil	hypotension	155 2
Intraoperative events	Arrhythmia	ECG changes	1 9
	Vasopressor use	Hypotension and ECG change	30 1
	Hypotension, arrhythmia		2

Tab. 2. Association of pre and intraoperative factors on NLR and PLR.

	Low/ N NLR	High NLR	P value	Low/N PLR	High PLR	P value
Preoperative chemo	35	44	0.315	30	49	0.084
Duration of surgery >3 hours	57	77	0.116	58	86	0.01
Intraoperative blood loss > one litre	39	71	0.064	46	64	0.083
Intraoperative events	12	33	0.03	15	30	0.085
Intraoperative transfusion	30	57	0.272	32	55	0.148

Tab. 3. Preoperative NLR and postoperative complications.

Postoperative complications	Low pre-op nlr (n=80) (pre op nlr <=1.90)	High pre-op nlr (n=120) (pre op nlr > 1.90)	P value
Wound infection	2	21	0.001
Anastomotic leak	8	16	0.477
Sepsis	6	21	0.04
Cardiovascular complications	13	42	0.004
Renal complications	2	14	0.019
Vasopressor use	14	58	0.001
Prolonged ventilation	4	11	0.273
Postop pneumonia	7	17	0.248
Thirty day mortality	1	8	0.07
Postop hospital stay	44	90	0.003
Duration of ICU stay	27	75	0.001

Tab. 4. Preoperative PLR and postoperative complications

Postoperative Complications	Low Pre-OP PLR (n=91) (Pre OP PLR <=142.90)	High Pre-OP PLR (n=109)(Pre OP PLR > 142.90)	P value
Wound infection	3	20	0.001
Anastomotic leak	7	17	0.085
Sepsis	5	22	0.002
Cardiovascular complications	20	35	0.11
Renal complications	3	13	0.025
Vasopressor use	16	56	0.001
Prolonged ventilation	2	13	0.009
Postop pneumonia	7	17	0.087
Thirty day mortality	2	7	0.186
Postop hospital stay	49	85	0.001
Duration of ICU stay	32	70	0.001

Occurrence of postoperative wound infection and sepsis are significantly high in patients with high preoperative NLR and also in patients with high postoperative PLR. But incidence of anastomotic leak was not significant in both the groups. Renal complications are significantly high in both groups.

Prolonged ventilation was high in both groups but association was statistically significant in high PLR group. Incidence of postoperative pneumonia was not statistically significant in both groups.

Postoperative hospital stay and duration of ICU stay had statistically significant association in both the groups. But 30 day mortality had no significant association in both the groups.

DISCUSSION

Our study found that both elevated NLR and PLR can significantly predict the occurrence of postoperative complications. They can also predict prolonged duration of ICU stay and postoperative hospital stay. But they failed to predict 30 day mortality after major onco-surgeries.

The preoperative PLR and NLR are expensive and widely available markers to reflect systemic inflammation status [13-15]. Several

recent studies have demonstrated that preoperative inflammation state is associated with a worse postoperative outcome after surgery [16-18]. Our study showed that both preoperative PLR and NLR have a positive correlation with the postoperative complications.

As immune cells, platelets can initiate and accelerate many vascular inflammatory conditions [19-21]. Previous study also has the similar result that preoperative thrombocytosis is associated with an increased risk of major postoperative complication [17, 22]. Our study confirms these findings and further defines the nature of the association. We demonstrated that preoperative elevated PLR was independently associated with the development of postoperative wound infection, sepsis, renal complications, hypotension and prolonged ventilation.

NLR increases when neutrophil mediated inflammatory response was enhanced or lymphocyte mediated immune response was reduced, which may weaken antibacterial ability and toleration of surgery stress. Yasuhiko M. reported that NLR could independently predict the development of postoperative infectious complication. Our study also confirms these findings.

The association between elevated NLR and the development of postoperative infectious complication is likely complex and remains unclear; however, possible explanations exist. NLR,

which is derived from the absolute neutrophil and absolute lymphocyte counts of a full blood count, is a routinely available marker of the systemic inflammatory response. The antibacterial responses of natural killer cells and activated T cells may be suppressed by increased number of neutrophils near the site of bacterial contamination [23]. A high NLR reflects both a heightened neutrophil-dependent inflammatory response and a decreased lymphocyte-mediated antibacterial immune reaction, which may weaken the lymphocyte-mediated antibacterial cellular immune response and contribute to increasing bacterial invasion and growth. Although the exact mechanism remains unclear, the results of our study suggest that NLR, as a simple preoperative inflammatory biomarker, may identify patients at increased risk for postoperative infectious complications [24].

Our study has several limitations. First, this study was performed in a single centre, which might limit the generalizability of our

observation to others. Second, the sample size of our study is small. Third, this was a retrospective study. Fourth, although the perioperative management and surgical procedures have remained relatively constant, the skills and experiences of the surgeons were not included in the analysis.

More prospective studies with higher sample size are needed to be done to find the predictive value of high preoperative NLR and PLR.

CONCLUSION

NLR and PLR are two simple and cost effective indices to predict postoperative complications after major oncosurgeries. They predict both systemic and infectious complications. Early prediction of complications helps to take better precautions in the perioperative period so that postoperative morbidity and mortality and also financial burden can be reduced.

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