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ORIGINAL ARTICLE

Postoperative changes in neutrophil-to-lymphocyte ratio and platelet count: A simple prognostic predictor for adult-to-adult living donor liver transplantation

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KEYWORDS

complete blood count;
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Summary *Background/Objective:* The neutrophil-to-lymphocyte ratio (NLR) is a simple index that represents systemic inflammatory change. The number of platelets is also known to reflect both post-transplant graft regeneration and dysfunction. Thus, we aimed to investigate the usefulness of NLR and platelet number in predicting the clinical course after adult-to-adult living donor liver transplantation (AA-LDLT) in the acute postoperative period in recipients. *Methods:* Between January 1999 and December 2013, 61 patients underwent their first AA-LDLT at our institute. We retrospectively analyzed their clinical data, including NLR and number of platelets, until postoperative day 14, and evaluated their ability to predict prognosis after AA-LDLT.

Results: The optimal cutoff values of postoperative maximum NLR and maximum platelets to predict prognosis were 50 and $80 \times 10^3/\mu\text{L}$, respectively. The 1- and 5-year survival rates were

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87.5% and 79.1% in the normal maximum NLR group, respectively, and 46.2% for both in the high maximum NLR group ($p = 0.0033$). The 1- and 5-year survival rates, respectively, were 90.9% and 84.1% in the high maximum platelets group and 47.1% and 41.2% in the low maximum platelets group ($p < 0.0001$). In multivariate analysis, maximum NLR ≥ 50 and maximum platelets $< 80 \times 10^3/\mu\text{L}$ were independently associated with 1-year mortality.

Conclusion: A high NLR and a low platelet count during acute postoperative period might correlate with poor prognosis after AA-LDLT.

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1. Introduction

In the liver transplantation (LT) domain, graft shortage continues to be a problem, especially in Japan. Thus, living donor LT (LDLT), in which problems related to graft size mismatch are frequently encountered, has been the main therapeutic modality for patients with liver failure. Therefore, a good understanding of perioperative management procedures are important for achieving better outcomes.

Complete blood count (CBC) is a simple yet useful test after major surgeries, including LT. The neutrophil-to-lymphocyte ratio (NLR) has recently been reported as a simple and useful marker of various inflammatory changes and is calculated from CBC data.^{1–7} NLR is reported to be a predictor of patient survival in acute coronary syndrome and various malignancies, including hepatocellular carcinoma (HCC).^{4–7}

In LT, the usefulness of NLR has been reported in limited situations. Most of these reports involved prognosis of liver transplant surgery for HCC.¹ NLR was also reported to be a predictor of intraoperative circulatory risk, and as a prognostic factor for patients who underwent LT for acute-on-chronic liver failure.^{8,9} Recently, we also investigated NLR in adult-to-adult living donor LT (AA-LDLT) and reported the relationship between postoperative NLR elevation and graft size.¹⁰

In addition to white blood cell differentiation, relationship between white blood cell and platelets is associated with inflammatory change, tissue repair/regeneration, and ischemia/reperfusion injury.^{11–13} We also reported platelet aggregation in the space of Disse in a postoperative graft dysfunction case.¹⁴ Thus, platelets might have an important role in both post-transplant graft regeneration and dysfunction. Therefore, the number of platelets in the acute phase of LT has been reported as a prognostic factor for early post-transplant survival or graft function.^{15,16} However, the details of these changes are still unknown.

In this study, we aimed to investigate the usefulness of NLR and the platelet number in predicting the clinical course after AA-LDLT in the acute postoperative period in recipients.

2. Patients and Methods

Between January 1999 and December 2013, 61 adult patients (age ≥ 20 years) underwent their first AA-LDLT at Kanazawa University Hospital. These patients were

included in this retrospective study after obtaining approval from the Institutional Review Board of Kanazawa University Hospital, and the study was conducted in accordance with the 2000 Declaration of Helsinki and Declaration of Istanbul 2008. All patients signed an informed consent for this purpose. Donor and recipient data were collected from the hospital's medical records system.

The evaluation of living donors was performed using contrast-enhanced abdominal computed tomography, and the results were used to calculate the volume of the whole liver, partial liver graft, and residual liver in the donor. Standard liver volume was calculated using the formula reported by Urata et al.¹⁷ The graft size was evaluated as the graft volume-to-standard liver volume ratio and graft recipient weight ratio. Initially, we limited our LT program to end-stage liver disease patients without any malignancies. However, from 2003, we extended the program to all HCC patients. From 2007 onward though, we confined our program to HCC patients within Milan criteria.¹⁸ In addition, we have started blood-type incompatible LT using rituximab from 2008.

After the transplantation, immunosuppressive therapy was started with tacrolimus (Prograf; Astellas Pharma, Tokyo, Japan) and corticosteroids. The tacrolimus dose was adjusted to achieve a trough level of 10–15 ng/mL for 2 weeks following the transplantation. Thereafter, the target trough level was gradually reduced to approximately 7 ng/mL. The corticosteroids were administered as an initial dose of 2 mg/kg/d, which was tapered gradually. In addition, from 2001, mycophenolate mofetil was added as a postoperative immunosuppressive therapy for approximately 2 weeks after LDLT. For platelet transfusion, the threshold for transfusion had generally been less than 30,000/ μL . However, in the case of treatment with blood purification, the threshold for transfusion had been less than 50,000/ μL . Importantly, principles of postoperative management of transplant recipients did not differ according to the graft size.

The recorded clinical data, including Model for End-Stage Liver Disease (MELD) score, postoperative changes in CBC, prothrombin time-international normalized ratio, and total bilirubin levels obtained from daily blood sampling until postoperative day 14, were analyzed. The MELD score was calculated using the formula reported by Kamath et al.¹⁹ The preoperative general demographics of the patients, postoperative treatment, and clinical events during postoperative hospital stay, such as immunosuppressive

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