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Original Article

Correlation between preoperative nutritional status and postoperative clinical outcomes in patients undergoing artificial hip and knee replacement

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Abstract: Objective: To investigate the effect of prognostic nutritional index (PNI) on the clinical outcome of patients undergoing total hip/knee arthroplasty (THA/TKA), and to construct a nomogram prediction model. Method: A retrospective analysis was performed on 504 patients who underwent THA/TKA at The Third Affiliated Hospital of Chengdu Medical College, Pidu District People's Hospital from January 2020 to January 2025. Among them, 379 patients treated between January 2020 and January 2024 were used for model construction and internal validation, and 125 patients treated from February 2024 to January 2025 were used for external validation. Univariate and multivariate Logistic regression analyses were used to identify the independent risk factors for the clinical outcomes of patients, based on which a nomogram prediction model was established. Result: A total of 71 patients (14.09%) experienced adverse clinical outcomes. Multivariate analysis showed that T2DM and disease duration ≥ 10 years were independent risk factors for poor outcomes in THA/TKA patients (all $P < 0.05$). Higher WOMAC scores were associated with increased risk of adverse outcomes, while higher PNI levels were associated with reduced risk (both $P < 0.05$). Internal validation demonstrated good discrimination and calibration of the nomogram. In external validation, the sensitivity, specificity, and accuracy of the prediction model were 96.36% (106/110), 66.67% (10/15), and 92.80% (116/125), respectively. Conclusion: A low preoperative PNI level may increase the risk of poor outcomes in THA/TKA patients. The nomogram model incorporating PNI, T2DM, disease duration, and WOMAC score provides good reference for clinical assessment of postoperative risk.

Keywords: Total hip/knee arthroplasty, prognostic nutritional index, logistic, nomogram

Introduction

Artificial total hip/knee arthroplasty (THA/TKA) is a surgical procedure that involves replacing the damaged hip/knee joint surfaces with artificial prostheses to restore joint function and alleviate pain [1, 2]. Its efficacy in relieving pain and rebuilding joint function has been well established. With the maturity and widespread adoption of THA/TKA, accurately predicting and optimizing postoperative outcomes has become essential for improving medical quality. However, current preoperative evaluation system relies heavily on traditional indicators such as age and comorbidities, and generally overlooks a key controllable factor - nutritional status [3-5]. Nutrition is the cornerstone for the body to cope with surgical stress, promote tissue healing and functional recovery, and has higher controllability compared to traditional indicators. The prognostic nutritional index (PNI), a quantitative indicator combining serum albumin and lymphocyte count, reflects systemic inflammation and nutritional-immune status.

A study of Zhang et al. reported that gastrointestinal cancer patients with high PNI had significantly prolonged overall survival (OS) and progression-free survival (PFS), suggesting that PNI can reflect the nutritional and immune foundation required for immunotherapy response [6]. Wang et al. found that, in patients with hip fracture, PNI independently predicted postoperative complications and 2-year mortality, and patients with low PNI had a significantly higher risk of adverse outcomes [7]. It can be seen

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that PNI has been proved as an effective prognostic tool in many surgical fields [6-8]. However, there is no consensus on its value in joint replacement. Existing evidence highlights several issues that urgently need to be clarified: PNI does not function in isolation, and its interaction with other important prognostic factors such as patient comorbidities, inflammation levels, and physical function, as well as whether and how this interaction collectively affects patient clinical outcomes, remains unclear. Moreover, the lack of a clinical predictive model that integrates PNI and other key variables limits its clinical applicability in individualized risk assessment for THA/TKA.

To address these research gaps, this study intends to conduct a retrospective cohort analysis to systematically evaluate the correlation between preoperative PNI and postoperative clinical outcomes in patients undergoing THA/TKA. We assume that preoperative PNI is an independent predictor of postoperative outcomes after THA/TKA, and low PNI is significantly associated with an increased risk of adverse outcomes. Furthermore, it still has predictive value for the clinical outcomes of THA/TKA patients when interacting with other factors.

Data and methods

General information

Patients who underwent THA/TKA at the Third Affiliated Hospital of Chengdu Medical College, Pidu District People's Hospital from January 2020 to January 2025 were retrospectively selected as the research subjects. Their clinical information was collected. Inclusion criteria: (1) Meeting surgical indications and receiving THA/TKA; (2) Age ≥ 25 years; (3) First-time THA/TKA. Exclusion criteria: (1) Presence of severe infectious diseases; (2) Comorbid mental illnesses; (3) Presence of malignant tumors; (4) Incomplete clinical or 1-year follow-up data required for this study.

Based on predefined inclusion and exclusion criteria, a total of 504 patients were included in the study. In a chronological order of admission, 379 cases between January 2020 to January 2024 were used for model construction and internal validation, while the remaining 125 cases between February 2024 and January 2025 were used for external validation. This study was approved by the Ethics Committee of the Third Affiliated Hospital of Chengdu Medical College, Pidu District People's Hospital.

Data collection

Clinical data collections were done using the hospital electronic medical record system, covering (1) Baseline data: age, sex, Body Mass Index (BMI), hypertension, type 2 diabetes mellitus (T2DM), smoking and alcohol consumption history. (2) Disease and treatment related parameters: disease type, disease course, severity, type of surgery (THA/TKA), and anesthesia method (general anesthesia or spinal anesthesia). (3) Pre-surgical laboratory examination indicators: white blood cell count (WBC), neutrophile granulocyte (NEUT), hemoglobin (Hb), albumin (Alb), lymphocyte (Lym), platelet (Plt), prothrombin time (PT), rheumatoid factor (RF), anti-cyclic citrullinated peptide antibody (CCP), C-reactive protein (CRP), uric acid (UA), and red blood cell distribution width (RDW). PNI was calculated using the following formula: PNI = Alb (g/L) + 5 × Lym (× 10^9/L).

The severity of disease was evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [9]. WOMAC consists of 24 entries, each of which is rated on a 5-level scale of 0-4, with a total score range of 0-96 points. Higher score suggests more severe joint pain, stiffness, and functional impairment.

Clinical outcome evaluation and grouping

Clinical outcomes were obtained from patients' follow-up data, including all-cause mortality rate within postoperative 6 months, major postoperative complications, severe blood loss, revision operation, and significant pain. Major postoperative complications included major cardiovascular adverse events, postoperative pulmonary complications, urinary complications, cerebrovascular events, and lower limb deep vein thrombosis. Significant pain was defined as readmission for pain symptom. Severe blood loss was defined as infusion of more than 2 units of concentrated red blood cells during hospitalization. Patients who met any of the above criteria were included in the

poor outcome group, while the remaining patients were included in the good outcome group.

Model construction and verification

Model construction: (1) The 379 research subjects were randomly divided into a training set and a validation set at a 7:3 ratio using R software; (2) Univariate analysis was conducted to screen factors with significant differences between good and poor outcome groups, which were then entered into multivariate logistic regression analysis to identify independent risk factors for poor prognosis; (3) Independent risk factors identified through multiple logistic regression analysis were used to construct the nomogram prediction model.

Model validation: (1) Internal validation: Receiver characteristic curve (ROC), calibration curve, and decision curve were used to test the predictive value of the model for patient prognosis in both the training and validation sets. (2) External validation: The sensitivity, specificity, and accuracy of the model for predicting clinical outcomes of THA/TKA patients were obtained through confusion matrix calculation.

Statistical analysis

SPSS 26.0 software and R 4.5.1 were used for data analysis. Measurement data conforming to normal distribution were represented by mean ± standard deviation, and inter-group comparisons were conducted using t-test. Categorical variables were represented by n (%) and inter-group comparisons were conducted using the χ^2 test. Univariate and multivariate logistic regression analyses were conducted to clarify the relationship between PNI and patient prognosis, as well as to identify the independent factors affecting the prognosis of THA/TKA patients. A *P* value of < 0.05 was considered with significant difference.

Results

Clinical outcomes and univariate analysis of THA/TKA patients

Among the 379 patients used for model construction and internal validation, 56 cases had adverse clinical outcomes, accounting for 14.78%. Univariate analysis (**Table 1**) revealed significant differences in age, BMI, T2DM, course of the disease, WOMAC score, WBC, Lym, and PNI between the poor and the good outcome groups (all P < 0.05).

Multivariate logistic regression analysis of clinical outcomes in THA/TKA patients

Factors with significant differences in the univariate analysis (age, BMI, T2DM, course of disease, WOMAC, Alb, Lym and PNI) were included as independent variables, and clinical outcomes of patients were taken as dependent variable for multivariate logistic regression analysis. PNI is calculated from Alb and Lym, and an exact linear relationship (complete collinearity) exists between these three variables. Therefore, when conducting univariate and multivariate logistic regression analysis, Alb and Lym were excluded. The assignment of variables is shown in **Table 2**. Multivariate regression analysis (**Table 3**) showed that, T2DM and a course of disease ≥ 10 years were independent risk factors for adverse clinical outcomes in THA/TKA patients (all P < 0.05). In addition, multivariate analysis also suggested that an increased WOMAC score was associated with a higher risk of adverse outcomes, whereas a higher PNI was associated with a lower risk (both P < 0.05).

Construction of the nomogram prediction model for clinical outcomes of THA/TKA patients

Based on the multivariate logistic regression analysis, a nomogram model was constructed using the variables with P < 0.05. The constructed nomogram model comprised four predictors: T2DM, course of disease, WOMAC and PNI (**Figure 1**), each represented by a line segment of proportional length. By adding up the score of each influencing factor, a total risk score of each patient can be calculated. For a patient with T2DM, a disease duration of 12 years, a WOMAC score of 45, and a PNI of 60, the total score was calculated as 17.5 + 25 + 35 + 32.5 = 110. Then, the corresponding predicted risk of poor outcome is slightly higher than 0.1 (10%).

Internal validation of the nomogram model

ROC analysis (**Figure 2**) showed that the nomogram model achieved an AUC of 0.838 (95% CI: 0.776-0.899) in the training set and 0.765

Table 1. Univariate analysis of factors affecting clinical outcomes in patients

Index	Poor outcome (n = 56)	Good outcome (n = 323)	χ^2/t	*P*
Age (years)			3.896	0.045
≥ 60	48 (16.84)	237 (83.16)		
< 60	8 (8.51)	86 (91.49)		
Sex			0.011	0.916
Male	20 (15.04)	113 (84.96)		
Female	36 (14.63)	210 (85.37)		
BMI (kg/m^2)			9.234	0.002
> 24.0	30 (22.22)	105 (77.78)		
≤ 24.0	26 (10.66)	218 (89.34)		
Hypertension			2.601	0.107
Yes	37 (17.37)	176 (82.63)		
No	19 (11.45)	147 (88.55)		
T2DM			10.505	0.001
Yes	31 (22.63)	106 (77.37)		
No	25 (10.33)	217 (89.67)		
Smoking history			0.074	0.786
Yes	15 (15.63)	81 (84.38)		
No	41 (14.49)	242 (85.51)		
Drinking histiry			1.721	0.190
Yes	21 (18.42)	93 (81.58)		
No	35 (13.21)	230 (86.79)		
Type of the disease			2.979	0.084
Primary osteoarthritis	43 (17.00)	210 (83.00)		
Secondary osteoarthritis	13 (10.32)	113 (89.68)		
Course of the disease			26.464	< 0.001
≥ 10 years	32 (29.63)	76 (70.37)		
< 10 years	24 (8.86)	247 (91.14)		
WOMAC score	53.46 ± 8.79	47.27 ± 7.51	5.551	< 0.001
Surgical approach			0.527	0.468
THA	36 (15.86)	191 (84.14)		
TKA	20 (13.16)	132 (86.84)		
Anesthesia method			0.007	0.936
General anesthesia	40 (14.87)	229 (85.13)		
Intrathecal anesthesia	16 (14.55)	94 (85.45)		
WBC (× 10^9/L)	6.67 ± 0.89	6.47 ± 0.94	1.504	0.133
NEUT (× 10^9/L)	3.91 ± 0.62	3.73 ± 0.68	1.88	0.060
Hb (g/L)	133.29 ± 12.22	136.12 ± 11.78	-1.589	0.113
Alb (g/L)	38.75 ± 6.05	42.76 ± 6.73	-4.172	< 0.001
Lym (× 10^9/L)	1.58 ± 0.36	2.02 ± 0.68	-4.709	< 0.001
PNI	46.67 ± 6.85	52.87 ± 7.90	-5.518	< 0.001
Plt (× 10^9/L)	226.07 ± 30.98	229.36 ± 26.32	-0.840	0.401
PT (S)	12.06 ± 0.80	11.89 ± 0.94	1.5298	0.195
RF positive	12 (19.67)	49 (80.33)	1.384	0.239
CCP positive	10 (18.18)	45 (81.82)	0.593	0.441
CRP (ng/mL)	12.63 ± 2.93	12.72 ± 2.61	-0.266	0.807
UA (μmol/L)	316.86 ± 32.32	318.80 ± 29.06	-0.456	0.649
RDW (%)	12.56 ± 2.67	12.30 ± 2.40	0.764	0.445

Note: BMI: Body Mass Index, T2DM: Type 2 Diabetes Mellitus, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, WBC: White blood cell count, NEUT: Neutrophile granulocyte, Hb: Hemoglobin, Alb: Albumin, Lym: Lymphocyte, PNI: Prognostic Nutritional Index, Plt: Platelet, PT: Prothrombin time, RF: Rheumatoid factor, CCP: Anti-cyclic citrullinated peptide antibody, CRP: C-reactive protein, UA: Uric acid, RDW: Red blood cell distribution width.

Table 2. Variable assignment table

Variable	Assignment
Dependent variables	
Clinical outcome	0: good outcome, 1: poor outcome
Independent variables	
Age	0: < 60 years, 1: ≥ 60 years
BMI	0: ≤ 24.0 kg/m^2, 1: > 24.0 kg/m^2
T2DM	0: No, 1: Yes
Course of disease	0: < 10 years, 1: ≥ 10 years
WOMAC	sctual value
PNI	sctual value

Note: BMI: Body Mass Index, T2DM: Type 2 Diabetes Mellitus, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, PNI: Prognostic Nutritional Index.

Table 3. Multivariate logistic analysis of factors affecting clinical outcomes in patients

Variable	β	SE	Wald χ^2	P	OR	95% CI
Age ≥ 60 years	0.536	0.528	1.030	0.310	1.709	0.607-4.812
BMI > 24.0 kg/m^2	0.613	0.412	2.215	0.137	1.846	0.823-4.139
T2DM	0.833	0.408	4.164	0.041	2.301	1.033-5.123
Course ≥ 10 years	1.057	0.408	6.717	0.010	2.877	1.294-6.398
WOMAC	0.079	0.024	10.861	0.001	1.083	1.033-1.135
PNI	0.097	0.030	10.127	0.001	0.908	0.855-0.964
Constant	2.426	1.977	1.505	-	-	-

Note: BMI: Body Mass Index, T2DM: Type 2 Diabetes Mellitus, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, PNI: Prognostic Nutritional Index.

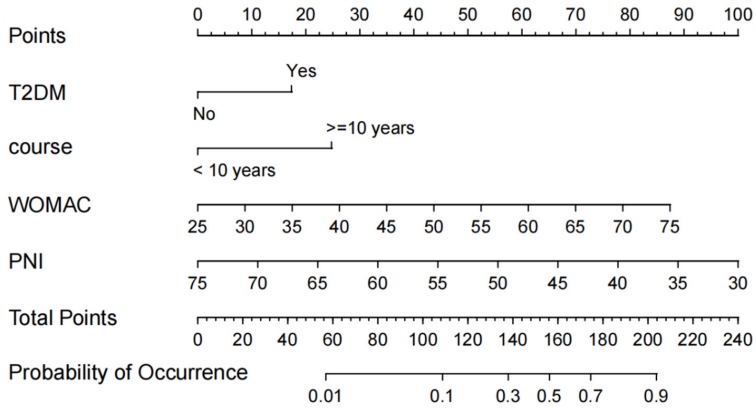

Figure 1. Nomogram model. Note: T2DM: Type 2 Diabetes Mellitus, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, PNI: Prognostic Nutritional Index.

(95% CI: 0.623-0.907) in the validation set. The calibration curves (**Figure 3**) showed that the mean absolute error of the nomogram model was 0.019 in the training set and 0.029 in the validation set. The decision curve analysis (**Figure 4**) demonstrated that, at an adverse-outcome incidence of 14.78%, the model provided a higher net benefit than both the "All" and "None" strategies at threshold probabilities of 3-63% in the training set and 7-83% probabilities in the validation set.

Predictive value of PNI and prediction models for the clinical outcomes of THA/TKA patients

The ROC curves for the nomogram model and each factor in predicting clinical outcomes of THA/TKA patients are plotted (**Figure 5**), with corresponding data summarized in **Table 4**. The AUC of the nomogram model (0.838) was significantly higher than those of T2DM (0.613), Course (0.675), WOMAC (0.705), and PNI (0.723). DeLong test results showed that the AUC of the nomogram model was significantly higher than that of each individual indicator (all $P < 0.05$). Although the AUC of PNI was higher than that of the other single indicators, the differences were not statistically significant ($P > 0.05$).

External validation of the nomogram model

Among the 125 patients included in external validation cohort, 15 cases had adverse outcomes, accounting for 12.00%. As shown in the confusion matrix in **Table 5**, the constructed nomogram model demonstrated a sensitivity, specificity, and accuracy of 96.36% (106/110), 66.67% (10/15), and 92.80% (116/125), respectively, for predicting the clinical outcomes of THA/TKA patients (**Table 5**).

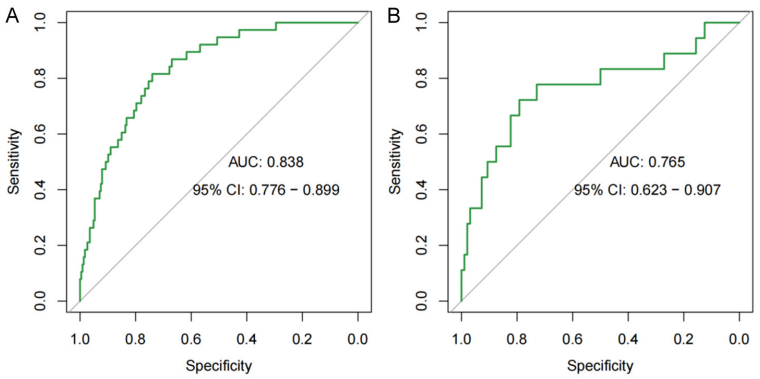

Figure 2. ROC curve analysis for the predictive model in the training set (A) and the validation set (B). Note: ROC, Receiver operator characteristic.

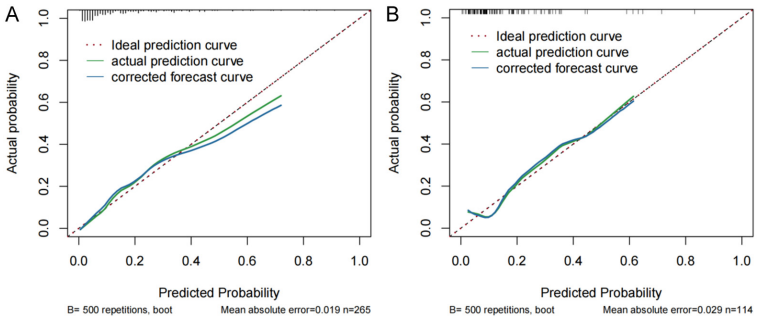

Figure 3. Calibration curve. A. Training set; B. Verification set.

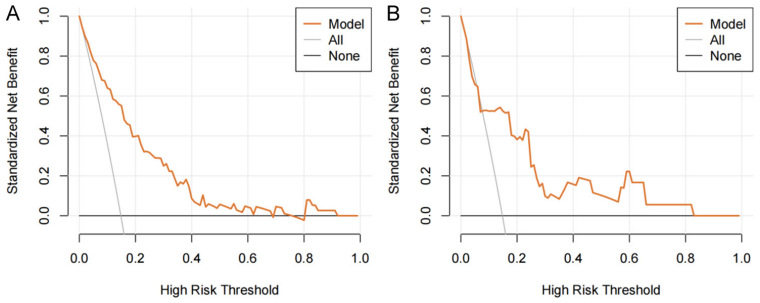

Figure 4. Decision curve analysis for the model in the training set (A) and verification set (B).

Discussion

THA/TKA are two common orthopedic surgeries widely used to treat severe osteoarthritis (OA) of the hip and knee joints, femoral neck fractures in the elderly, hip dysplasia, rheumatoid arthritis, and osteonecrosis of the femoral head [10-12]. These surgeries replace the worn joint surfaces with artificial prostheses to restore the joint function, alleviate pain, improve joint mobility, and thereby enhance patients' quality of life. THA involves replacement of the acetabulum and femoral head, while TKA involves the replacement of the distal femur, proximal tibia, and patellar surface of the knee joint [13, 14]. With the continuous advancement of surgical techniques and the improvement of prosthetic materials, the success rates and long-term effects of these surgeries have been significantly improved, making them effective means for treating severe joint diseases. However, not all patients can achieve a good clinical outcome in THA/TKA treatment. Among the 504 THA/TKA patients included in this study, 71 cases had poor clinical outcomes, accounting for 14.09%, which aligns with previously reported data [15-17].

In this study, T2DM, a disease duration of ≥ 10 years, and a higher disease severity were independent risk factors for poor clinical outcomes in patients undergoing THA/TKA. The hyperglycemic state in patients with T2DM impairs immune system function, compromising the phagocytic action and bactericidal ability of white blood cells, thereby increasing the risk of infection [18, 19]. Hong et al. [20] conducted a meta-analysis of 39 studies and found that the postoperative prosthesis replacement rate was higher in diabetic patients undergoing TKA. Patients with a longer disease duration usually have more severe joint lesions, and the wear and degeneration of joint cartilage are more significant. Long-term joint lesions can lead to the destruction of joint structure, such as bone hyperplasia, narrowing of the joint space, and formation of bone spurs. These structural changes will increase the complexity and difficulty of the surgery. Patients with a higher WOMAC score have more severe

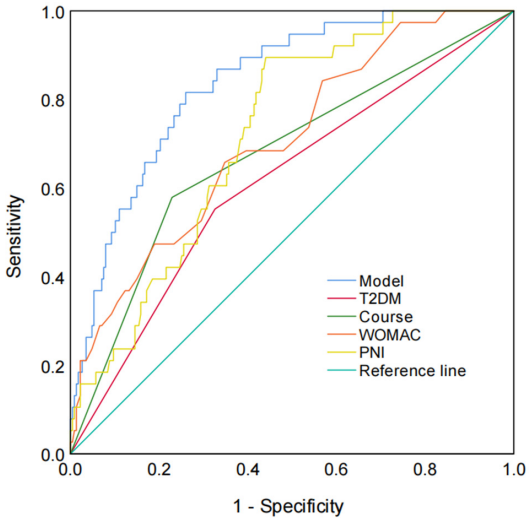

Figure 5. ROC curves for the model and each single factor. Note: ROC: Receiver operator characteristic, T2DM: Type 2 Diabetes Mellitus, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, PNI: Prognostic Nutritional Index.

joint dysfunction, and the preoperative pain and dysfunction are more significant. This severe joint lesion not only increases the risk of surgery but also may affect post-operative recovery of joint function [21]. Clinically, for THA/TKA patients with T2DM, longer disease duration, and higher disease severity, more detailed preoperative assessment and preparation are essential, which should include optimizing blood sugar control, enhancing preoperative rehabilitation training, and formulating individualized postoperative management plans, in order to reduce the risk of adverse outcomes after surgery, improve the success rate of the surgery, and enhance the quality of life of patients.

The findings from this study have shown that PNI could be an independent predictor of poor outcomes in THA/TKA patients. As PNI decreases, the risk of negative clinical outcomes in the patients increases (OR = 0.865, 95% CI: 0.817-0.915, $P < 0.001$). According to the result of this study, the preoperative nutritional status influences the postoperative clinical outcomes of THA/TKA. The patient's general health condition assessment is reflected in Alb and Lym, which represent nutritional and immune status, respectively. Alb is a significant indicator that reflects the long-term nutritional status. Its reduction usually indicates malnutrition, which may hinder tissue repair regeneration ability [22]. In THA/TKA surgery, good nutritional status is important for bone tissue healing and wound healing. Malnutrition slows down the production of collagen, a crucial factor for tissue strength, thereby delaying wound healing and increasing the risk of post-operative complications. Additionally, low levels of albumin can weaken the immune response and expose patients to infection. According to Liu et al. [23], low levels of Alb was associated with an increased risk of postoperative blood loss in THA patients. Lymphocytes and other leukocytes in the peripheral blood can produce various cytokines, which end up in the remnant blood. The immune function during THA/TKA surgery helps protect against infection and assist the healing process. The risk of infection following an operation, the healing ability of wounds, and the recovery after surgery are all affected by a decline in the immune function. Furthermore, lymphocytes are also important players in the inflammatory response, while Lym may affect the body's regulatory capacity for postoperative inflammation, which may further aggravate postoperative complications [24]. The findings from Zhu et al. [25] suggested that Lym could moderate the high-intensity physical activity and musculoskeletal diseases relationship.

Using PNI, which combines Alb and Lym into a single indicator, is more informative compared with using either of the two alone, as it can simultaneously reflect the patient's nutritional status and immune level. Alb is a key indicator which reflects the body's long-term nutritional status; its half-life is long and can stably reflect the protein intake and synthesis of the patient for a long time. Nevertheless, Alb undergoes relatively slow changes and is not very responsive to acute nutritional changes. Apart from this, Alb levels may be affected by other factors like inflammation and liver function, giving a false indication of the nutritional status. On the contrary, Lym is an essential indicator reflecting the immune function of the body and can quickly reflect the patient's current condition of immune status. A decrease in Lym levels indicates impaired immune function, increasing the risk of infection. Nevertheless, Lym can be greatly affected by short-term factors and fluctuates greatly, which may not sufficiently reflect the patient's nutritional status if used alone.

Table 4. ROC curve parameters for the model and each factor alone

Index	AUC	SE	95% CI	Z_1	P_1	Z_2	P_2
Nomogram model	0.838	0.031	0.788-0.880	-	-	3.101	0.002
T2DM	0.613	0.044	0.552-0.672	5.287	< 0.001	1.787	0.074
Course	0.675	0.043	0.615-0.731	4.469	< 0.001	0.867	0.386
WOMAC	0.705	0.045	0.646-0.759	3.272	0.001	0.319	0.750
PNI	0.723	0.037	0.665-0.776	3.101	0.002	-	-

Note: Z_1 indicates comparison with the AUC of the model, and Z_2 indicates comparison with the AUC of PNI. T2DM: Type 2 Diabetes Mellitus, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, PNI: Prognostic Nutritional Index.

Table 5. External validation of the nomogram model

Actual observed	Nomogram Model		Total
	Good outcome	Poor outcome	
Good Outcome	106	4	110
Poor Outcome	5	10	15
Total	111	14	125

PNI combines Alb and Lym, overcoming the shortcomings of a single indicator. In the PNI calculation, Alb is given a weight of 1, while Lym is weighted at 5. PNI is more sensitive to the nutritional and immune status of patients with the weighting method. Diminished PNI is considered a marker of not only nutritional deficiency but may also signify deterioration of the immune function that is vital in the postoperative setting. THA/TKA induces stress that activates the body's stress response, increasing metabolic demand. A good nutritional and immune status provides the energy and nutrients necessary for coping with surgical stress and supporting tissue repair and healing. A low preoperative PNI is associated with malnutrition and reduced immune function that cannot withstand the metabolic stress of surgery, adversely affecting postoperative recovery of the patient. Research by Hanada et al. [26] showed that low PNI is related to an increased risk of infection in TKA patients two weeks post-surgery. Karlidag et al. [27] also pointed out in their research that PNI can be used as a predictor of postoperative infection in TKA patients.

From the above analysis, it can be concluded that the postoperative clinical outcomes of THA/TKA patients are influenced by multiple factors. This study constructed a prediction model for the postoperative clinical outcomes of THA/TKA patients based on multiple factors (including PNI). Through internal and external validation, it was found that the constructed model has good predictive efficacy for the clinical outcomes of patients. This study also discovered that PNI, as one of the main indicators of the prediction model, has a better predictive efficacy than most of the indicators in the model. Although the difference did not reach a statistical significance, it still suggests a strong correlation with the patient's clinical outcomes. Despite the comprehensive collection of clinical data, some key information may still be missing, such as preoperative factors like dietary habits, lifestyle (e.g., exercise frequency and intensity), and psychological state, which may have important influences on the postoperative outcomes. Due to the limitations of data sources, these factors were not included in the analysis. Future prospective studies can be conducted to include more comprehensive influencing factors and further explore the impact of the interaction between PNI and various factors on the clinical outcomes of THA/TKA patients.

Conclusion

A lower preoperative PNI level may increase the risk of adverse clinical outcomes in patients undergoing THA/TKA. By using PNI as one of the indicators and combining it with T2DM, disease course, and WOMAC score, a nomogram model can be constructed to predict the risk of adverse clinical outcomes in patients undergoing THA/TKA.

Disclosure of conflict of interest

None.

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