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Prognostic value of Controlling Nutritional Status score for postoperative complications and biochemical recurrence in prostate cancer patients undergoing laparoscopic radical prostatectomy

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Abstract

Background: Controlling Nutritional Status (CONUT) score was used for screening the preoperative nutritional status. The correlation between the CONUT score and the prognosis of patients with prostate cancer (PCa) has yet to be elucidated. Herein, we analyzed the prognostic value of CONUT scores in patients with PCa who underwent laparoscopic radical prostatectomy.

Materials and methods: Data of 244 patients were retrospectively evaluated. Perioperative variables and follow-up data were analyzed. The patients were categorized into 2 groups according to their preoperative CONUT scores. Postoperative complication and incontinence rates were also compared. The Kaplan-Meier method was used to estimate the median biochemical recurrence-free survival (BCRFS) between the 2 groups. Univariate and multivariate Cox regression analyses were performed to identify the potential prognostic factors for BCRFS.

Results: Patients were categorized into the low-CONUT group (CONUT score <3, $n = 207$) and high-CONUT group (CONUT score ≥3, $n = 37$). The high-CONUT group had a higher overall complication rate (40.5% vs.19.3%, $p = 0.004$), a higher major complication rate (10.8% vs. 3.9%, $p = 0.013$), and longer postoperative length of stay (8 days vs. 7 days, $p = 0.017$). More fever, urinary infection, abdominal infection, scrotal edema, rash, and hemorrhagic events (all p values < 0.05) were observed in the high-CONUT group. A higher rate of urinary incontinence was observed in the high-CONUT group at 1 (34.4% vs. 13.2%, $p = 0.030$) and 3 months (24.1% vs. 8.2%, $p = 0.023$) postoperatively. The high-CONUT group had shorter medium BCRFS (23.8 months vs. 54.6 months, $p = 0.029$), and a CONUT score ≥3 was an independent risk factor for a shorter BCRFS (hazards ratio, 1.842; $p = 0.026$).

Conclusions: The CONUT score is a useful predictive tool for higher postoperative complication rates and shorter BCRFS in patients with PCa who undergo laparoscopic radical prostatectomy.

Keywords: Controlling Nutritional Status score; Prostate cancer; Laparoscopic radical prostatectomy; Complication; Biochemical recurrence

1. Introduction

Prostate cancer (PCa) is one of the most common malignant tumors in men and the most common malignant tumor of the genitourinary system.[1,2] Radical prostatectomy is one of the main treatment options for localized PCa and plays an critical role in improving the long-term survival rate of patients. The popularization of minimally invasive technologies such as laparoscopy and robot-assisted surgery has further promoted innovation in the surgical treatment of PCa.

In recent years, the literature has indicated that impaired nutritional status may affect tolerance to surgery and the prognosis of patients with various types of cancer.[3–5] In this context, the Controlling Nutritional Status (CONUT) score was developed by Ignacio de Ulíbarri et al.[6] for screening the preoperative nutritional status. This index was calculated based on the preoperative serum albumin concentration, total peripheral blood lymphocyte count, and total cholesterol concentration (Supplementary Table S1, http://links.lww.com/CURRUROL/A46). The CONUT score is a useful predictor of survival in patients with colorectal, lung, and esophageal cancers.[7–9] However, the correlation between the CONUT score and the prognosis of patients with PCa has not been elucidated. In this retrospective study, we investigated the prognostic value of the CONUT score for postoperative complications and biochemical recurrence-free survival (BCRFS) in PCa patients who underwent laparoscopic radical prostatectomy (LRP).

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2. Materials and methods

2.1. Patient selection

We retrospectively analyzed the data of patients with PCa who underwent LRP between September 2012 and August 2021 at Beijing Chaoyang Hospital, Capital Medical University. All patients were diagnosed with PCa using transrectal ultrasound-guided biopsy or transurethral resection of the prostate. The following exclusion criteria were used: (1) incomplete data; (2) presence of other malignant diseases not originating from the prostate; and (3) bone metastatic lesions indicated by magnetic resonance imaging, bone scan, or other imaging examinations. The decision to administer neoadjuvant androgen deprivation therapy was made at the discretion of the surgeons. The CONUT scores were calculated based on serum albumin concentration, total peripheral blood lymphocyte count, and total cholesterol concentration (Supplementary Table S1, http://links.lww.com/CURRUROL/A46), which were tested within 3 days before LRP. According to a previous report, a CONUT score of 3 was chosen as the cut-off to divide patients into the high-CONUT (CONUT score ≥3) and low-CONUT (CONUT score <3) groups.[10]

2.2. Surgical procedure

Laparoscopic radical prostatectomy was performed using the extraperitoneal approach by 2 urology surgeons with at least 5 years' experience in laparoscopic surgery. A single dose of a second-generation cephalosporin was administered to all patients 1 hour before surgery. For those allergic to cephalosporins, levofloxacin was used as antibiotic prophylaxis. Early ambulation was encouraged, which included getting up slowly within 4 hours and getting out of bed within 6 hours postoperatively. All patients underwent routine physical thromboprophylaxis, including ankle pump exercises and use of antithrombotic elastic socks. For patients with a high risk of venous thromboembolism (Caprini score ≥5) or a history of venous thromboembolism, low-molecular-weight heparin was administered as prophylaxis.

2.3. Data collection

Baseline data, perioperative parameters, and pathological results were retrospectively collected from the electronic medical record system of a doctor who did not participate in the surgery. Postoperative complications were recorded and graded according to the Clavien-Dindo system, of which grades 1–2 were considered minor and grades 3–5 were considered major complications.[11] Fever was defined as an elevated ear temperature over 38.5°C. Hemorrhage was defined as progressive bleeding requiring blood transfusion or surgical hemostasis. In cases of increased drainage volume, the creatinine level in the drainage fluid was examined to exclude urine leakage from the urethral anastomotic fistula.

Whole blood hemoglobin was measured postoperatively. The baseline and lowest postoperative hemoglobin levels were utilized to calculate the degree of hemoglobin decline. The pelvic drainage tube was removed when the drainage volume was less than 10 mL on 2 consecutive days. The indwelling time of the pelvic drainage tube and the total drainage volume were recorded.

Data on biochemical recurrence (BCR) and postoperative urinary continence status were collected during the outpatient follow-up. Postoperative incontinence was defined as the use of more than 1 pad every 24 hours. The urinary continence status reported by the patients was documented at 1 month, 3 months, and 1 year after the urethral catheter was removed. Biochemical recurrence was defined as 2 consecutive prostate-specific antigen (PSA) values ≥0.2 ng/mL. If the postoperative PSA level failed to decrease below 0.2 ng/mL, the date of LRP was defined as the date of BCR. The BCRFS time was calculated from the date of surgery to the date of BCR or the last follow-up visit.

2.4. Statistical analyses

Normally distributed continuous variables were expressed as mean values with standard deviations and compared using the Student *t* test. Nonnormally distributed continuous variables were expressed as medians with interquartile ranges and compared using the Mann-Whitney *U* test. Categorical variables were compared using the chi-squared test or Fisher's exact test, as appropriate. The Kaplan-Meier method was used to estimate the BCRFS median. The log-rank test was used to analyze survival differences between the high- and low-CONUT groups. Univariate and multivariate Cox regression analyses were used to identify the potential prognostic factors for BCRFS. Hazards ratios (HRs) and 95% confidence intervals were calculated for the CONUT score and other clinicopathological factors. Variables found to be significant in the univariate analysis ($p < 0.05$) were entered into multivariate analysis. IBM SPSS Statistics version 26.0 (IBM Corp, Armonk, NY, USA) and R (version 4.1.2; http://www.r-project.org/; The R Foundation for Statistical Computing, Vienna, Austria) were used for statistical analysis. All statistical tests were 2-tailed, and statistical significance was set at p value < 0.05.

3. Results

3.1. Baseline characteristics

A total of 291 consecutive patients were included in this study. Patients with missing clinical data (n = 47) were also excluded, resulting in a final cohort of 244 patients. A total of 207 (84.8%) patients were categorized into the low-CONUT group (CONUT score <3) and 37 (15.2%) were categorized into high-CONUT group (CONUT score ≥3). The baseline clinical characteristics of all patients are presented in Table 1. A total of 76 (31.1%) patients received neoadjuvant androgen deprivation therapy before surgery. Most patients (n = 69) received short-term neoadjuvant androgen deprivation therapy (<6 months) with a median duration of 8.9 weeks (range, 2.0–30.6 weeks). Patients with CONUT score ≥3 had lower body mass index (24.62 ± 3.14 kg/m^2 vs. 25.68 ± 2.95 kg/m^2, p = 0.046) and lower preoperative hemoglobin levels (137.5 ± 15.0 g/L vs. 142.2 ± 12.9 g/L, p = 0.048). Prostate volume, biopsy Gleason score, clinical T stage, and preoperative serum PSA level were not significantly different between the 2 groups (all p values > 0.05). A history of chronic diseases and abdominal surgery showed no significant differences between the 2 groups (all p values > 0.05).

3.2. Postoperative data

The postoperative data are presented in Table 2. There were no significant differences in the operating surgeon, operation time, pathological Gleason score, or pathological T stage between the 2 groups (all p values > 0.05). No patients underwent open surgery. Forty-three (17.6%) patients had minor complications (Clavien-Dindo grade 1–2), and 12 (4.9%) patients experienced major complications (Clavien-Dindo grade 3–5) during the perioperative period.

Patients in the high-CONUT group had a significantly higher rate of overall complications (40.5% vs. 19.3%, p = 0.004) and major complications (10.8% vs. 3.9%, p = 0.013). They more frequently experienced fever (13.5% vs. 1.4%, p = 0.007), urinary infection (8.1% vs. 0.5%, p = 0.012), abdominal infection (8.1% vs. 0.5%, p = 0.012), scrotal edema (8.1% vs. 1.0%, p = 0.026), and rash (10.8% vs. 2.4%, p = 0.032). More patients in the high-CONUT

Table 1

Baseline data of all patients undergoing laparoscopic radical prostatectomy.

Variables	Overall (n = 244)	High-CONUT group (n = 37)	Low-CONUT group (n = 207)	*p*
Age, yr, mean ± SD	68.1 ± 6.7	69.2 ± 6.7	67.9 ± 6.7	0.284
BMI, kg/m^2, mean ± SD	25.52 ± 3.00	24.62 ± 3.14	25.68 ± 2.95	**0.046**
Biopsy Gleason score, n (%)				0.685
6	64 (26.2)	9 (24.3)	55 (26.6)	
3 + 4	45 (18.4)	6 (16.2)	39 (18.8)	
4 + 3	51 (20.9)	7 (18.9)	44 (21.3)	
8	39 (16.0)	9 (24.3)	30 (14.5)	
9 or 10	45 (18.4)	6 (16.2)	39 (18.8)	
Clinical T stage, n (%)				0.876
cT1/2	215 (88.1)	32 (86.5)	177 (85.5)	
cT3	29 (11.9)	5 (13.5)	30 (14.5)	
Serum PSA level, ng/mL, median (IQR)	15.38 (9.51–31.49)	17.43 (9.84–39.26)	15.31 (9.39–31.22)	0.629
D'Amico risk stratification, n (%)				0.653
Low risk	24 (9.8)	2 (5.4)	22 (10.6)	
Intermediate risk	89 (36.5)	13 (35.1)	76 (36.7)	
High risk	131 (53.7)	22 (59.5)	109 (52.7)	
Neoadjuvant androgen deprivation therapy, n (%)	76 (31.1)	8 (18.9)	68 (32.9)	0.174
Prostate volume, cm^3, median (IRQ)	37.15 (25.73–53.75)	34.65 (25.85–50.04)	38.50 (25.60–54.80)	0.362
Medical history, n (%)				
Hypertension	109 (44.7)	16 (43.2)	93 (44.9)	0.849
Diabetes	52 (21.3)	11 (29.7)	41 (19.8)	0.175
Coronary disease	44 (18.0)	8 (21.6)	36 (17.4)	0.538
History of cerebral infarction	19 (7.8)	3 (8.1)	16 (7.7)	1.000
Chronic obstructive pulmonary disease	14 (5.7)	3 (8.1)	11 (5.3)	0.452
Other malignant diseases	15 (6.1)	3 (8.1)	12 (5.8)	0.708
Abdominal surgical history	52 (21.3)	9 (24.3)	43 (20.8)	0.627
Smoking history	75 (30.7)	7 (37.7)	68 (32.9)	0.091
Hemoglobin, g/L, mean ± SD	141.5 ± 13.3	137.5 ± 15.0	142.2 ± 12.9	**0.048**
Albumin, g/L, median (IQR)	41.3 (38.2–44.9)	37.8 (34.2–43.2)	41.6 (38.7–45.2)	**<0.001**
Total lymphocyte count, /mm^3, median (IQR)	1886.18 (1482.89–2303.37)	1392.50 (1099.49–1710.80)	1940.20 (1621.62–2339.64)	**<0.001**
Total cholesterol, mg/dL, median (IQR)	169.18 (147.04–193.35)	138.44 (133.02–154.29)	172.08 (151.59–201.86)	**<0.001**

$p < 0.05$ is indicated by boldface.

BMI = body mass index; CONUT = Controlling Nutritional Status; IQR = interquartile range; PSA = prostate-specific antigen; SD = standard deviation.

group experienced hemorrhagic events (10.8% vs. 1.4%, $p = 0.011$) and required blood transfusion (8.1% vs. 0.9%, $p = 0.028$). In addition, patients with CONUT score ≥3 showed significantly higher estimated intraoperative bleeding (100 mL vs. 50 mL, $p = 0.002$) and hemoglobin decline (24 g/L vs. 20 g/L, $p = 0.047$). They also had a longer duration of pelvic drainage (6 days vs. 5 days, $p = 0.017$) and a longer postoperative length of stay (8 days vs. 7 days, $p = 0.017$). Nine patients were readmitted within 3 months after discharge, and 4 of the whom underwent a second surgery because of urethral stricture at the bladder neck-urethral anastomosis. One patient in the low-CONUT group died of pulmonary embolism after discharge.

3.3. Prognostic outcomes

The follow-up data of 188 patients were retrieved, including 159 in the low-CONUT group and 29 in the high-CONUT group. A total of 38 (20.2%) reported urinary incontinence within 3 months of surgery. Patients with CONUT score ≥3 had a significantly higher rate of incontinence at 1 month (34.4% vs. 13.2%, $p = 0.030$) and 3 months (24.1% vs. 8.2%, $p = 0.023$) after LRP (Table 3). No significant difference was observed 1 year postoperatively (6.9% vs. 5.7%, $p = 0.688$). Kaplan-Meier curve analysis showed that CONUT score ≥3 was significantly associated with shorter medium BCRFS (23.8 months vs. 54.6 months; $p = 0.029$) (Fig. 1). Univariate and multivariate Cox regression analyses revealed that a CONUT score ≥3 (HR, 1.842; $p = 0.026$) and preoperative serum PSA level (HR, 1.002, $p = 0.005$) were independent risk factors for BCR (Table 4). Subset analysis according to risk stratification showed that a CONUT score ≥3 was an independent risk factor for BCR in the low- and high-risk groups (Supplementary Table S2, http://links.lww.com/CURRUROL/A46).

4. Discussion

The present study explored the prognostic value of the CONUT score, a screening tool for nutritional status, in patients with PCa undergoing LRP. Demographic and baseline disease characteristics were generally well balanced between the high-CONUT and low-CONUT groups, which were divided using a CONUT score ≥3 as the threshold. We found that patients with high preoperative CONUT scores experienced greater intraoperative blood loss, longer drainage duration, and longer hospital stay. They experienced more postoperative complications, including fever, infection, scrotal edema, rash, and hemorrhagic events, and required more blood transfusions. Our study also showed that a high-CONUT score correlated with a higher rate of short-term incontinence and BCR postoperatively. These results indicate that the CONUT score is a prognostic factor for patients with PCa undergoing LRP.

The CONUT score is an efficient tool for assessing the nutritional status and detecting malnutrition in hospitalized patients. The CONUT score is calculated based on serum albumin concentration,

Table 2

Postoperative period data of all patients.

Variables	Overall (n = 244)	High-CONUT group (n = 37)	Low-CONUT group (n = 207)	*p*
Intraoperative details				
Operating surgeon, n (%)				0.174
Surgeon 1	168 (68.9)	29 (78.4)	139 (67.1)	
Surgeon 2	76 (31.1)	8 (21.6)	68 (32.9)	
Operation time, min, median (IQR)	140 (120–180)	150 (120–202.5)	135 (120–180)	0.123
PLND, n (%)	231 (94.7)	36 (97.3)	195 (94.2)	0.698
Nerve-sparing procedure, n (%)	31 (12.7)	7 (18.9)	24 (11.8)	0.280
Estimated intraoperative bleeding, mL, median (IQR)	80 (50–100)	100 (50–200)	50 (50–100)	**0.002**
Pathological data				
Pathological Gleason score, n (%)				0.632
6	36 (14.8)	5 (13.5)	31 (15.0)	
3 + 4	69 (28.3)	10 (27.0)	59 (28.5)	
4 + 3	65 (26.6)	13 (35.1)	52 (25.1)	
8	20 (8.2)	1 (2.7)	19 (9.2)	
9 or 10	54 (22.1)	8 (21.6)	46 (22.2)	
Pathological T stage, n (%)				0.427
pT2	156 (63.9)	21 (56.8)	135 (65.2)	
pT3	88 (36.1)	16 (43.2)	72 (34.8)	
Positive surgical margin, n (%)	116 (47.5)	17 (45.9)	99 (47.8)	0.833
Positive lymph nodes metastasis, n (%)	32 (13.1)	7 (18.9)	25 (12.1)	0.289
In-hospital data				
Hemoglobin decline, g/L, median (IQR)	21 (15–29)	24 (17–32)	20 (13–29)	**0.047**
Pelvic drainage duration, d, median (IQR)	5 (4–7)	6 (4–8)	5 (3–6)	**0.017**
ICU stay after surgery, n (%)	11 (4.5)	2 (5.4)	9 (4.3)	0.400
Total drainage volume, mL, median (IQR)	200 (120–317)	224 (134–360)	195 (115–310)	0.206
Postoperative hospital stay, d, median (IQR)	7 (5–8)	8 (6–12)	7 (5–8)	**0.002**
Blood transfusion during perioperative period, n (%)	5 (2.0)	3 (8.1)	2 (0.9)	**0.028**
Postoperative complication				
Overall complications, n (%)	55 (22.5)	15 (40.5)	40 (19.3)	**0.004**
Highest grade complication, n (%)				**0.013**
None	189 (77.5)	22 (59.5)	167 (80.7)	
Minor (Clavien-Dindo grade 1–2)	43 (17.6)	11 (29.7)	32 (15.5)	
Major (Clavien-Dindo grade 3–5)	12 (4.9)	4 (10.8)	8 (3.9)	
Minor complications, n (%)				
Fever	8 (3.3)	5 (13.5)	3 (1.4)	**0.007**
Urinary infection	4 (1.6)	3 (8.1)	1 (0.5)	**0.012**
Abdominal infection	4 (1.6)	3 (8.1)	1 (0.5)	**0.012**
Anastomotic leak necessitating prolonged catheterization	10 (4.1)	1 (2.7)	9 (4.3)	1.000
Scrotal edema	5 (2.0)	3 (8.1)	2 (1.0)	**0.026**
Rash	9 (3.7)	4 (10.8)	5 (2.4)	**0.032**
Chest tightness and palpitation	9 (3.7)	2 (6.0)	6 (2.9)	0.348
Major complications, n (%)				
Hemorrhage	7 (2.9)	4 (10.8)	3 (1.4)	**0.011**
VTE	2 (0.8)	1 (2.7)	1 (0.5)	0.281
Pelvic effusion necessitating puncture	2 (0.8)	1 (2.7)	1 (0.5)	0.281
Anastomotic stenosis necessitating surgery	3 (1.2)	1 (2.7)	2 (1.0)	0.391
Death	1 (0.4)	0 (0)	1 (0.5)	-
Rehospitalization within 3 months after discharge, n (%)	9 (3.7)	1 (2.7)	8 (3.9)	1.000

$p < 0.05$ is indicated by boldface.

CONUT = Controlling Nutritional Status; ICU = intensive care unit; IQR = interquartile range; PLND = pelvic lymph node dissection; SD = standard deviation; VTE = venous thromboembolism.

lymphocyte count, and total cholesterol level, which can be easily collected preoperatively from routine blood analysis. Serum albumin concentration, lymphocyte count, and total cholesterol levels are associated with multiple physiological functions, including the immune response, infection, inflammation, tissue repair, and regeneration.[10] Albumin concentration represents not only the nutritional status but is also a reliable indicator of systemic immunity and inflammation, such as inflammation caused by cancer cells.[12,13] It has been previously reported to be associated with poor prognosis in patients with cancer.[14] The antitumor effects of lymphocytes include the induction of apoptosis, inhibition of tumor

Table 3

Follow-up data of postoperative incontinence.

Follow-up interval	Overall (n = 188)	High-CONUT group (n = 29)	Low-CONUT group (n = 159)	*p*
1 month, n (%)	38 (20.2)	10 (34.4)	28 (13.2)	**0.030**
3 months, n (%)	20 (10.6)	7 (24.1)	13 (8.2)	**0.023**
1 year, n (%)	11 (4.7)	2 (6.9)	9 (5.7)	0.688

$p < 0.05$ is indicated by boldface.

CONUT = Controlling Nutritional Status.

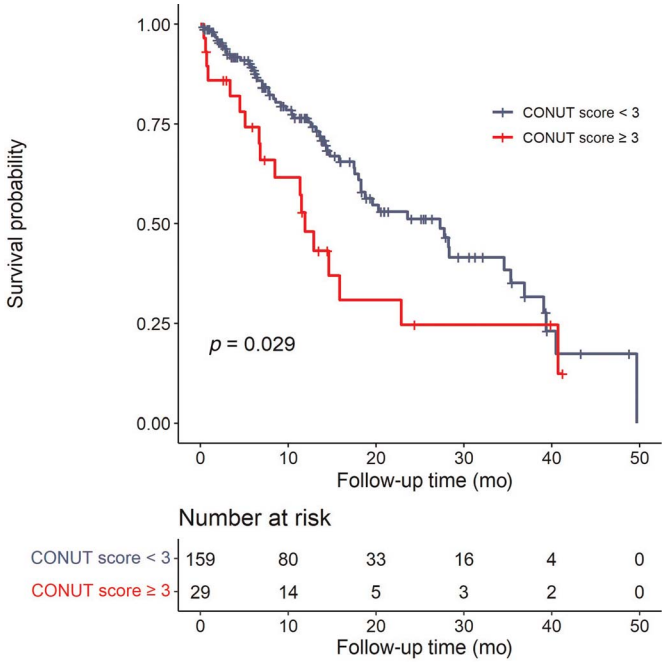

Figure 1. Kaplan-Meier curve analysis of biochemical recurrence-free survival in patients who underwent laparoscopic radical prostatectomy. CONUT = Controlling Nutritional Status.

growth and migration, and mediation of cytotoxicity.[15] The decrease in lymphocyte count may promote a microenvironment favorable for cancer proliferation and metastasis, leading to poor prognosis in patients with advanced cancer.[16] Cholesterol metabolism also enhances the immune response of CD8(+) T cells, and thus participates in antitumor mechanisms.[17] Low serum cholesterol levels have been reported to be associated with poor prognosis in cancer patients.[18–20] In summary, a higher CONUT score reflects not only poor nutritional status, but also systemic inflammation and an impaired immune response, suggesting that the ability to tolerate therapy may be compromised in these patients.

Recently, several studies have examined the correlation between high-CONUT scores and poor postoperative prognosis in patients with urological carcinoma. Elghiaty et al.[21] found that patients with renal cancer with high preoperative CONUT scores had shorter recurrence-free, cancer-specific, and overall survival. Ishihara et al.[22] reported that the preoperative CONUT score is a predictive biomarker of survival in patients treated with radical nephroureterectomy. Huang et al.[23] and Nemoto et al.[24] reported that the CONUT score was an independent predictor of poor prognosis in patients with bladder cancer who underwent transurethral resection of bladder tumors and radical cystectomy, respectively. At present, however, there is still a lack of evidence regarding the prognostic value of the CONUT score in patients with PCa. The study by Zhang et al.[10] reported CONUT score as a prognostic indicator of PSA progression-free survival in 94 patients with oligometastatic PCa who underwent radical prostatectomy. However, the correlation between CONUT score and prognosis in patients with PCa undergoing LRP remains unclear.

In this study, we analyzed the prognostic value of preoperative CONUT score in patients with PCa undergoing LRP. We found that patients with high-CONUT scores (CONUT score ≥3) experienced more perioperative complications. It was worth noting that these patients had higher incidence of fever (≥38.5°C), urinary infection, abdominal infection, and rash, suggesting a tendency to experience immune dysfunction. Although there was no significant difference in the total drainage volume between the 2 groups, patients in the high-CONUT group had a significantly longer drainage-dwelling time, higher estimated intraoperative bleeding, higher hemoglobin decline, and more hemorrhagic events, which indicated a higher bleeding risk. Patients with high-CONUT scores had significantly higher rates of incontinence at 1 and 3 months, suggesting poor short-term urinary control after LRP. In addition, consistent with a previous report, we also found that CONUT score ≥3 was significantly correlated with shorter BCRFS.[10] In summary, patients with PCa and high-CONUT scores had a poor prognosis after undergoing LRP. Appropriate nutritional and immunological interventions may enhance tolerance to surgery, reduce complications, and improve the long-term prognosis of these patients.[25,26]

Our study had some limitations. First, it was a retrospective study with the potential for selection bias. Our study was conducted at a single center. As a result, the cohort was relatively small, and the number of patients with a high-CONUT score was limited. Second, we used a preoperative CONUT score ≥3 as the cut-off, which may be inconsistent with some previous studies that focused on the prognostic value of the CONUT score in malignant diseases. Third, more than half (n = 131, 53.7%) of the patients were stratified as high-risk, and 88 patients (36.1%) had pT3 stage disease. However, multivariate Cox analysis did not support a correlation between pT3 stage and BCR after LRP (HR, 1.464; p = 0.104). Therefore, further studies with larger sample sizes are warranted. Fourth, we used more than 1 pad per day to define incontinence after LRP. Data on pad weight and urinary control status before the LRP were not retrieved.

Table 4

Univariate and multivariate cox analyses of biochemical recurrence-free survival.

	Univariate analysis		Multivariate analysis	
Variables	**HR (95% CI)**	***p***	**HR (95% CI)**	***p***
Age	1.019 (0.980–1.060)	0.342		
BMI	1.063 (0.982–1.152)	0.131		
Preoperative serum PSA level	1.002 (1.000–1.003)	**0.007**	1.002 (1.001–1.003)	**0.005**
Neoadjuvant androgen deprivation therapy	1.432 (0.926–2.216)	0.107		
CONUT score ≥3	1.799 (1.053–3.075)	**0.032**	1.842 (1.075–3.156)	**0.026**
Pathological Gleason score >7	1.116 (0.702–1.776)	0.643		
Pathological T3 stage	1.543 (0.979–2.432)	**0.062**	1.464 (0.925–2.319)	0.104
Positive surgical margin	1.309 (0.829–2.065)	0.247		

$p < 0.1$ in the univariate analysis and $p < 0.05$ in the multivariate analysis are indicated by boldface.

BMI = body mass index; CI = confidence interval; CONUT = Controlling Nutritional Status; HR=hazard ratio; PSA = prostate-specific antigen.

5. Conclusions

In the present study, we found that patients with PCa and high-CONUT scores had more complications, a higher bleeding risk, and a longer length of stay during the perioperative period of LRP. A CONUT score ≥3 was correlated with poor short-term urinary control and also an independent risk factor for shorter BCRFS after LRP. The CONUT score is a potential clinical tool for evaluating the surgical tolerance and prognosis of patients with PCa.

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None.

Statement of ethics

Our study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Institutional Review Board of Beijing Chaoyang Hospital, Capital Medical University (No. 2022-Ke-55), which waived the requirement for informed consent for this retrospective analysis.

Conflict of interest statement

YN is an editorial board member of *Current Urology*. This article was accepted after a normal external review. No conflict of interest has been declared by the other authors.

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Author contributions

TX: Made a substantial contribution to the design of the study and was the major contributor in writing the manuscript;
XY, GZ: Collected data;
FC, YC, LS, MW, WW, NX: Contributed to the study design;
YN: Designed the study and revised the manuscript;
All the authors have read and approved the final version of the manuscript.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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