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EVALUATION OF POSTOPERATIVE COMPLICATIONS OF PATIENTS SUBMITTED TO OPEN INGUINAL HERNIOPLASTY BASED ON THE CONUT INDEX

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Abstract: Different tools can be used to assess nutritional status in hospitalized patients. The nutritional control index (CONUT) estimates the risk of malnutrition based on unique analytical parameters (serum albumin, total plasma cholesterol and plasma lymphocytes). The objective of this study was to correlate preoperative CONUT to surgical complications in patients undergoing open inguinal hernioplasty. Prospective observational clinical study carried out at Hospital Municipal Santa Isabel, in João Pessoa-PB with quantitative analysis of data collected in a questionnaire applied to the study. Of the 107 patients, 8.41% (n=09) had some type of postoperative complication: hematoma (n=02), seroma (n=02), surgical site infection (n=01), paresthesia (n=01) =01), suture dehiscence (n=01), femoral artery injury (n=01) and surgical wound granuloma (n=01). All complications affected men, with a mean age of 54.33 years and a mean BMI of 27.12. In 28% (n=31) of the patients, a CONUT ≥ 2 (malnourished) was obtained, with post-surgical complications in 9.7% (n=03). No significant difference was observed between the groups with and without complications through the statistical tests used. The objective analysis of laboratory parameters allows an impartial view of the nutritional status and possible repercussions of the surgical procedure. However, subjective clinical factors measured by other nutritional instruments cannot be excluded. In this study, it was not possible to identify an explicit correlation between malnutrition and the rates of postoperative complications. Thus, it is necessary to analyze according to the association of other nutritional parameters (laboratory and clinical) and perform the test on a larger sample for a more assertive screening of the association. It is known that nutritional deficiencies are considered a problem of clinical relevance

with repercussions on surgical results. However, in this study, no correlation was identified between malnutrition and the rates of postoperative complications, requiring analysis of other nutritional parameters to prove the suggested association.

Keywords: Malnutrition, Inguinal hernia, Nutritional Assessment, Surgery.

INTRODUCTION

Malnutrition is a problem of clinical relevance, interfering with the immune system and the healing of surgical wounds. Evidence from the literature reveals a complication rate in surgeries that is almost twice as high in mildly malnourished patients when compared to well-nourished patients; in severe malnutrition, there is a tenfold increase in these complications.

Malnourished patients have their length of stay increased by about 1.5x, with a 24% increase in average cost compared to nourished patients. A number of factors contribute to this increase: higher rates of readmissions, higher rates of pressure ulcer infections, and impaired wound healing.

Preoperative nutritional screening identifies risk factors for adverse surgical outcomes. Aiming at early nutritional support3, different instruments are applied to hospitalized patients, such as the Nutritional Control Index (CONUT). It is a simple method, based on three analytical parameters, two of which are biochemical (serum albumin and total plasma cholesterol) and the absolute number of plasma lymphocytes.

Inguinal hernia - failure of the abdominal wall - can produce swelling and discomfort in this topography. Several factors are associated with muscle-aponeurotic weakening of the inguinal region, such as increased intra-abdominal pressure in obese individuals. On the other hand, a relationship between malnutrition and inguinal fragility is postulated, linked to the most frequent complications of hernioplasties: seroma, hematomas and infections5. Thus, this article aimed to evaluate the correlation between preoperative nutritional status and surgical complications in patients undergoing inguinal hernioplasty.

MATERIALS AND METHODS

Prospective study carried out with 107 patients treated at the General Surgery service of Hospital Municipal Santa Isabel, João Pessoa-PB, from January 2018 to January 2020. Research conducted in accordance with government regulations, under resolution No. 466/12, and approved by the Research Ethics Committee of Faculdade de Medicina Nova Esperança (Famene), with registration number 28066419.7.0000.5179. All patients were previously informed about the research, and spontaneously accepted to participate in the study, signing an informed consent form.

The inclusion criteria adopted were: patients of both sexes, over 18 years of age, with a clinical diagnosis of inguinal hernia and indication for surgical correction of this pathology. Patients with a protuberance in the inguinal region, but with a diagnosis of femoral hernia at the time of surgery, were excluded.

Data were collected in a questionnaire designed for the study, which was applied during the patient's admission, hospitalization and postoperative follow-up. The following were recorded: medical record number, date of birth, place of birth, education, sex, age, body mass index (BMI), laboratory tests, Nyhus clinical classification for hernia and surgical complications.

All patients were analyzed according to the nutritional status control index (CONUT), the day before or on the day of surgery; after compiling the biochemical parameters (total plasma cholesterol and serum albumin) and

the absolute value of plasma lymphocytes, the CONUT was assigned. This index is expressed by a score from 0 (zero) to 12 (twelve), being classified as: normal (0-1), mild malnutrition (2-4), moderate malnutrition (5-8) and severe malnutrition (9- 12) (Table 1).

Patients were operated on under spinal anesthesia by general surgeons of the service, using the open technique, with transverse or oblique inguinotomy. Selectively, non-absorbable polypropylene mesh was applied. The patients were evaluated through anamnesis and physical examination on the fifteenth postoperative day, by a single surgeon - research advisor. Possible complications were described in the same questionnaires applied in the pre-surgical evaluation.

In the sample in the statistical analysis, the Kolmogorov-Smirnov test was applied to verify the normality of the sample and the statistical difference, relating the CONUT to the surgical complications. To analyze and compare the difference between the groups with and without complications, the T Test (samples with normal distribution) and the Mann-Whitney Test (samples with non-normal distribution) were used. Finally, Fisher's Exact Test was used to assess the association between the malnourished subgroup (CONUT $\geq$ 2) and postoperative complications.

RESULTS AND DISCUSSION

Table 2 presents the descriptive analysis of the sample according to sex, age, BMI and location of the inguinal hernia (unilateral or bilateral). The distribution of the sample according to the CONUT index, as well as the frequency of complications that occurred, are shown in Table 3.

The distribution of the sample according to the classification of *Nyhus* is described in Graph 1. A higher concentration of patients with inguinal hernias was observed in the classifications of *Nyhus* IIIa and IIIb, characterized by destruction of the internal inguinal ring.

| Degree of malnutrition				
Parameter	Normal	Light	Moderate	Severe
Serum albumin (g/dl)	3.5 - 4.5	3.0 - 3.49	2.5 - 2.9	<2.5
Punctuation	0	2	4	6
Total lymphocytes/ml	>1600	1200-1599	800-1199	<800
Punctuation	0	1	2	3
Cholesterol (mg/dl)	>180	140-180	100-139	<100
Punctuation	0	1	2	3
Total Score	0-1	2-4	5-8	9-12

Table 1. Assessment of the degree of malnutrition by the CONUT.

Groups	Gender % (n)	Age Average ± DP	BMI Average ± DP	Location % (n)
With complication (n=09)	Male 100% (09) Feminine 0% (0)	54,33 ±16,44	27,12 ±3,25	Unilateral 88,9% (8) Bilateral 11,1% (01)
Uncomplicated (n=98)	Male 94,9% (93) Feminine 5,1% (05)	54,93 ±14,31	26,40 ±4,01	Unilateral 91,8% (90) Bilateral 8,2% (08)

Table 2 - Descriptive analysis of the sample's socio-demographic parameters, according to the occurrence or not of complications (n = 107).

Parameter	n	%	with complications n (%)
Normal (< 1)	76	71	6 (7,9%)
Malnutrition (≥ 2)	31	28	3 (9,7%)

Table 3 - Sample distribution according to index CONUT.
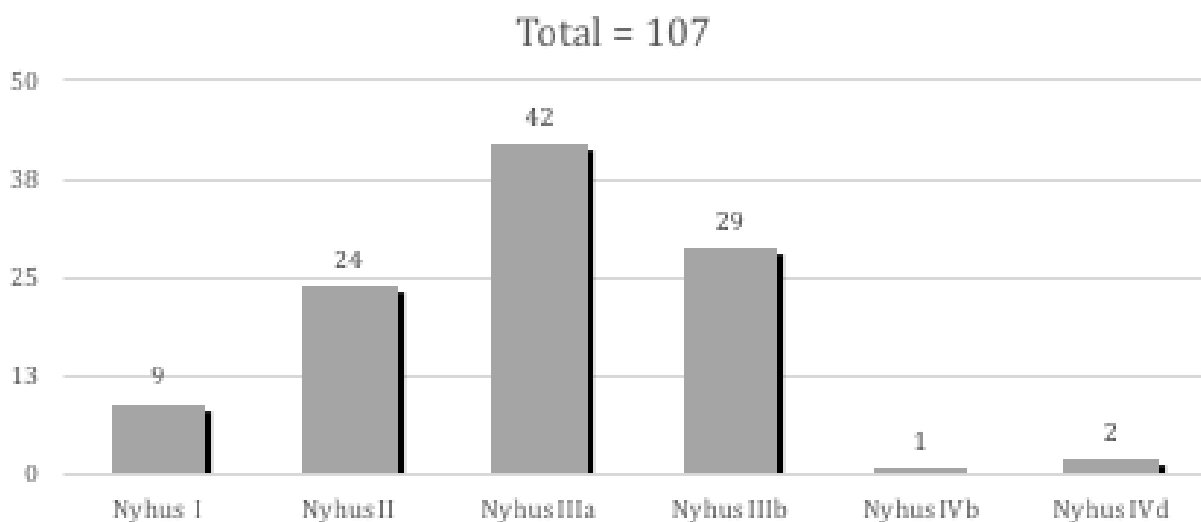
Graphic 1. Sample distribution according to the classification of *Nyhus*.

It was found that 8.41% of patients (n = 09) had postoperative complications, which were hematoma (n = 02), seroma (n = 02), surgical site infection (n = 01), paresthesia (n = 01) = 01), suture dehiscence (n = 01), femoral artery injury (n = 01) and surgical wound granuloma (n = 01). To compare the differences between the WITH COMPLICATION and WITHOUT COMPLICATION groups, the T test (for samples with normal distribution) and the Mann-Whitney Test (for samples with non-normal distribution) were performed. The normality of the samples was analyzed using the Kolmogorov-Smirnov test. When comparing groups with and without complications, there was no statistically significant difference between the two groups regarding the parameters used to calculate the CONUT (albumin, total cholesterol and total lymphocytes). Likewise, the CONUT score did not differ between the groups with and without complications (Table 4). The association between CONUT and the occurrence of postoperative complications was also studied based on its clinical significance, considering normal nutritional status when CONUT ≤ 1, and malnutrition (mild or moderate) when CONUT ≥ 2. Fisher's Exact Test showed that there was no association between the presence of malnutrition (CONUT ≥ 2) and the occurrence of postoperative complications ($p = 0.716$, phi = 0.029).

Groups	n	Mín	Max	Median	Interval interquartil	Normality (Sig)*	Difference between groups (Sig)**
Albumina (g/dl)							
Uncomplicated	98	2,83	5,10	4,00	0,30	0,047	0,363
With complication	9	3,77	4,10	3,91	0,12	0,847	
Total	107	2,83	5,10	3,99	0,24	0,026	
Cholesterol (mg/dl)							
Uncomplicated	98	42	278	174	55	0,920	0,564
With complication	9	114	228	153	63	0,850	
Total	107	42	278	173	55	0,924	
Total lymphocytes (n/ml)							
Uncomplicated	98	853	17998	2014	1527	< 0,001	0,297
With complication	9	1110	3026	1839	881	0,997	
Total	107	853	17998	2004	1400	< 0,001	
Punctuation CONUT							
Uncomplicated	98	0	6	1	2	< 0,001	0,701
With complication	9	0	4	1	3	0,578	
Total	107	0	6	1	2	< 0,001	

* Kolmogorov-Smirnov test, normally distributed data when Sig. > 0.05. ** T test for samples with normal distribution and Mann-Whitney test for samples with non-normal distribution, statistically significant difference when Sig. < 0.05.

Table 4 - Comparison of groups WITH COMPLICATION and WITHOUT COMPLICATION according to the parameters used to calculate the CONUT (n = 107).

CONCLUSIONS

The assessment of nutritional status still lacks a standardized instrument for estimating postoperative risks. The analysis of the nutritional profile in this study was restricted to the laboratory context, involving only three biochemical parameters; the use of CONUT was the result of its easy applicability and low operating cost. Disregarding clinical aspects such as body mass index (BMI) and other anthropometric data may have impaired the association between malnutrition and surgical complications in this analysis. Based on the results, patients with CONUT ≤ 1, supposedly eutrophic, or malnourished (CONUT ≥ 2) may or may not have post-hernioplasties complications; this index did not represent a risk factor for adverse events in this assessment.

In Brazil, 30-40% of hospitalized patients had some degree of malnutrition. Nutritional deficiencies are questioned as inducers of adverse events in surgery. In a study on the surgical repair of paraesophageal hernias, a correlation was reported between malnutrition and surgical site infection, urinary tract infection, acute kidney injury, pneumonia, reoperation and readmission within 30 days, in addition to higher mortality. The CONUT parameter, used in the present study, included 31 patients as malnourished, but with no significant association with operative complications.

And also from the perspective of malnutrition, Okamoto et al. also applied the CONUT, which was linked to a poor prognosis in a group of patients with multiple myeloma. They reported an increase in complications in patients with CONUT > 4, eligible for bone marrow transplantation[8]. On the other hand, as in the present analysis, Soldevila et al. did not recognize CONUT as a nutritional tool for prognostic assessment in patients with acute heart failure.

Malnutrition can determine an increase in postoperative complications. In the present study, based only on laboratory parameters: 28% of the patients presented some degree of malnutrition (CONUT > 2), corresponding to 33.3% of the surgical complications. In a study with 200 patients undergoing digestive surgery, 20% were classified as malnourished in the preoperative period by the Nutrition Risk Index (NRI) and Nutrition Risk Score (NRS). Of this sample, 25% had some complication after the surgeries, showing a relationship between unfavorable outcomes and nutritional risk. This index, however, is centered on clinical-anthropometric criteria, and is based on BMI, weight loss, ability to feed, and comorbidity. These findings – which illustrate two approaches to nutrition, may represent the need for a broader assessment of the nutritional profile of patients.

Subjective and objective analysis (by clinical and laboratory parameters together) would allow an approach to nutritional status with fewer biases. The CONUT index, together with the Nutrition Risk Screening-2002 (NRS-2002) and Subjective Global Assessment (SGA) indexes, found an association with gastrointestinal tract complications; these parameters recognized nutritional risk in the first 48 hours of hospitalization in 196 patients with gastrointestinal diseases. However, the CONUT index was not able to predict the risk of adverse surgical outcomes in hernioplasties by this study. There was no statistically significant difference between the groups that presented or did not present operative complications.

Among the surgical complications observed in the 107 patients, surgical site infection (SSI), hematoma and seroma stood out. The only infection observed was of a superficial nature, being treated on an outpatient basis with antibiotics and oral anti-inflammatory drugs. In open technique hernioplasties, it

is assumed that the expected SSI rate is 2%, whereas in this study it was obtained 0.93%, in contrast to the infection rate of 5%, reported by Orelio et al. However, a systematic review must be highlighted, which accounted for 4-5% of surgical wound infections, even though hernioplasties were classified as clean surgeries. Indeed, antibiotic prophylaxis with first-generation cephalosporin is not credited with the low frequency of SSI in our sample. Although prophylactic administration in anesthetic induction is a strict protocol of the Service, Erdas et al., in a meta-analysis with 5519 patients, do not recommend the use of prophylactic antibiotics in inguinal hernioplasties. It is also noteworthy that in this sample of 107 patients, the prophylactic antibiotic did not prevent the infection of the surgical wound. Perez et al., in a prospective randomized study, concluded that antibiotic prophylaxis in inguinal herniorrhaphy with mesh did not reduce the risk of SSI.

Hematoma also represented a usual complication after inguinal hernioplasty, with a frequency of less than 10% in most studies. In this study, there was an incidence of 1.8% of hematoma, but without the need for surgical drainage. Smoot et al. found that the risk factors most associated with this event were: perioperative use of warfarin, valvular disease, atrial fibrillation, previous bleeding, hematological and vascular diseases. Furthermore, Zeb et al. identified hernia characteristics and low molecular weight heparin as independent risk factors for hematomas after inguinal herniorrhaphy. In our evaluation, there was no question about the use of anticoagulant before surgical approaches. No specific approach was performed preoperatively to prevent post-surgical bleeding in this study. Preoperative evaluation with coagulation tests is routine in the Service. However, according to Mensah et al., the investigation of bleeding disorders must focus on individuals with a personal or family history of bleeding.

Among the risk factors for hematoma are incarceration and recurrent hernia. It must also be noted that the reduced number of recurrent hernias in the sample (3/107 - 2.8%) was compatible with the low frequency of hematomas. Furthermore, no patient with recurrent hernia developed a surgical complication, although classified as malnourished by CONUT.

In a study with 326 patients, seroma was among the most frequent complications found in the immediate postoperative period, representing 4.6% of cases[19]. This data coincides with our findings, where seroma and hematoma were the most prevalent complications, both with a rate of 1.8%. The management of registered seroma cases consisted of the use of dressings and the use of anti-inflammatory drugs on an outpatient basis. In a systematic review, Massey et al. ratified the high frequency of seroma in the postoperative period, and proposed the use of fibrin sealants, talc, drains and negative pressure therapy to reduce its incidence.

Aiming at reducing complications arising from malnutrition, the European Society for Clinical Nutrition and Metabolism - ESPEN listed conducts to obtain better surgical results. One of these recommendations was based on nutritional screening, and tools such as NRS (Nutritional Risk Screening) can be used during admission or first contact with the patient.

This study presented some limitations in its execution. When performing a nutritional analysis, the small sample did not allow other statistical inferences. Furthermore, the small number of surgical complications reinforced the need for studies with more representative samples. Statistical tests did not establish a correlation between malnutrition (CONUT ≥ 2) and rates of postoperative complications.

We also observed that the assessment of patients with adequate nutritional status (CONUT ≤ 1) was not a contributing factor to lower complication rates. In this study, it was expected that the assessment of patients with adequate nutritional status (CONUT ≤ 1) would be associated with a better prognosis. Refuting this expectation, the statistical tests did not establish a correlation between malnutrition (CONUT ≥ 2) and the rates of postoperative complications. Possible justifications would be the reduced number of patients and the low frequency of complications (8.41%). According to the findings described, studies are needed, using other parameters for a more assertive preoperative nutritional screening.

In view of the above, there was no correlation between the Nutritional Control Index (CONUT) and complications in inguinal hernioplasties in this study. As mentioned, a larger sample could result in a higher rate of complications, and a different outcome than the one obtained. The use of only one parameter for nutritional screening seems to have been insufficient. Thus, a combination of clinical and laboratory indices of preoperative nutrition could be more assertively associated with complications in hernia surgeries.

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