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Complete blood count and neutrophil to lymphocyte ratio as predictors of surgical site infection after hysterectomy

Histerektomi sonrası yara yeri enfeksiyonunu öngörmede tam kan sayımı ve nötrofil-lenfosit oranının kullanımı

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ABSTRACT

Surgical site infections (SSI) represent a significant burden concerning morbidity, mortality and additional cost to health system. For these reasons, the prevention of SSI is important. In this study, the potential relationship between preoperative blood count parameters and SSI after hysterectomy was investigated. A total of 270 patients who underwent abdominal hysterectomy between 2009 and 2013 were retrospectively evaluated. Patients with postoperative superficial SSI were compared to those without postoperative infectious complication. Patients' age, BMI, comorbidity, preoperative serum hemoglobin and albumin levels, use of an immunsupressive medication and rate of current smoker were similar between groups. Patients with SSI had significantly elevated levels of neutrophil, neutrophil/lymphocyte ratio and decreased levels of lymphocyte compared to those without SSI. Serum platelet level did not differ between groups. Based on these data, one may suggest using preoperative high neutrophil and NLR levels and low lymphocyte levels as predictors of SSI after hysterectomy.

ÖZ

Cerrahi işlem sonrası gelişen yara yeri enfeksiyonları, günümüzde hala belirgin morbidite ve mortaliteye yol açmakta, aynı zamanda sağlık sistemi için ekonomik yük oluşturmaktadır. Bu nedenlerden dolayı, yara yeri enfeksiyonunun önlenmesi önem göstermektedir. Bu çalışmada, tam kan sayımı parametrelerinin histerektomi sonrası yara yeri enfeksiyonu gelişimi ile ilişkisi araştırıldı. 2009-2013 arası abdominal histerektomi yapılan 270 hasta, retrospektif olarak değerlendirildi. Postoperatif yara yeri enfeksiyonu gelişen hastalar ile herhangi bir enfeksiyöz komplikasyon gelişmeyen hastalar karşılaştırıldı. Her iki grup arasında hasta yaş, komorbidite, preoperatif hemoglobin ve albümin seviyeleri, immünsupresif kullanımı ve sigara içen oranı açısından fark izlenmedi. Yara yeri enfeksiyonu gelişen olgularda, preoperatif nötrofil seviyeleri ve nötrofil-lenfosit oranı anlamlı olarak yüksek, preoperatif lenfosit seviyesi ise anlamlı olarak düşük bulundu. Trombosit seviyeleri iki grup arasında benzerdi. Çalışmanın sonucuna dayanarak, preoperatif yüksek nötrofil seviyesi ve yüksek nötrofil-lenfosit oranının ve düşük lenfosit seviyesinin, histerektomi sonrası yara yeri enfeksiyonu gelişimini öngörmede kullanılması önerilebilir.

Keywords: *NLR, neutrophil, lymphocyte, hysterectomy, infection*

Anahtar kelimeler: *Nötrofil, lenfosit, histerektomi, enfeksiyon*

INTRODUCTION

Surgical site infections (SSIs) are one of the worst complications associated with considerable morbidity. SSIs were shown to be the most common type of healthcare-associated infection, approaching the incidence of 11.8 per 100 surgical procedures in low and middle-income countries[1]. According to Center for Disease Control (CDC) data, SSIs after hysterectomy occur in 1.7% of cases[2].

SSI is associated with up to 11 additional inpatient days. Additionally, patients with SSI have double the risk of death compared to patients without SSI[3]. When these factors are taken into consideration along with high financial burden of SSIs, efforts have been focused on prevention of SSIs in recent years[4].

In an ideal world, possible risk factors for SSI should be identified and protective steps should be taken for high-risk patients[1]. Several studies tried to identify possible risk factors for SSI[5-8]. A high American Society of Anesthesiologists Performance Status (ASA-PS) score and prolonged surgery time were consistently reported as high risk factors for SSIs[5,6]. Furthermore, diabetes mellitus, obesity and advanced age are the other most frequently seen risk factors[7,8].

Neutrophil-lymphocyte ratio has been shown as a cheap, easy and widely available biomarker of the inflammatory response[9]. Higher preoperative NLR was suggested as a predictor of postoperative infectious complications[10,11]. However, there is still limited data regarding the use of preoperative complete blood count (CBC) parameters as predictors of postoperative infectious morbidity after hysterectomy.

We, therefore, performed a retrospective research approach to determine whether preoperative neutrophil, lymphocyte, platelet count and neutrophil/lymphocyte ratio (NLR) are useful as predictors of SSIs in patients who underwent hysterectomy for a benign disease.

MATERIALS and METHODS

After obtaining Institutional Review Board approval, retrospective analysis of patients who underwent abdominal hysterectomy for a benign disease from January 2009 to May 2013 was performed. The data including patients' age, body mass index (BMI), medical history and laboratory tests before and after surgery were collected from the medical reports. Patients who developed deep SSI or organ infection after surgery and patients with missing data were excluded from the analysis.

CBC was performed at 3-10 days prior to the surgery. NLR was calculated as the the ratio between neutrophil , and lymphocyte counts.

A total abdominal hysterectomy, with or without a salpingo-oophorectomy was performed infrafasci-

ally, using the clamp-cut-ligate technique for each patient. A single dose of a 1 gr cefazolin was administered intravenously one hour prior to surgery. The dose was doubled in patients with BMIs more than 35 kg/m^2. In case of an allergy to beta-lactam antibiotics, clindamycin was used.

All patients were followed up for 3 months postoperatively. A superficial SSI was defined according to CDC criteria[12]. Consistent with this, infection involving skin or subcutanous tissue occurred within 30 days after surgery with at least one of the following criteria was accepted as superficial SSI: i) Purulent drainage from the incision, ii) Isolation of an organism from the incision, iii) Signs or symptoms of infection such as pain, tenderness, localized swelling, redness or heat, iv) Diagnosis of surgical site infection by the surgeon.

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 16.0 (SPSS Inc., Chicago, IL, USA). T-test and chi-square test were used when needed. Mean and standard deviations were used for comparison. A probability value of less than 0.05 was accepted as statistically significant.

RESULTS

A total of 293 patients were identified. Twenty-two patients were excluded because of missing data. One patient with deep SSI was excluded. Finally, 270 patients were included in the analysis. Of them, 23 patients had superficial surgical site infection.

Patients were divided into two groups: Patients who did not develop any postoperative infection (n=247) and patients who developed superficial SSI (n=23). Table 1 shows demographic and clinical comparisons among groups. Patients' age, BMI, comorbidity, preoperative serum hemoglobin and albumin levels, use of an immunsupressive medication and the number of current smokers were similar between groups (Table 1).

Table 1. Demographic and clinic variables of the patients.

Characteristics	Group 1 (Uncomplicated) (n=247)	Group 2 (Complicated) (n=23)	p-value
Age (years)*, mean±SD	59.1±8.3	59.4±6.2	0.307
Comorbidity**, n (%)	162 (74.6)	30 (75)	0.121
BMI (kg/m2)*, mean±SD	28.8±4.5	29.9±8.1	0.192
Preoperative hemoglobin* (g/dL), mean±SD	12.2±1.3	12.5±2.2	0.350
Preoperative serum albümin* (g/dL), mean±SD	3.67±0.49	3.59+0.59	0.054
Use of an immunsupressive medication**, n (%)	9 (4.1)	3 (7.5)	0.381
Current smoker**, n (%)	46 (21.1)	9 (22.5)	0.412
Duration of operation (minute)*, mean	65	67	0.899

*t test was used.
**Chi-square test was used.
BMI: Body mass index.

Table 2. Comparison of complete blood count parameters between groups.

	Group 1 (Uncomplicated) (n=247)	Group 2 (Complicated) (n=23)	p-value
Neutrophil (x10^3 count)*, mean±SD	4.8±1.7	5.2±2.2	<0.001
Lymphocyte (x10^3 count)*, mean±SD	2.9±1.9	1.9±0.81	<0.001
Platelet (x10^3 count)*, mean±SD	243±85	249±81	0.428
NLR*	2.1±1.5	3.3±2.2	<0.01

*t test was used for comparisons.
NLR: Neutrophil/lymphocyte ratio.

When preoperative serum neutrophil, lymphocyte and platelet count and NLR were evaluated among two groups, significantly elevated levels of neutrophil and NLR in Group 2 were found (Table 2). Serum lymphocyte level was significantly decreased in Group 2. Serum platelet levels did not differ between groups.

DISCUSSION

Our study shows that complete blood count parameters such as neutrophil, lymphocyte and NLR are associated with superficial SSI developed after abdominal hysterectomy. While these biomarkers were studied for various surgeries, scientific evidence regarding hysterectomy is limited[10,11].

The exact mechanism of association between elevated NLR and postoperative infections remains unclear. Possible explanations include that high levels of neutrophil may suppress the antibacterial responses of activated T cells and natural killer cells[13]. Also, decreased lymphocyte-mediated cellular immune reaction may ease bacterial invasion of surgical site[14]. When clinical studies are considered, NLR has been shown as a successful marker of postoperative complications after colorectal surgery[15]. Furthermore, Yombi et al.[11] suggested that elevated NLR level is certainly a sign of underlying infection after total knee arthroplasty. A very recent study investigating SSIs in colorectal surgery showed that high NLR is associated with an increased risk of SSIs[16]. Another study regarding intra-abdominal infection after colorectal surgery showed that NLR on the postoperative day 5 is a reliable predictor of SSI[17]. The recent English literature lacks evidence regarding NLR and abdominal hysterectomy. The present study has demonstrated that patients who developed SSI after hysterectomy have significantly elevated NLR and neutrophil level and decreased lymphocyte level compared to patients without any postoperative infectious complications.

The strength of this study is that all patients underwent the same type of surgery and possible confounding factors such as comorbidity, BMI, anemia and

smoker rate were similar between groups.

The main limitations of our study is its retrospective design and that all operations were not performed by the same surgical team which is an inherent characteristics of a teaching hospital.

In conclusion, preoperative high neutrophil and NLR levels and low lymphocyte level may predict postoperative superficial SSI after hysterectomy. By this way, patients with higher risk of SSI may be determined and preventive strategies may be developed. Future studies are warranted to determine the optimal cut-off values for preoperative neutrophil and lymphocyte counts and NLR as predictors of SSI after hysterectomy.

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