ORIGINAL ARTICLE

The effect of general and spinal anesthesia on neutrophil to lymphocyte ratio in patients undergoing cesarian section

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ABSTRACT

Objective: Neutrophil to lymphocyte ratio (NLR) has become popular recently so that many studies have been done to find out the predictive value of NLR in many different aspects of clinical practice. The aim of this retrospective study was to evaluate the relationship between blood NLR and anesthetic techniques in patients undergoing cesarian section.

Methodology: In this study, eighty patients (American Society of Anesthesiologists physical status I- II) undergoing elective cesarian section using spinal (Group S: 40) or general anesthesia (Group G: 40) were retrospectively analyzed for neutrophil to lymphocyte ratio.

Results: The demographic characteristics of the groups, amount of bleeding, before the operation hemoglobin values, platelet counts, and NLR values were similar in both the spinal and general anesthesia groups. However, significant differences were observed with regard to NLR values in the postoperative period.

Conclusion: Postoperative neutrophil to lymphocyte ratio in patients undergoing cesarian section under spinal anesthesia was found to be significantly lower as compared to general anesthesia.

Key words: Anesthesia, Spinal; Anesthesia, general; Lymphocytes; Neutrophils

INTRODUCTION

Neutrophil/lymphocyte ratio (NLR) has been proposed to be a simple marker for inflammatory response.¹ NLR in peripheral blood is used as a parameter providing information about the relationship between inflammatory environment and physiological stress. Currently NLR is accepted as a parameter showing both the high neutrophil count reflecting acute inflammatory response and the low lymphocyte count reflecting physiological stress response.² Neutrophil and lymphocyte counts are affected by a variety of hormones, cytokines and acute phase reactants in addition to surgical trauma. In addition it has been determined that they are also affected by anesthetic method in this situation.³⁵ Surgical stress and form of anesthetic cause different responses by affecting many systems; starting with the immune system. The formed responses are affected by factors such as direct pharmacological effect of anesthetic material, form, duration and depth of anesthesia, as well as the trauma. The stress response to the combination of anesthesia and surgical stress causes endocrine and metabolic changes.⁴ During anesthesia and surgery there are changes in every stage of the immune system. These are the body’s general physiological response, which changes linked to the extent of surgery, age of the patient, general health, medications used...
Neutrophil to lymphocyte ratio was used to evaluate the effects of anesthesia in cesarean operations on NLR.

**METHODOLOGY**

Our study retrospectively investigated the NLR of 80 cases operated under elective conditions with spinal or general anesthesia at Canakkale 18 Mart University Medical Faculty Hospital between January 2013 and February 2014. The study was completed with permission from University Clinical Research Ethics Committee. Information was obtained from the patient files and anesthetic documents. Age, gender, height, weight and hemodynamic monitoring data were recorded from the files and documents. Non-elective cases, multiple pregnancies, preterm pregnancies; and cases associated with fetal anomalies, fetal development retardation, fetal birth weight below 2500 g, and infants with aspiration of meconium or amniotic fluid, were not included in the study. In addition data from patients, with inflammation or anemia in the preoperative period and more than expected hemorrhage during the operation, were not included in the study. In addition to data from patients, with inflammation or anemia in the preoperative period and more than expected hemorrhage during the operation, were not included in the study. All patients taken to the operating room were routinely monitored for electrocardiogram (ECG), peripheral oxygen saturation (SPO$_2$), and non-invasive blood pressure.

In the Group G propofol 2 mg/kg and rocuronium 0.6 mg/kg were administered IV for induction. During induction cases were oxygenized with 100% O$_2$ at 6 L/min through a mask. After 2 min of controlled ventilation through the mask, they were intubated with a suitable sized endotracheal tube. To maintain anesthesia, patients were ventilated with 2% sevoflurane in 50% air and 50% O$_2$ at 6 L/min. The patients were ventilated at a tidal volume of 6-8 ml/kg and respiration rate of 12/min, with an Avance S/5 anesthetic machine. After the baby was born inj. fentanyl 1 µg/kg was given. When the last skin suture was being completed the inhalation agents were stopped and manual ventilation with 100% O$_2$ was begun. In this period all parameters were measured. When spontaneous respiration began neuromuscular antagonization was achieved with atropine 0.01 mg/kg and neostigmine 0.03 mg/kg. After extubation the patient was taken to the recovery room.

For spinal anesthesia, patients chose to sit or lie on their side and a 26 G spinal needle was used in the L2-L3 or L3-L4 intervertebral space. When free cerebrospinal fluid flow was observed, slow injection of 0.5% hyperbaric bupivacaine (about 12.5 mg appropriate to the patient’s height and weight) was completed for spinal anesthesia. After spinal injection the patients were placed in supine, raised head position and left until sensory block rose above T5 level. Sensory block was tested using the pinprick technique with a 22 G needle. When sensory block reached T5 the operation began. The maximum block height reached was recorded. Blood pressure was measured before spinal anesthesia, every 2 min in the 30 min after spinal anesthesia and every 5 min after this. If systolic blood pressure fell below 20% of initial value or below 90 mmHg, hypotension was recorded and 10 mg ephedrine IV was administered. Patients taken to the recovery room after operation were checked for block level. In both groups patients had blood taken in the 2nd hour postoperative and hemoglobin and platelet counts were measured with a Beckman Coulter LH 780 analyzer (Beckman Coulter, Inc. CA, USA) device and NLR were calculated.

**Statistical Analysis**

For statistical evaluation SPSS for Windows 15.1 version was used. Differences between the groups were tested with the chi-square test. Blood count parameters (leukocyte, neutrophil and lymphocyte) were found not to have normal distribution. NLR parameter was analyzed with the Mann Whitney U-test. All parameters are expressed as mean ± standard deviation. P < 0.05 was accepted as statistically significant.

**RESULTS**

From the point of view of demographic characteristics there was no significant difference between the Group G and Group S (p > 0.05) (Table 1). The amount of blood loss and the duration of surgery was also comparable in the two groups (Table 1). In both groups there was no significant statistical
difference between the hemoglobin and platelet values before and after the operation. The NLR values in the general anesthesia and spinal anesthesia groups were similar before the operation (p > 0.05) (Table 2).

However in the postoperative period while NLR was 15.63 ± 11.1 in the Group G, it was observed to be 10.58 ± 4.3 in the Group S (p < 0.05) (Table 3).

**DISCUSSION**

As a result of this study it was observed that comparing inhalation anesthesia with spinal anesthesia for cesarean operation the Group S had significantly lower NLR ratios. Studies on stress caused by surgical trauma have reported a suppression of cellular resistance and susceptibility to inflammation. In addition the increase in postoperative leukocyte values and reduction in lymphocyte values increase the tendency for infection. These leukocyte changes have been proposed to cause inflammatory cytokines similar to IL-6. Studies have shown that total leukocyte count and changes in leukocyte subtypes are important markers for morbidity and mortality in cancer patients, renal failure patients and cardiovascular patients. The neuroendocrine system is activated during and after surgery. Neuroendocrine hormones and cytokines are released linked to surgical stress. The effects of general or regional anesthesia in elective surgery on pro-inflammatory and antiinflammatory cytokines have been described by previous studies. Regional anesthesia suppresses neuroendocrine activity linked to surgical procedure with sympathetic blockage. As a result while cortisol levels do not change, cytokine production reduces. While this effect is observed during high-level block (T4-S5), it is not observed at desired levels with lower-level block. NLR provide information about the immune system and are an important morbidity marker in the postoperative period. Additionally in clinical application the measurement of NLR in peripheral blood is a cheap and simple test. To research the effects of anesthetics on the immune system multi-modal anesthetic techniques have been applied. Studies with TIVA administration have found less effect on adrenergic and immune response in the postoperative period compared to inhalation anesthetics. However there is no study found on the effect on NLR of inhalation anesthesia and spinal anesthesia. Some studies comparing spinal anesthesia with general anesthesia have

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**Table 1: Demographic characteristics of the group**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group G (age)</th>
<th>Group S (age)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>30.4 ± 5.3</td>
<td>29.7 ± 4.8</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>161.9 ± 5.7</td>
<td>157.8 ± 8.3</td>
<td></td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>80.9 ± 17.3</td>
<td>80.1 ± 15.8</td>
<td></td>
</tr>
<tr>
<td>Amount of bleeding (ml)</td>
<td>620 ± 20</td>
<td>590 ± 30</td>
<td></td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>66.5 ± 22.7</td>
<td>64.2 ± 12.5</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: The preoperative and postoperative hemoglobin and platelet values of both groups**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group G (pre-op / post-op)</th>
<th>P</th>
<th>Group S (pre-op / post-op)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobine (g/dL)</td>
<td>11.6 ± 1.3 / 10.3 ± 1.3</td>
<td>0.47</td>
<td>11.4 ± 1.3 / 10.1 ± 1.4</td>
<td>0.75</td>
</tr>
<tr>
<td>Platelets (/mm³)</td>
<td>211 ± 65 / 198 ± 62</td>
<td>0.88</td>
<td>210 ± 61 / 183 ± 51</td>
<td>0.33</td>
</tr>
</tbody>
</table>

**Table 3: The preoperative and postoperative neutrophil to lymphocyte ratio values of both groups**

<table>
<thead>
<tr>
<th></th>
<th>NLR (preoperative)</th>
<th>NLR (postoperative)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group G</td>
<td>4.44 ± 2.3</td>
<td>15.63 ± 11.1</td>
<td>0.02</td>
</tr>
<tr>
<td>Group S</td>
<td>4.41 ± 2.5</td>
<td>10.58 ± 4.3</td>
<td></td>
</tr>
</tbody>
</table>

P*: The significantly difference was observed with regard to NLR values in the postoperative period
shown the reduction in neuroendocrine response to surgery as an advantage. Another study reported that total intravenous anesthesia (TIVA) reduced stress hormones, cytokines and immune mediators by more compared to inhalation anesthesia. As different anesthetic methods and anesthetics used in obstetrics affect the immunity of both mother and newborn the importance is greater. During pregnancy leukocytosis is an expected situation, leukocyte values may be 16,000/mcgL. In addition in normal pregnancies leukocytosis is accepted as a marker of an increasing inflammatory response.

LIMITATIONS

There are some limitations to our study. First, other factors such as surgical stress or psychological state of the mothers may affect the differences in NLR between the groups. Additionally the variation in surgical factors may have an effect. Also the NLR measured at different periods during the first 24 hours, in addition to 2 hours after the operation, may be more significant.

CONCLUSION

In conclusion spinal anesthesia, often chosen for elective cesarean sections, is associated with less rise in the neutrophil to lymphocyte ratio at two hours postoperative period than general anesthesia. This topic requires further prospective studies with a larger sample size and an extended period of measurement.

Conflict of interest: None declared by the authors.

Author contribution: All of the authors took part in the management of this patient and in manuscript preparation.

REFERENCES