

LEVELS OF INFLAMMATORY BLOOD PARAMETERS FOLLOWING THIRD MOLAR SURGERY IN PATIENTS VISITING AN ORAL AND MAXILLOFACIAL SURGERY DEPARTMENT

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ABSTRACT

Objectives: Third molar surgery is the most common procedure done by oral and maxillofacial (OMF) surgeons. The C-reactive protein levels (CRP); erythrocyte sedimentation rate (ESR), and total leukocyte count (TLC) were examined in patients who underwent impacted third molar surgery. The pain and swelling before and after surgery were also assessed.

Materials and Methods: This prospective study was conducted in the OMF Surgery unit of Peshawar Dental College (PDC), Peshawar between September 2023 and March 2024. A total of 100 subjects based on specific inclusion and exclusion criteria were selected for the study.

Standard laboratory procedures were used to measure CRP, ESR, and TLC in the blood samples. Basic Statistical Methods were applied to analyze the data.

Results: The CRP level significantly increased and peaked 48 hours after surgery ($P < 0.001$). The ESR level showed an upward trend after the operation with a peak level on the seventh day ($P < 0.001$). Whereas the TLC did not increase significantly with the third molar surgery ($p = 0.075$).

The preoperative CRP levels showed a positive correlation with post-operative CRP levels ($p < 0.05$) and symptoms of discomfort (pain and swelling). The different ages, genders, and types/locations of the impacted third molars did not affect the inflammatory blood parameters.

Conclusions: CRP and ESR were found to be better indicators of inflammation and infection in comparison to TLC, pain, and swelling. As the serum CRP achieved its peak level at a faster rate hence was found to be the best marker for detecting postoperative infections.

Keywords: Inflammatory Blood Parameters, Pain, Swelling, Third Molar Surgery, OMF patients

This article may be cited as: Khan AH, Shah SA, Ishfaq M, Ashraf N, Asma, Younas M. Levels of Inflammatory Blood Parameters Following Third Molar Surgery in Patients Visiting Oral and Maxillofacial Surgery Department. Pak Oral Dent J, 2024; 44(3):10-14.

INTRODUCTION

The impacted mandibular third molar is frequently removed in oral surgery, which is often accompanied by multiple complications¹. Pain, swelling, and trismus are frequently seen as complications associated with the mentioned surgery.¹ The reported complications harm the quality of life of patients, causing psychological, biological, and social consequences.²

Several factors related to the third molar like pre-operative infection, pre-operative inflammation, pericoronitis, and the duration of the extraction procedure, the extraction technique, and the use of antibiotics during the procedure, may influence postoperative symptoms without a specific pattern.^{3,4} Nevertheless, these factors should not be considered reliable indicators for the discomfort (Pain and swelling) that occurs following surgery.³

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Received for Publication: July 22, 2024

Revised: Sept 22, 2024

Approved: Sept 26, 2024

Knowing different techniques to reduce complications after third molar surgery, as well as identifying reliable indicators of postoperative complications, can assist both the surgeon and patient in effectively managing any discomfort experienced after the surgery.⁵ CRP is a protein that is produced in the liver due to inflammation in the body, which can be used to detect infections with high sensitivity.⁶

Additionally, TLC and ESR are regarded as possible markers for the early detection of infections.⁷ The ESR is a hematological condition that increases when the body is affected by infections, inflammation, major stressors, and autoimmune diseases.⁸ Similarly, the presence of more leukocytes in adult subjects can indicate various ailments, such as infection, inflammation, tissue damage/burns, dehydration, thyroid storm, leukemia, stress, or steroid use.⁹

The time required for the blood parameters to return to their pre-operative level may vary and differ among various studies involving different populations¹⁰. Furthermore, no research has been conducted regarding this matter among the population of this area, which has lower levels of education, distinct lifestyles, varied living environments, and different dietary habits compared to the developed world. Therefore, the current study was conducted to determine the infection rate by examining blood parameters in patients undergoing third molar surgery.

METHODOLOGY

The study was conducted in the OMF department of Peshawar Dental College, Peshawar, from September 2022 to March 2023. The study evaluated 100 patients (60 men and 40 women) from the middle socioeconomic class who were having third molar surgery. The individuals had an age range of 25 to 59 years. None of them had any previous history of inflammatory, or chronic diseases, and they were all willing to participate in the study.

The study's exclusion criteria were the patients who failed to attend follow-up, those with proven infection or previous maxillofacial trauma, and those with a history of diabetes, smoking, periodontal disease, or cardiovascular diseases. Patients who had taken antibiotics and analgesics before the surgery, or who were allergic to the antibiotics, were also excluded from the study.

The local ethical research committee of the college approved the study. The objectives of the project and the surgical procedure were explained to the patients. They were ensured confidentiality and obtained written consent from them for the surgical procedure. No analgesic or sedative drugs were allowed before surgery.

The presence of infection and inflammation before

surgery was evaluated by observing the swelling and pain. The swelling was measured by determining the distance between the corner of the mouth and the ear lobe on the side where the surgical extraction of the third molar was performed¹¹. Pre-operative pain and discomfort were assessed using a visual analog scale and clinical examination.

The cases included underwent rigorous aseptic procedures and were administered with local anesthesia (lignocaine 2% with adrenaline concentrations of 1:2, 00,000). Anesthesia was ensured by using both the long buccal technique and the classic inferior alveolar nerve block. An incision was made in every patient's mouth to reach the third molar. The mucoperiosteal flap was raised after that. The tooth was removed using buccal and distal bone guttering. In case a tooth needed sectioning, it was executed. All the surgical procedures were carried out by a single surgeon.

The patients received identical postoperative antibiotics (Augmentin 625 mg and metronidazole 400 mg) and analgesics (Brufen 400 mg) for 05 days as recommended. In addition, patients were given instructions on how to use food and precautions such as using mouth rinse three times a day with 0.12% chlorhexidine after surgery. Postoperative assessments were performed after 24-hours, 48-hours, and 7-days of surgery to assess pain and swelling using the same method as employed before the operation.

Blood samples of 05 ml were collected for assessing inflammatory blood parameters at different intervals, including one hour before surgery, and 24 hours, 48 hours, and 7 days after surgery. To 2.5 ml of blood, EDTA was added, and from the remaining blood after coagulation serum was separated. CRP was measured by the automatic instrument Architect plus C 4000, manufactured by Abbott Company, and TLC was measured using the instrument CELL-DYN ruby. The Westergren method was utilized for estimating ESR¹².

The Statistical Package for Social Sciences (SPSS) version 17 was utilized in the analysis of the data. The significance level was set to 0.05, and frequency distribution tables were generated including the mean, percentage, and standard deviations.

RESULTS

In the current study, 60% of participants were male and 40% were female, resulting in a gender ratio of 3:2. A higher number of male patients were observed at the ages of 45 and 49, whereas females were more prevalent at 40 and 44 years. The average age of the participants was 47.0 ± 7.0 years. The surgical extraction procedure took between 18 and 34 minutes, with an average of 26 minutes. As compared to the preoperative sample, the mean CRP levels in each sample increased significantly

following surgery ($p < 0.001$).

The ESR level significantly increased after 24 hours, 48 hours and 7 days following surgery, compared to the levels before surgery ($p < 0.001$). The surgical procedure did not result in a statistically significant increase in the total leukocyte count ($p=0.075$). However, no discernible variations in the analyzed blood parameters were found among the different genders, age groups, and types/locations of the third molar in the present study.

The patients with high preoperative CRP levels showed varying levels of pain and swelling before surgery. However, patients who had high levels of CRP before the operation experienced more post-operative pain and swelling and high CRP levels. While the preoperative swelling did not exhibit any significant correlation with postoperative pain and swelling. Similarly, there was no significant correlation found between preoperative pain and postoperative pain and swelling.

DISCUSSION

Third molar surgery is one of the most common minor surgical procedures performed in the dental field. The procedure mentioned frequently causes pain and swelling after surgery, which can be made worse by pre-existing inflammation and infection.¹³ However, pain and swelling are not reliable indicators in the procedure of third molar surgery. The measurements of CRP, ESR, and TLC in the blood after surgery provide significant information concerning infection and inflammation.¹³

CRP particularly measures the extent of inflammation and immune injury in tissues. Previous research has used CRP measurements to document inflammation after surgery.¹⁴ It has been utilized for evaluating the degree of inflammation and enables the tracking of the anti-inflammatory impact of medications.¹⁵

CRP is primarily used for primary prevention, specifically to identify individuals who are at high risk but have not yet been identified as having a problem.¹³ In

TABLE 1: DISTRIBUTION OF SUBJECTS BY AGE AND SEX

| Age range (Years) | Male (Number) | % age | Female (Number) | % age |
|-------------------|---------------|-------|-----------------|-------|
| 25-29 | 04 | 06.7 | 02 | 05.0 |
| 30-34 | 06 | 10.0 | 04 | 10.0 |
| 35-39 | 08 | 13.3 | 04 | 10.0 |
| 40-44 | 08 | 13.3 | 10 | 25.0 |
| 45-49 | 14 | 23.4 | 08 | 20.0 |
| 50-54 | 08 | 13.3 | 06 | 15.0 |
| 55-59 | 12 | 20.0 | 06 | 15.0 |

TABLE 2: AVERAGE LABORATORY PARAMETERS RELATED TO THIRD MOLAR SURGERY

| Analyzed sample | CRP (mg/l) | ESR (mm/1st hour) | TLC ($10^3/\text{mm}^3$) |
|------------------------|------------|-------------------|----------------------------|
| 01 hour before surgery | 04 + 1.1 | 11 + 2.4 | 07 + 0.4 |
| 24 hours after surgery | 45 + 3.3 | 13 + 3.2 | 07 + 1.0 |
| 48 hours after surgery | 61 + 5.6 | 32 + 8.7 | 08 + 1.3 |
| 07 days after surgery | 37 + 3.2 | 54 + 9.6 | 07 + 1.0 |

TABLE 3: COMPARISON OF LABORATORY PARAMETERS BEFORE AND AFTER SURGERY

| Parameter | Before Surgery (Mean) | After Surgery (Average of 03 Means) | p. Value |
|----------------------------|-----------------------|-------------------------------------|----------|
| CRP (mg/l) | 04 + 1.1 | 47. 6 + 4.5 | < 0.001 |
| ESR (mm/1st hour) | 11 + 2.4 | 33. 0 + 7.1 | < 0.001 |
| TLC ($10^3/\text{mm}^3$) | 07 + 0.4 | 07. 3 + 1.1 | = 0.075 |

the current study, patients who had high preoperative CRP levels were found to have high postoperative levels of CRP, pain, and swelling.

Pre-operative analgesics and antibiotics have been documented to reduce levels of C-reactive protein before and after surgery which is important information for Dental Surgeons.¹⁶ If the recommended medications are taken before surgery, they will reduce the preoperative CRP level and ultimately alleviate postoperative discomfort (Pain and Swelling).

Certain scientists demonstrated that maintaining a healthy lifestyle leads to a decrease in serum CRP levels, whereas obesity, timing of surgery, lack of physical activity, and smoking contribute to an increase in this protein.¹⁷ Similarly, the patients with periodontitis exhibited elevated levels of C-reactive proteins.¹⁷ Because of this reason, patients with previous cardiovascular diseases, periodontitis, and smoking, among others were not included in this study.

In our study (Table-02), the mean CRP level was 45 mg/l after 24 hours, increased to 61 mg/dl after 48 hours, and then decreased to 37 mg/dl after 07 days of surgery. Similar results were observed after surgery, with a consistent increase in CRP level that reached its peak on the second day following operation.¹⁸ Several researchers have described that the CRP level in healthy individuals increases two-fold every 08 hours after surgery and returns to normal within a span of 7 days.¹⁹

There was an upward trend in the average ESR of our patients following the third molar surgery. A previous study showed that ESR levels increase when there is infection /inflammation in the body.⁷ According to another study, the ESR reached its peak five days after the surgery and gradually returned to the preoperative levels.²⁰ Larsson and his coworkers also conducted serial measurements to determine the level of ESR and discovered that the peak ESR occurred after 05 days of surgeries.²¹

In the present study, the TLC didn't show a significant rise like that of CRP and ESR, but a slight increase was observed 48 hours after the surgery. A previous study also recorded that the average postoperative TLC count increased during the first two days after surgery, but then decreased to its preoperative level by the fourth day.²² Hence, the TLC is not a more reliable indicator for detecting infection in surgery, and as a result, measuring this parameter has no more importance in such studies.⁷

The limitation of this study was observed in terms of budgeting as it did not receive any funding from government, private, or non-profit sources. The lack of budget restricted the research to limited samplings.

To observe any changes in race and ethnicity, further research is needed to confirm the findings using larger populations from various geographic locations worldwide. The study was conducted by the authors with the community's best interest in mind, and they have no conflicts of interest to disclose.

CONCLUSION

C-reactive protein proved to be more trustworthy than other indicators, like ESR, TLC, pain, and swelling. Furthermore, only pre-operative CRP levels showed a correlation with post-operative CRP levels, pain, and swelling. Therefore, the preoperative CRP should be reduced using medications to minimize post-operative pain and swelling.

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CONTRIBUTIONS BY AUTHORS

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| 1 Awais Hassan Khan: | Substantial contribution to the conception/plan of the work. Data collection and analysis of the work. Managed the work including dental examination and drafting the work |
| 2 Syed Amjad Shah: | Data interpretation for the work, overall supervision of the Project, and Preparation of the Manuscript. |
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