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IMPACT OF ANESTHETIC MANAGEMENT AND USE OF TRANEXAMIC ACID ON OUTCOMES IN TONSILLECTOMY

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Abstract

Recurrent tonsillitis is one of the most common pathologies in otorhinolaryngology. The proportion of tonsillectomies varies from 10% to 20% of all surgical interventions in the otorhinolaryngological departments. Important factors for tonsillectomy are the duration of operation, the amount of blood loss, postoperative complications, the general condition of the patient in the postoperative period, the severity of pain, the time of the hospital stay. The type of anesthesia and postoperative medical hemostatic support can have a significant impact on these factors. Our study aimed to optimize the approach to carry out tonsillectomy by preoperative application of the tranexamic acid 10% solution (TXA) and choosing between general and local anesthesia. Clinical studies were made among 212 patients with recurrent tonsillitis who went through a bilateral tonsillectomy. The patients were divided into three groups. The first group included 54 patients undergoing tonsillectomy using general anesthesia with the administration of TXA at the rate of 10 mg/kg of body weight. The second group consisted of 97 patients undergoing tonsillectomy using local anesthesia. A third control group included 61 patient undergoing tonsillectomy using general anesthesia. The first and control (third) groups of patients were compared to assess the efficacy of using TXA. Factors such as the duration of the surgery, the amount of blood loss, intraoperative events, the number of incidents of primary and secondary bleeding, and laboratory data were considered. The second and control (third) groups were compared to evaluate the impact of anesthetic management. We considered the factors such as duration of surgery, the amount of blood loss, intraoperative events, number of incidents of primary and secondary bleeding, assessment of pain syndrome, necessity of analgesics administration, length of hospital stay, and recovery period. We conclude that tonsillectomy using local anesthesia requires less time to perform, has less blood loss, fewer intraoperative events, and less incidents of primary and secondary bleeding. The average level of pain is higher in patients using general anesthesia. The use of TXA significantly reduces the amount of blood loss, intraoperative complications, and lower the emergence of postoperative bleeding and its intensity.

Keywords: *tonsillectomy, bleeding, tranexamic acid (TXA), local anesthesia, general anesthesia*

Introduction

Recurrent tonsillitis is one of the most common pathologies in otorhinolaryngology. According to statistics, the prevalence of tonsillitis among the adult population ranges from 10 to 30 % [1]. One of the most common and effective treatments for recurrent tonsillitis is surgery [2]. The proportion of tonsillectomies varies from 10% to 20% of all surgical interventions in the otorhinolaryngological departments [3,4]. Despite the high frequency of tonsillectomy, it can be accompanied by severe complications. The most common complication of tonsillectomy requiring special attention is postoperative bleeding. Reports from different hospitals and countries regarding the occurrence of bleeding after tonsillectomy are quite different. Their frequency varies from 1% to 10% [5,6,7,8,9].

Important factors for tonsillectomy are the duration of operation, the amount of blood loss, postoperative complications, the general condition of the patient in the postoperative period, the severity of pain, the time of the hospital stay. The type of anesthesia and postoperative medical hemostatic support can have a significant impact on these factors.

There are several studies investigating the effect of different anesthetic management on the frequency of postoperative bleeding. Their results differ significantly. Some studies indicate an increased incidence of postoperative bleeding after surgery under general anesthesia. [10,11,12]. Yet, there are some studies that have shown the opposite results [13]. There is also a study that found no significant difference in the frequency of postoperative bleeding episodes depending on the type of anesthesia [14]. No research has been conducted on the effect of the type of anesthesia on other factors, such as the severity of pain in the postoperative period, the period of hospital stay and the period of return to a normal diet. Thus, at present, there is not enough research on a large clinical material that would clearly indicate the benefits of choosing one or another method of anesthesia.

Also, one of the most prospective methods to decrease bleeding during tonsillectomy and the frequency of postoperative bleeding is the use of inhibitor of fibrinolysis, which includes tranexamic acid (TXA) [15,16]. TXA is widely used to reduce blood loss during surgery in other medical fields [17,18,19]. There are different studies showing a reduction of blood loss and the frequency of blood transfusions during surgery using TXA solution in otorhinolaryngology [20,21]. But in some other studies, there was no significant efficacy of using a solution of TXA in tonsillectomy [22]. At the same time, others confirmed a significant decrease in blood loss [23]. A systematic review and meta-analysis of the use of TXA in tonsillectomy showed that most studies were conducted before 1980. Therefore, to study the risks and benefits of using a TXA solution, it is necessary to perform a new, extensive, and well-planned randomized controlled trial [24].

Our study aimed to optimize tonsillectomy surgery to reduce the intraoperative blood loss, the frequency of intraoperative and postoperative complications, and to improve patients' postoperative period course by a prudent choice of anesthesia and postoperative use of TXA.

Methods

A comparative study was conducted at the Department of Otorhinolaryngology of Odessa National Medical University in Odessa Municipal Hospital No. 11. There were 212 patients with recurrent tonsillitis under the supervision. Among the patients there were 93 men (44%) and 119 women (56%). The average age of patients was 23.7 years. All patients underwent a surgical treatment of bilateral tonsillectomy.

All patients were divided into three groups. The first group consisted of 54 patients who underwent bilateral tonsillectomy under general anesthesia. In the preoperative period, 30 minutes before the start of surgery, the patients were injected with 10% TXA solution of 10 mg/kg of body weight. The second group consisted of 97 patients undergoing tonsillectomy with local anesthesia, who were not given TXA in the preoperative period. The third control group consisted of 61 patients who underwent bilateral tonsillectomy under general anesthesia, who were not given TXA in the preoperative period. The groups were homogeneous in age, gender, and clinical course of

the disease (P> 0.05). In the first group, there were 31 men (57%) and 23 women (43%), the median age was 24.5 years. In the second group, there were 46 men (47%) and 51 women (53%), the median age was 23.8 years. In the third group, there were 29 men (51%) and 32 women (49%), the median age was 24.9 years.

All patients underwent a comprehensive general clinical examination: a collection of complaints and taking an anamnesis, standard examination of ENT organs. Laboratory and instrumental studies included a general clinical blood and urine tests, biochemical blood tests (glucose, total bilirubin and fractions, urea, creatinine, total cholesterol, ALT, AST, thymol test, uric acid, amylase, rheumatic test, C-reactive protein, sialic acids, seromucoid), coagulogram (prothrombin, fibrinogen, D-dimer, a soluble fibrin-monomer complex (SFMC), and thrombin time), determination of blood type and Rh factor. Additionally, an ECG and chest X-ray were done. In the postoperative period, a daily medical examination of patients was performed. The presence of reactive phenomena in the oropharynx, such as edema, hyperemia, the reaction of regional lymph nodes, and signs of ongoing bleeding were taken into consideration.

To solve the set tasks, we compared such indicators: the blood loss during the surgery, intraoperative events (episodes of bleeding during the operation that required coagulation or ligation of the vessels), the presence of primary and secondary bleeding in the postoperative period, duration of surgery, laboratory parameters (initial and postoperative level of D-dimer, SFMC level, thrombin time).

Statistical data analysis was performed using the programs for biomedical research, Microsoft Exel 2010, and Statistica 6.0 (StatSoft, 2006). The average values are given in the form (M ± m), where 'M' is the average value of the indicator, 'm' is the standard error of the mean. The reliability of the differences was evaluated using Student's t-test. Statistical processing of data that did not correspond to the normal distribution was performed using nonparametric methods of statistical analysis according to the Mann-Whitney U test.

Results and Discussion

The first and control (third) groups of patients were compared to assess the efficacy of using TXA. Factors such as the duration of the surgery, the amount of blood loss, intraoperative events, the number of incidents of primary and secondary bleeding, and laboratory data were considered.

The average time of tonsillectomy in patients of the first group was 27.02 ± 6.46 min (from 19 to 47 min), and in the control group it constituted 35.07 ± 7.12 min (from 21 to 51 min). The intergroup difference is statistically significant (p <0.01), which confirms the shorter duration of the operation when using a 10% solution of TXA.

The average volume of blood loss during tonsillectomy in the first group was 68.83 ± 16.84 ml (from 33 to 112 ml), and 77.20 ± 17.67 ml (from 43 to 131 ml) in the control group. Thus, the volume of blood loss in the first group was significantly lower (p <0.01) compared to the control group.

Intraoperative events were distributed as follows: the need for suturing the bleeding vessel arose in 13 patients, including 5 patients from the first group, and 8 patients from the control group. The need for palatine arch stitching arose in 8 patients, including 3 patients from the first group and 5 patients from the control group. The need for additional injection of procoagulants arose in 16 patients, including 6 patients from the first group and 10 patients from the control group. Primary bleeding was recorded in 5 patients of the first group and 8 patients of the control group. Secondary bleeding was observed in only 4 patients, 1 patient from the first group, and 3 from the control group.

In the postoperative period, a statistically significant increase in the parameters of SFMC, D-dimer, and thrombin time occurred in patients of both groups. However, in the first group, the increase of fibrinolysis products and lengthening of thrombin time was significantly less marked than in the control group.

The second and control (third) groups were compared to evaluate the impact of anesthetic management. The factors, such as duration of the surgery, the amount of blood loss, intraoperative events, the number of incidents of primary and

secondary bleeding, pain assessment, the necessity of analgesics injection, the length of hospital stay, and the recovery period were considered.

The average time of tonsillectomy in patients of the second group was 22,57±4,30 min (from 15 to 38 min), and in the control group it stood at 35.07 ± 7.12 min (from 21 to 51 min). The intergroup difference is statistically significant ($p < 0.01$), which confirms the shorter duration of the operation using a local anesthesia. If general anesthesia has been chosen for surgery, it is necessary to additionally take into account the time for preparing the patient for anesthesia, intubation, awakening and extubation. The average time to be added to the time of surgery is 31 ± 12.54 minutes.

The average volume of blood loss during tonsillectomy in the second group was 60,14±12,64 ml (from 24 to 79 ml), and 77.20 ± 17.67 ml (from 43 to 131 ml) in the control group. Thus, the blood loss in the second group was significantly lower ($p < 0.01$) compared to the control group.

Intraoperative events were distributed as follows: the need for suturing the bleeding vessel arose in 8 patients from the second group, and in 8 patients from the control group. The need for palatine arch stitching arose in 3 patients from the second group and 5 patients from the control group. The need for additional injection of procoagulants arose in 9 patients from the second group, and 10 patients from the control group. Primary bleeding was recorded in 7 patients of the second group and in 8 patients of the control group. Secondary bleeding was observed in 3 patients in both of the groups.

In this study, a 10-point visual analogue scale was used to determine the degree of pain in the postoperative period.

On the first day, pain was observed at the same level, 5.6 points for the second group and 5.5 for the control group. On the second day, the patients in the second group showed a decrease in pain to 5.2 points. Meanwhile, the control group indicated a moderate increase to 6.1. On days 3-5, an increase in pain was registered in both groups of the patients. The most severe pain was registered on the 4th day after the surgery, with 7 points in the second group and 8.2 points in patients of the control group. On days 6-8, pain decreased evenly in both groups to similar figures. The intergroup difference is statistically significant ($p < 0.01$). This indicates a more intense pain in patients who underwent surgery with general anesthesia in the postoperative period.

We assume the presence of additional injuries to be one of the reasons that may cause such results. Some additional injuries may occur during intubation and extubation due to the difficulty of nasotracheal intubation. Also, the use of a nasotracheal tube can cause injury of the nasal mucosa, nasopharynx, swelling of the nasal mucosa and problems with nasal breathing in the postoperative period. Breathing through the mouth during sleep, overdrying of the mucous membrane of the oropharynx can cause additional discomfort. Also, additional trauma can be caused by the use of Boyle Davis mouth gag and the position of the patient's head during anesthesia.

Conclusions

Tonsillectomy using local anesthesia requires less time to perform, has less blood loss, fewer intraoperative events, and less incidents of primary and secondary bleeding. The average level of pain is higher in patients using general anesthesia.

The use of tranexamic acid 10% significantly reduces the amount of blood loss, intraoperative complications, and lower the emergence of postoperative bleeding and its intensity.

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The authors declare that there are no conflicts of interest.

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Table 1. Duration of tonsillectomy surgery

Groups	Average duration, min	Minimum duration, min.	Maximum duration, min.
1 Group	27,02±6,46	19	47
2 Group	22,57±4,30	15	38
3 Group (control)	35,07 ±7,12	21	51

Table 2. Blood loss during surgery

Groups	Average duration, min	Minimum duration, min.	Maximum duration, min.
1 Group	68,83± 16,84	33	112
2 Group	60,14±12,64	24	79
3 Group (control)	77,20± 17,67	45	131

Table 3. Laboratory parameters in groups of patients undergoing tonsillectomy surgery with and without the use of preoperative administration of 10% TA solution

Indicators	1 Group			Control Group		
	Before surgery	After surgery	P1	Before surgery	After surgery	P2
D-dimer, mkg/ml	0.35± 0,13	0.70± 0,09	<0,05	0.33± 0,19	1.63± 0,34	< 0,001
SFMC, mg/100 ml	4.2± 0,35	5.5± 0,27	<0,05	4.2± 0,67	9.6± 1,33	< 0,001
Thrombin time, s	11,1± 0,27	12,1± 0,18	<0,05	11,4± 0,44	15,1± 1,11	< 0,001