Clinical Cancer Investigation Journal-ISSN: 2278-0513

The Effects of Various Antibiotic Prophylaxis Prescription Approaches on Postoperative Adenotonsillectomy Complications

Abstract

Adenotonsillectomy (AT) is among the most frequent surgeries performed, especially in children. AT surgery has always been associated with postoperative complications. This study investigates the effects of preoperative antibiotic therapy and its effect on surgical complications.

Children that referred to Imam Reza Educational, Research, and Treatment Centers for AT were chosen through a purposeful random sampling method. Participants were split into three groups, including "Group A" receiving 50 mg/kg of cefazolin administered intravenously 30 min before AT, "Group B" receiving 50 mg/kg of cefazolin administered intravenously 30 min before AT, and oral amoxicillin after surgery, and "Group C" receiving no antibiotics. All patients underwent cold dissection and electrocautery tonsillectomy and then were checked for postoperative complications a day, one week, and two weeks after surgery.

Complications such as bleeding and bad breath were inflated during treatment, while this increase was not significant in the groups ($p > 0.05$). During the whole follow-up, there was no statistically significant difference between the groups in terms of fever, pain, type of nutrition, the tonsillar bed for fibrin membrane condition, bad breath, and bleeding at the surgical site ($p > 0.05$).

The preoperative injection of antibiotics or orally administrated antibiotics following the intravenously antibiotic injections possessed no superiority over prescribing no antibiotics in terms of complications during the first two weeks after surgery.

Keywords: *Antibiotics, Complications, Adenotonsillectomy (AT), Surgery*

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Introduction

Surgical removal of palatine tonsils (tonsillectomy) and simultaneous palatine and pharyngeal tonsils (adenotonsillectomy) is one of the most common surgeries performed by otolaryngologists (1). It seems that the peak of adenotonsillectomy surgeries performed in America took place in the 1940s-1950s, but within the last thirty years, due to changes in surgical indications, this amount has decreased significantly (2).

Today, the most common indications for adenotonsillectomy are: chronic obstruction of the upper airways caused by hypertrophy of the pharyngeal tonsils or chronic infection such as chronic recurrent tonsillitis (1 and 2).

The most serious secondary complications related to tonsillectomy and adenotonsillectomy are: pain, bleeding, airway obstruction, post-surgery pulmonary edema, tasopharyngeal stenosis, palato-pharyngeal dysfunction and death (1).

Several studies have been conducted on whether prescribing antibiotics after surgery can reduce complications or prevent them. According to some studies, the risk of bleeding after surgery is high in patients with acute laryngopharyngitis infection, and in this situation, the use of antibiotics before surgery reduces the related infection and reduces the risk of bleeding slow (2). Sometimes a clear infection occurs after surgeryAntibiotics need to be prescribed. This happens especially in dehydrated patients (3). Post-operative care is mentioned in many otolaryngological reference books, but the use of antibiotics after surgery is not mentioned in any reference as a rule and without exception. Some recommend the use of antibiotics after the operation due to the prevention of infection and complications after the operation (3). Most patients take antibiotics after surgery, but there is no general agreement on whether or not to use them, the dosage, how to use them, and the type of antibiotics (4). On the other hand, many otolaryngology reference books in America pay attention to postoperative care and do not consider it necessary to give antibiotics routinely (5-7).

AT complications, such as fever, throat pain, etc., raise patients' visits to medical centers and the therapy burden, and

make patients uncertain about the efficacy of this treatment. Accordingly, practical approaches to reducing surgical complications can diminish the economic and therapeutic burden and promote the culture of therapy in the community when the treatment is optimally performed. Effective preoperative antibiotic prescription can be a practical option in many adenotonsillectomy cases due to the low cost of the procedure. In this context, the present study investigates the effects of various antibiotic prophylaxis prescription approaches on post-adenoidectomy complications.

Methodology

The present clinical trial was registered by the Organizational Ethics Committee (OEC) of Mashhad University of Medical Sciences (MUMS) under the ethical code of RED.MEDICAL. IR.MUMS.REC.1400.055 and IRCT code IRCT20210814052181N1. The study targeted three patient groups after performing AT surgery.

The children, who were referred to Ghaem and Imam Reza Educational, Research, and Treatment Centers for AT, were selected through a purposeful random sampling method. They were then randomly split into three groups, including "group A" receiving 50 mg/kg of cefazolin administered intravenously 30 min before AT, "group B" receiving 50 mg/kg of cefazolin administered intravenously 30 min before AT, and oral amoxicillin after surgery, and "group C" receiving no antibiotics. All patients were eventually checked for postoperative complications a day, one week, and two weeks after surgery.

Inclusion criteria were having an age between 5 and 18 years, not consuming antibiotics two weeks before surgery, having no infectious disease before surgery, developing no allergy to cefazolin and penicillin, and preparing consent forms signed with parents. Patients developing sensitivity to antibiotics were excluded from the study. All the patients were monitored for bleeding, body temperature, pain, type of nutrition, the tonsillar bed for fibrin membrane condition, and bad breath during follow-up.

The condition of the tonsil bed in terms of fibrin membrane (presence of membrane observed by the researcher in the tonsil bed who More than 50% or not) and bad breath (patient's mouth odor) were clinically evaluated by the researcher. Bleeding criteria (clinical examination of the pharynx based on the presence or absence of active bleeding or chelation), body temperature (evaluation based on axillary thermometry), and condition of the tonsil bed in terms of chelation.

The VAS[1] was used to assess the patients' pain thresholds. The researcher used a visual-linear pain assessment scale that has been standardized to quantify the intensity of pain. The divisions of the linear-visual pain measuring scale, from 0 to 10, are as follows:

0-1: No pain
2-3: Low pain
4-5: High pain,
6-7: Very bad pain
8-9: Maximum pain
10 unbearable pain

All patients underwent cold dissection and electrocautery tonsillectomy and then were checked for postoperative complications a day, one week, and two weeks after surgery based on the checklists prepared.

Data were analyzed in SPSS-23 software employing descriptive statistics (scattering indicators) and inferential statistics (Kruskal-Wallis and $\chi 2$ tests) at the 95% Confidence Interval.

Findings

This study evaluated 65 patients undergoing AT surgery, aged 9.27±3.61 years on average. Of all patients, 49.2 % were male, and the remaining 50.8 % were female. A total of 44 parents had a diploma degree. There was no significant statistical relationship between the parent's education and the treatment type ($p = 0.53$). Of all surgeries performed, 50.8 % were due to obstructive reasons, 18.5 % were due to infections, and 30.8 % were due to concurrent obstructive and infectious causes.

Table 1. The study of patients and Underlying reasons for surgery

The study of patients and groups		
Group	Number	Percentage
Intravenously injected antibiotics	24	36.9
Intravenously injected antibiotics + oral antibiotics	25	38.5
No antibiotics during treatment	16	24.6
Underlying reasons for surgery		
Group	Number	Percentage
Obstructive	33	50.8
Infectious	12	18.5
Obstructive + infectious	20	30.8

[1] visual pain scale

According to Table 1, 24 patients received just preoperative intravenously injected cefazolin, while 25 received preoperative intravenously injected cefazolin and postoperative oral amoxicillin. In addition, 16 patients received no antibiotics during treatment. reasons for surgery were obstruction (in 50.8% of cases), infection (for 18.5% of cases), and concurrent obstruction and infection (in 30.8% of cases).

Evaluation of patients

Table 2. Bleeding in the study groups after surgery				
first week after surgery				
Group	Bleeding		Total	p-value*
	Yes (%)	No (%)		
Intravenously injected antibiotics	1 (25)	23 (37.7)	24 (36.9)	0.856
Intravenously injected antibiotics + oral antibiotics	2(50)	23 (37.7)	25 (38.5)	
No antibiotics during treatment	1 (25)	15 (24.6)	16 (24.6)	
two weeks after surgery				
Intravenously injected antibiotics	1 (33.3)	23 (37.1)	24 (36.9)	0.176
Intravenously injected antibiotics + oral antibiotics	0	25 (40.3)	25 (38.5)	
No antibiotics during treatment	2 (66.7)	14 (22.6)	16 (24.6)	
* Kruskal–Wallis test				

a day after surgery: In the study of patients on the first day after surgery, there was no bleeding at the operation site.

According to Table 2, In the first week after surgery, there was an increase in the number of patients with bleeding, however, most patients in all groups continued to spend the first week after surgery without bleeding. Bleeding patients were treated only with initial measures and no further measures were needed. There was no significant difference in bleeding a week after surgery between the groups (p = 0.856). Two weeks after surgery, bleeding was observed in a patient receiving intravenously injected antibiotics and two patients receiving no antibiotics. However, hospitalization was not required, and bleeding was controlled with initial measures. There was no significant difference in bleeding two weeks after surgery between the groups (p = 0.176).

Table 3. Relationship between body temperature and pain in patients after surgery

Body temperature(°C)				
a day after surgery				
	Min[1]	Max[2]	MCT[3]	p-value*
Intravenously injected antibiotics	36.5	38.2	36.8	0.614
Intravenously injected antibiotics + oral antibiotics	36.6	37.3	36.8	
No antibiotics during treatment	36	37.2	36.8	
a week after surgery				
Intravenously injected antibiotics	36.5	37	36.8	0.7
Intravenously injected antibiotics + oral antibiotics	36.3	37.1	36.9	
No antibiotics during treatment	36.5	37	36.8	
two weeks after surgery				
Intravenously injected antibiotics	36.4	37	36.9	0.329
Intravenously injected antibiotics + oral antibiotics	36.5	37	37	
No antibiotics during treatment	36.7	37.2	37	
Pain (vas pain scale)				
a day after surgery				
Intravenously injected antibiotics	0	8	4	0.179
Intravenously injected antibiotics + oral antibiotics	0	8	4	

No antibiotics during treatment	0	8	2	
a week after surgery				
Intravenously injected antibiotics	0	4	1	0.9
Intravenously injected antibiotics + oral antibiotics	0	4	0	
No antibiotics during treatment	0	6	1	
two weeks after surgery				
Intravenously injected antibiotics	0	2	0	0.273
Intravenously injected antibiotics + oral antibiotics	0	2	0	
No antibiotics during treatment	0	2	0	
* Kruskal–Wallis test				

1- minimum, 2- maximum, 3- Measures of central tendency

According to Table 3:

There was also no significant difference in body temperature and pain between the groups after surgery in several study times (p >0/05).

Table 4. Bad breath status in the study groups surgery

a day after surgery				
Group	Bad breath		Total	p-value*
	Yes (%)	No (%)		
Intravenously injected antibiotics	1 (16.7)	23 (39)	24 (36.9)	0.558
Intravenously injected antibiotics + oral antibiotics	3 (50)	22 (37.3)	25 (38.5)	
No antibiotics during treatment	2 (33.3)	14 (23.7)	16 (24.6)	
a week after surgery				
Intravenously injected antibiotics	0	24 (40.7)	24 (36.9)	0.111
Intravenously injected antibiotics + oral antibiotics	3 (50)	22 (37.3)	25 (38.5)	
No antibiotics during treatment	3 (50)	13 (22)	16 (24.6)	
* Kruskal–Wallis test				

According to Table 4:

A day after surgery: Only a few patients had bad breath on the first day after surgery, most of whom were those receiving antibiotics orally and intravenously. However, there was no significant difference in bad breath a day after surgery between the study groups (P = 0.558).

A week after surgery: In the evaluation of bad breath in the first week after surgery, 3 people in the group who did not receive any treatment and also 3 people in the group receiving injectable and oral antibiotics had bad breath, however no cases of bad breath. It was not observed in patients receiving injectable antibiotics. However, there was no significant difference in bad breath a day after surgery between the study groups (P = 0.111).

None of the patients had postoperative bad breath two weeks after surgery.

Table 5. The tonsillar bed for fibrin membrane condition in the study groups after surgery
a day after surgery

Group	the tonsillar bed for fibrin membrane condition		Total	p-value*
	Over 50%	Below 50%		
Intravenously injected antibiotics	24 (37.5)	0	24 (36.9)	0.211
Intravenously injected antibiotics + oral antibiotics	25 (39.1)	0	25 (38.5)	
No antibiotics during treatment	15 (23.4)	1	16 (24.6)	
a week after surgery				
Intravenously injected antibiotics	24 (38.1)	0	24 (36.9)	0.192
Intravenously injected antibiotics + oral antibiotics	23 (36.5)	2	25 (38.5)	
No antibiotics during treatment	16(25.4)	0	16 (24.6)	
* Kruskal–Wallis test				

According to Table 5:

A day after surgery: only one patient among those receiving no antibiotics had less than 50% threatened tonsillar bed fibrin membrane. However, there was no significant difference in tonsillar bed membrane condition between the studied groups (p = 0.211).

a week after surgery: Only 2 patients who received oral and injectable antibiotics had a fibrin membrane below 50% in the evaluation of the condition of the tonsil bed, while there was no significant difference between the studied groups (p = 0.192).

Table 6. The tonsillar bed for fibrin membrane condition in the study group two after surgery

Group	the tonsillar bed for fibrin membrane condition			Total	p-value*
	Over 50%	Below 50%	No		
Intravenously injected antibiotics	4 (36.4)	19 (37.33)	1 (33.3)	24 (36.9)	0.242
Intravenously injected antibiotics + oral antibiotics	7 (63.6)	17 (33.3)	1 (33.3)	25 (38.5)	
No antibiotics during treatment	0	15 (29.4)	1 (33.3)	16 (24.6)	
* Kruskal–Wallis test					

According to Table 6, the majority of patients had less than 50% threatened tonsillar bed fibrin membrane, while there was no significant difference between the studied groups (p = 0.242).

Discussion

Tonsillectomy is a surgical procedure associated with an increased risk for postoperative colonization of saprophyticus and pathogenic bacteria. Local complications account for less than 1% of postoperative complications. They typically manifest into surgical wound infection with delayed healing, increased pain, need for additional treatment, and a more extended recovery period [8, 9]. The guidelines set by the American Society of Health-System Pharmacists (ASHSP) suggest the prophylactic administration of antibiotics in some surgeries [10, 11]. Regardless of the regimen, antibiotic prophylaxis was equally effective in alleviating pain and the period required to return to a regular diet and previous physical activity. Dispensing prophylactic antibiotics is adjusted concerning the fewer risk of side effects, the likelihood of lower antibiotic resistance, and diminished treatment costs [12].

Regarding postoperative complications, there was no significant difference between various methods of taking antibiotics and not receiving antibiotics. Complications were bleeding, body temperature, pain, Type of diet, condition of tonsillar bed in terms of fibrin membrane, and bad breath. In the following, we will evaluate this result:

Recent investigations have shown that whereas postoperative antibiotics are routinely prescribed by American laryngologists in 79 percent of patients, the percentage might reach 12 percent among British surgeons [13, 14]. This discrepancy most likely reflects the findings of pertinent investigations and statistical analyses carried out in Europe to validate the impact of antibiotic treatment on tonsillectomy recovery [13-15].

Johnson et al explained that Antibiotic prophylaxis was similarly beneficial regardless of diet in terms of pain management and the amount of time it took to resume a regular diet and prior physical activity [16]. Giving prophylactic antibiotics is justified due to the decreased risk of adverse effects, the potential for decreased antibiotic resistance, and the

likelihood of reduced treatment costs [16]. The objectives of intraoperative antibacterial prophylaxis were defined by Patterson in 1990, and he assumed that the procedure should be carried out in a way that the tissues subject to surgical trauma were saturated with the proper amount of antibiotics to prevent bacterial growth in the surgical wound [17]. The authors of the meta-analysis observed several positive outcomes of antibiotic medication, including a decreased risk of fever, a quicker return to normal for patients, and a shorter persistence of foul breath. They explained the results in light of the antibacterial effects of antibiotics. They also demonstrated that the time it took to resume a regular diet and the risk of postoperative subsequent bleeding were both marginally reduced by antibiotic prophylaxis. However, they found no evidence to support any notable reduction in postoperative pain, analgesic dosage, or use time associated with preventive antimicrobial treatment. They also detected a tiny percentage of individuals who had diarrhea, fungal infections, allergies, and anaphylaxis as adverse effects of antibiotic treatment. They also emphasized the possibility of an unjustified rise in treatment expenses as a result of antibiotic prophylaxis. The principal drawback of recurrent use of antibiotic prophylaxis following tonsillectomy was thought to be the development of drug resistance among pathogenic bacterial flora of the oral cavity [18]. In the conducted studies, the theory has been proposed that the damage caused to the tonsil tissues during surgery (for example, electrocautery surgery) causes the increase of bacteria in the surgical site. So, as a result, use of antibiotics is given as prophylaxis. But other evaluations state that surgical damage to the tissues and nerve endings of the operated tissues and contractions caused in the tonsils after surgery; causes damage and inflammation, and excessive growth of bacteria and their metabolism does not play a significant role in causing complications. Based on the present findings, the last opinion justifies the obtained results. Thus, the meta-analysis conducted from 1996 to 2004 is similar to the results of our study.

Theories consistent with the present study:

According to Divakar et al meta-analysis of data published between 1966 and 2004, researchers have discussed whether preventive antibiotic therapy should be administered following tonsillectomy and, if so, what protocol to follow to be examined and spoken about [19, 20]. They looked at a cohort of 1,035 tonsillectomy patients, and they discovered that antibiotic prophylaxis did not result in decreased postoperative pain levels. They also questioned if taking antibiotics lessened the possibility of developing a fever after a tonsillectomy. They were unable to ascertain, nevertheless, whether antibiotic prophylaxis had any favorable effects on the likelihood of postoperative subsequent bleeding [19]. Additionally, other studies contend that surgical damage to tissues and nerve endings, along with the stimulation, contraction, and pain that results from this damage, is what causes the majority of pain associated with surgical wounds and inflamed tissue, not bacterial metabolites [18, 20-26].

The effectiveness of topical disinfectants in avoiding postoperative infections in patients having different forms of head and neck surgery, whether alone or in conjunction with antibiotics or oral antibiotics, was not confirmed, however. Some scientists claim there is no correlation between using these preventative measures and less germs in oral lavage [27-31]. When comparing patients who received topical antibiotic therapy to those who did not, Karaman et al. examined the effects of topical antibiotic prophylaxis in patients who had tonsillectomy and discovered a decrease in the amount of aerobic and anaerobic bacteria in the tonsillar incisions. Observed [27,29,32]. Since several recent studies have demonstrated that patients' postoperative pain and bleeding were reduced after receiving topical intraoperative clindamycin, the question of topical postoperative antibiotic prophylaxis is still up for debate [27,28,29,33]. However, other research cast doubt on this idea [34-38]. From the perspective of the patient, one of the most crucial aspects of postoperative treatment is the level of discomfort experienced during tonsillar fissure healing. The assessment of other therapy characteristics, such as swallowing issues, weight loss, discomfort, and return to food and regular activities, is significantly influenced by pain severity. It may be quite difficult to determine the degree of pain objectively. In situations of edinophagy, lateral muscle activity that promotes swallowing has been used by many studies to gauge discomfort levels. The electromyographic potentials were used to measure their activity, and it was considered that they were related to the degree of pain [39-41]. The findings of several published investigations lend credence to the idea that bacterial metabolites that populate the cleft palate induce postoperative discomfort. This hypothesis predicts that prophylactic postoperative antibacterial medication will improve postoperative recovery metrics. In the context of intraoperative prophylaxis in patients undergoing tonsillectomy, Mann et al. compared the effectiveness of oral and injectable antibiotic treatment with the effects of topically applied clindamycin and amoxicillin/clavulanic acid [27-30,42-44]. Despite the fact that all procedures were successful, the researchers suggested topical clindamycin. This was linked to a significant reduction in the amount of aerobic and anaerobic bacteria in the oral cavity, as well as decreased discomfort and foul breath's length. In addition, the quantity of bacteria significantly decreased for at least 8 hours following topical clindamycin delivery. The researchers supported this preventative strategy instead of systemic antibiotic therapy. Clindamycin used topically reaches greater tissue concentrations, resulting in

better bacteriostatic action with fewer adverse effects [7,28,45-49]. Prophylactic topical treatment of clindamycin following tonsillectomy was successful in lowering postoperative discomfort, according to a related research by Miura et al. But only a statistically significant decrease in pain was seen the day after surgery, and there was no improvement during the course of the following days of topical antibiotic therapy [27-32,50,51].

Benefits and Limitations

Based on the findings of this research, the administration of prophylactic antibiotics has no special benefit over not injecting it. Thus, it must be mentioned that the antibiotics prescribed in this research are not potentially efficient for the patients.

One of the most important strengths of this research was the evaluation of different injectable and oral antibiotic treatment methods in patients and the elimination of confounding factors. Also, evaluating and monitoring patients on the day after surgery, the first week, and the second week; can further indicate the impact of this research.

Thus, the most significant weaknesses of the present research are failure to assess other efficient oral and injectable antibiotics, failure to assess efficient topical antibiotics, and failure to assess other factors influencing the incidence of complications in the patients.

At last, it is proposed that research be designed to assess and design the mechanisms of precise mechanisms which result in the complications and eliminate them as confounding factors. Also, it records the changes and side effects over a long period of time, and reviews and assesses the administration of other efficient antibiotics, both injectable and topical.**Conclusion**

According to the results of this study, there is no significant difference between preoperative intravenous injection of cefazolin before AT, preoperative injection of cefazolin, and postoperative oral administration of amoxicillin, and receiving no antibiotics in terms of AT complications during two weeks after surgery. At the same time, infectious agents account for fewer causes of complications regarding the importance of surgical procedures and specialist performance. Accordingly, antibiotics can be less prescribed if the surgery is performed correctly. In this study, effective topical antibiotics were not investigated. Therefore, future research is suggested to evaluate the administration of other effective antibiotics, either topically or intravenously.

Conflict of Interest

None.

Financial support Self funded.

Ethical statement This study was approved by the Ethics Committee of Mashhad University of Medical Sciences. In order to participate in this study, written consent was obtained from all the parents of the children in the case and control groups. The information of the participants was kept confidential and none of their personal details, including their names and surnames, were entered into the software. All the people were given a code specific to the project and the analysis was done based on it. The primary information will remain with the main organizer until the completion of the project and the publication of the articles. This research was conducted on 08/14/2019 in the Organizational Ethics Committee of the Faculty of Medicine of Mashhad University of Medical Sciences under the title "Evaluation of the effect of different methods of prescribing antibiotic prophylaxis on complications after adenotonsillectomy" " and No. 981743 with code IR.MUMS.MEDICAL.REC. 2017.393 has been approved.

Acknowledgment

The authors wish to thank the nurses and the doctors who assisted in the retrieval of the folders and the required information.

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