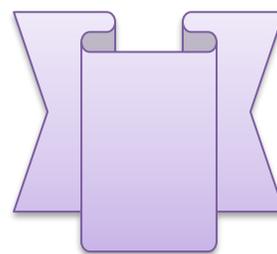
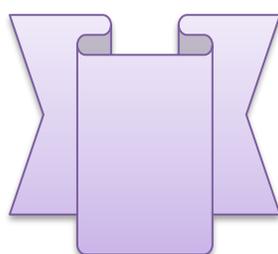
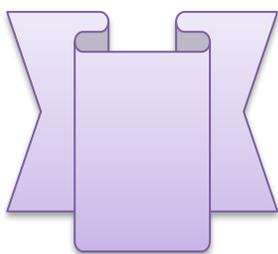
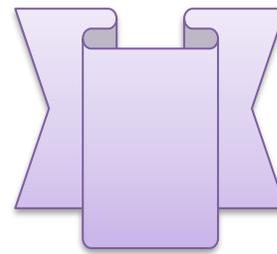
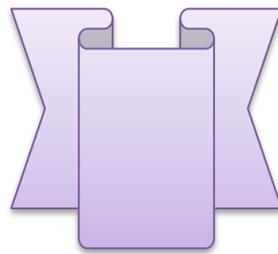
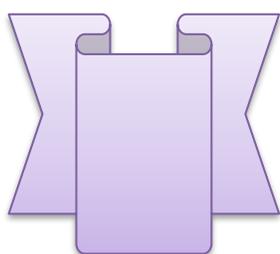
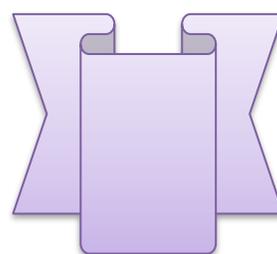
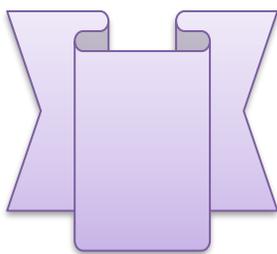
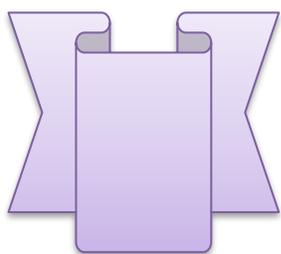


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Original Article

The Use of Hypertonic Saline Injection in Peritonsillar Fossa during Monopolar Tonsillectomy

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ABSTRACT

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Background: There are multiple techniques used for tonsillectomy including monopolar cautery. Monopolar electrocautery creates an electrical arch that occurs between the tissue and the appliance, which cause thermal damage with subsequent post-operative discomfort. It is hypothesized that normal saline injection may reduce thermal damage during monopolar cautery.

Aim of the work: To evaluate the role of intraoperative use of hypertonic saline in tonsillar fossa for reduction of patients' pain and discomfort.

Patients and Methods: This study included 50 pediatric patients indicated for tonsillectomy. Patients were divided into 2 groups; group [A]: 25 patients have electrical mono polar tonsillectomy with hypertonic saline injection into peritonsillar fossa, and group [B]: 25 patients have electrical mono polar tonsillectomy without hypertonic saline injection. The main outcomes were intraoperative blood loss, surgery duration and postoperative pain.

Results: In our study, patients in group [A] had significant reduction of blood loss [$P < 0.001$]. Regarding pain scores, patients in group [A] showed significant decrease of VAS started 2 hours after surgery, and continued for the first 24 hours [p-value < 0.001].

Conclusion: Hypertonic saline injection significantly associated with less blood loss, decreased post-operative pain and need for analgesia. Further large-scale studies are recommended.

Keywords: Tonsillectomy; Hypertonic Saline; Peritonsillar fossa; Monopolar Tonsillectomy.



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INTRODUCTION

A tonsillectomy is a commonly performed surgical procedure worldwide that involves the removal of the tonsils [1]. Reasons for performing a tonsillectomy include recurring cases of tonsillitis, repeat occurrences of abscesses in the neck, sleep apnea, and the removal of necessary tumor cells [2].

The choice of techniques for tonsillectomy relies mostly on the preference and expertise of the surgeon. These techniques include the traditional cold steel method and the hot methods such as bipolar diathermy, harmonic scalpel, coblation, and monopolar cautery [3].

Cold steel techniques are no longer widely used in most parts of the world due to the significant blood loss they often result in during surgery [4]. As an alternative, electrocautery methods have become more commonly employed as they are linked to less bleeding during the procedure and a faster surgical time [5].

Despite the benefits, concerns have arisen regarding the rise in post-operative complications associated with electrocautery techniques, such as increased pain and hemorrhage [6].

Monopolar electrocautery creates a spark between the instrument and tissue to remove the tonsillar tissue [7]. It uses temperatures of 400 °C or more to cut through the tissue and effectively separates the tonsil from the surrounding muscles. This process also helps to stop bleeding by sealing the blood vessels [8].

The use of this technique presents a significant issue as it can cause varying levels of heat damage to nearby structures. This damage can lead to complications during the recovery process, such as increased postoperative pain, delayed healing, and a higher risk of postoperative bleeding [9, 10].

The literature provides various techniques and methods that have been suggested to effectively manage pain, reduce complications, and promote faster recovery following a tonsillectomy [11].

Electric dissection during tonsillectomy leads to greater surgical pain compared to using a sharp instrument for dissection, primarily due to the occurrence of thermal damage. However,

there is limited information available on strategies to minimize thermal damage, which is crucial for ensuring the patient's comfort during the recovery phase [12].

In the developing countries, it is essential to find out a simple non-expensive method to reduce post-operative complications associated with thermal injury. So, our research examined the variation in clinical results when using monopolar diathermy with or without the injection of hypertonic saline into the peritonsillar fossa.

The aim of this work is to evaluate the role of intraoperative use of hypertonic saline in tonsillar fossa and postoperative evaluation of intraoperative blood loss, pain, oral temperature, nausea and vomiting after surgery and need for more analgesic drugs.

PATIENTS AND METHODS

This was a randomized controlled clinical trial of 50 children performed at Otorhinolaryngology Department at Damietta University Hospital from August 2020 to May 2021.

Patients were divided into two groups: **Group [A]:** 25 patients with odd numbers have electrical mono polar tonsillectomy with hypertonic saline injection into peritonsillar gap, **Group [B]:** Those with even numbers have electrical mono polar tonsillectomy without hypertonic saline injection.

Inclusion criteria: 1] children less than 12 years old, 2] patients indicated for tonsillectomy [recurrent acute tonsillitis, or obstructive sleep apnea older than 6 years].

Exclusion criteria included the presence of any medical condition that may disrupt the procedure, such as clotting disorders, cardiac ailments, challenges with intubation, operations lasting longer than one hour, use of anti-inflammatory drugs during anesthesia initiation, allergies to drugs, abnormal bleeding tendencies, and an inability to respond to inquiries.

Ethical consideration: Free informed written consent was obtained from the parents of each child. The research was approved by local ethical committee at Damietta Faculty of Medicine, Al-Azhar University.

Pre-operative evaluation: The patients underwent regular blood tests [complete blood count and clotting profile] which were expected to be within the normal range. The patients were admitted to the hospital early in the morning on the day of the surgery and had not eaten for a minimum of 6 hours.

The operative technique: The procedure took place with the patient under general anesthesia. The patients were lying flat on their backs on the surgical table, and a Boyle-Davis mouth gag was placed in their mouth. Then, the monopolar diathermy was utilized for the surgery.

In group [A], during surgery, first, the 3 cc of hypertonic saline was injected inside and upper peritonsillar areas. Then, the upper section of the tonsil was carefully separated and further dissected until the entire tonsil was extracted, after which the blood vessels that were encountered were then sealed with a cauterizing technique.

Additional hemostasis in the tonsillar fossa was achieved by using a monopolar device for point hemostasis. A sterile surgical towel [gauze] was placed in the oral cavity below the surgical area to absorb any blood. This gauze was weighed before and after the procedure to calculate the estimated blood loss. The volume of fluid injected into the tonsillar fossa was subtracted from the total volume and weight difference of the gauze to determine the amount of blood lost during the tonsillectomy.

The duration of the surgery was recorded from the initiation of the procedure on one side to the achievement of complete hemostasis following the extraction of the tonsils.

Post-operative evaluation: 24 hr post-operatively patients were observed. Early oral intake was encouraged, starting with ice cold food then semisolid food. They were given antibiotics in the form of amoxiclav for those not allergic to Penicillin. Patients' postoperative pain levels were evaluated by using analog visual scales, where a score of 0 indicated no

pain and a score of 10 represented the most severe pain. Pain evaluation was assessed at 1st, 2nd, 4th, 8th, 12th, and 24th hours after operation. Analgesic was administered if VAS score was ≥ 4 . The first administration for analgesic, the total amount of analgesic consumption and the first time for eating was also recorded. Side effects and complications were reported.

Statistical methods: All data was recorded and entered into a statistical package on a compatible computer. SPSS version 23.0 was used to perform various analyses. The Shapiro-Wilk test was used to assess the normality of the data. For normally-distributed quantitative data, the mean and standard deviation were reported, while for non-normally distributed data, the median and inter-quartile range [IQR] were used. Qualitative data was reported as the number and percentage of occurrences. The Chi square test was used to compare qualitative data between the two groups, and either the Student t-test or Mann-Whitney test was used to compare quantitative data. A significance level of $\alpha < 0.05$ [two-tailed] was employed.

RESULTS

No significant difference between studied groups regarding age, sex or surgery time [table 1].

Patients in group [B] had analgesic requirements more than patients in group [A] with statistically significant difference [P=0.034]. The frequency of nausea and vomiting was significantly higher [P=0.021] in group B [7 patients; 28%] than in group A [1 patient; 4%] as shown in table [2].

Regarding blood loss, patients in group [A] had significant reduction of blood loss [P=<0.001] as shown in table [3].

Regarding pain scores, patients in group [A] showed significant decrease of VAS started 2 hours after surgery, and continued for the first 24 hours [p-value < 0.001] [table 4].

Table [1]: Demographic data of studied patients

		Group A [n = 25]	Group B [n = 25]		P-value
Age	Mean \pm SD	5.7 \pm 1.6	5.6 \pm 1.5	t=0.26	0.790
Sex	Females	11 [44%]	12 [48%]	X ² =0.081	0.78
	Males	14 [56%]	13 [52%]		
Surgery time [min.]	Mean \pm SD	7.25 \pm 2.14	8.12 \pm 2.85	t=1.22	0.23

t: student t test; X²: Chi square test.

Table [2]: Comparison between studied groups regarding need for more analgesia and nausea and vomiting

		Group A [n = 25]		Group B [n = 25]		X ²	P-value
		No.	%	No.	%		
Need for more analgesia	No	23	92%	17	68%	4.5	0.034*
	Yes	2	8%	8	32%		
Nausea and vomiting	No	24	96%	18	72%	5.3	0.021*
	Yes	1	4%	7	28%		

Table [3]: Comparison between studied groups as regard post-operative oral temperature and intra-operative blood loss

		Groups		MW	P-value
		Group A [n = 25]	Group B [n = 25]		
PO oral temp [C ⁰]	Median	37.1	37.6	13.5	< 0.001*
	IQR	37 – 37.3	37.5 – 37.8		
Intra-operative blood loss [CC]	Median	9	12	16	< 0.001*
	IQR	8 - 10	11.25 – 13		

IQR: Inter-quartile range; MW: Mann-Whitney; *: significant.

Table [4]: Comparison between studied groups as regard post-operative pain [VAS]

Post-operative pain [VAS]		Groups		MW	P-value
		Group A [n = 25]	Group B [n = 25]		
After 2 hours	Median	3	8	0.0	< 0.001*
	IQR	2 – 4	8 – 9		
After 12 th hour	Median	1.5	6	0.0	< 0.001*
	IQR	1 – 2	6 – 7		
After 24 th hour	Median	0.5	5	0.0	< 0.001*
	IQR	0.5 - 1	4.25 - 6		

IQR: Inter-quartile range; MW: Mann-Whitney; *: significant.

DISCUSSION

Many surgical techniques have been developed in addition to cold knife dissection tonsillectomy, such as diathermy, laser, plasma excision, radiofrequency ablation, and harmonic scalpel, to treat chronic tonsillitis and/or tonsillar hypertrophy [13]. Nevertheless, none of these approaches have been definitively proven to be superior to the rest, and it is not advisable to endorse any particular technique as the established procedure [7]. CD and snare techniques are straightforward to carry out, but it is challenging to manage perioperative bleeding, particularly in pediatric patients. The use of diathermy in hot tonsillectomy techniques can help minimize intra-operative bleeding and reduce surgical duration [14].

Inflammation and spasms in the pharyngeal muscles occur as a result of damage to the underlying mucosa, leading to prolonged pain due to reduced blood flow [9]. Inflamed constrictor muscles cause severe discomfort because of their involvement in the process of swallowing. Additionally, the extreme heat generated by electrocautery, used to control bleeding or separate tissues, can lead to additional harm to the tissue [10].

A review of existing studies indicated that the use of electrical dissection in tonsillectomy procedures resulted in higher levels of surgical pain compared to the use of sharp dissection. This increased pain was primarily attributed to the thermal damage caused by the electrical dissection method [15].

The focus of this study was to develop a technique that could decrease the duration of surgery, lower the risk of bleeding during and after the procedure, minimize postoperative pain, and reduce the occurrence of complications. Monopolar diathermy was chosen as it is an uncomplicated and cost-effective method compared to other hot techniques, such as cold knife dissection. **Pizzuto et al.** [16] proposed that there was no discrepancy in the time it takes for the tonsillar fossae to heal between electrosurgical and classical dissection tonsillectomy. However, other researchers have claimed that the CD method allows for faster healing of the tonsillar fossa.

Electro dissection is more advantageous than the CD method, provided thermal damage is minimized. The crucial factor for ensuring the patient's comfort after surgery lies in reducing thermal damage [17].

To our knowledge our study was the first in Egypt and second in literature to examine the effect of hypertonic saline injection in peritonsillar fossa during monopolar tonsillectomy. Our analysis illustrated that the Hypertonic Saline injection associated with less post-operative analgesia request and Nausea and vomiting, significant reduction in oral temperature, intra-operative blood loose and significant lower VAS score. We found there were no significant difference between both groups as regard to post-operative bleeding [p=0.552].

In a study conducted by **Ma et al.** [18], the researchers examined the impact of injecting hypertonic saline into the peritonsillar fossa during monopolar tonsillectomy in a group of 60 patients. The patients were divided into two groups based on their odd or even numbered status. Group A consisted of patients who underwent electrical tonsillectomy on the right side with hypertonic saline injection, while Group B underwent electrical tonsillectomy on the left side without the saline injection. The same procedure was performed on the opposite side for patients in the other group. But unlike our finding they reported significant increase in post-operative bleeding incidence in group with hypertonic saline injection than group without injection.

In **Ma et al.** [18]'s study, they observed secondary bleeding due to a more severe thermal injury, which was evident through the presence of intraoperative cavity leak and extensive electric placing. The researchers attributed this to the sticky nature of the tonsil, which impeded the effectiveness of injecting hypertonic saline into the peritonsillar gap to push the tonsil away from the lateral pharyngeal wall.

In our study we found blood loss in group with hypertonic saline injection significantly less than without injection group [p=0.001]. The electrocautery method we utilized in our research allowed us to achieve a well-defined surgical area with sufficient visibility of blood vessels. This enabled us to seal off small blood vessels and tie up larger ones before making incisions or dissections, resulting in simultaneous prevention of bleeding. The clear visual field also facilitated the safe dissection of tonsils without harming the underlying muscle tissue. Application of electrical current can generate heat, leading to tissue and cell degradation.

Permanent damage can occur when the temperature exceeds 55 °C [19].

New research indicates that heat-susceptible enzymes start to break down once the temperature reaches 57 °C. Thermal injury can occur in two stages, with the first being a sudden effect and the second involving processes such as narrowing of blood vessels, clotting, reduced blood supply, and inflammation [20].

We found oral temperate significantly less in intervention group this could be explained by cooling effect of injected saline. According to our findings, injecting hypertonic saline into the peritonsillar gap resulted in a notable decrease in postoperative pain.

We noticed that the patients in intervention group significantly required analgesia less than group without injection [p=0.034]. That was supported by study of **Ma et al.** [18] they found intervention group had lower Vas score with statistically significant value [p=0.001].

On the other hand, a study conducted by **Vieira et al.** [20] examined the VAS score in a group of 66 patients, ranging in age from 1 to 12 years. The patients were divided into two groups: a control group of 33 patients and an experimental group of 33 patients. In the experimental group, the oropharynx was cooled for 10 minutes after tonsil dissection and hemostasis. The results showed that the experimental group had significantly lower VAS scores on days 0, 5, and 6 compared to the control group [p<0.05]. This suggests that cooling the oropharynx after tonsillectomy can effectively reduce postoperative pain without causing any additional complications.

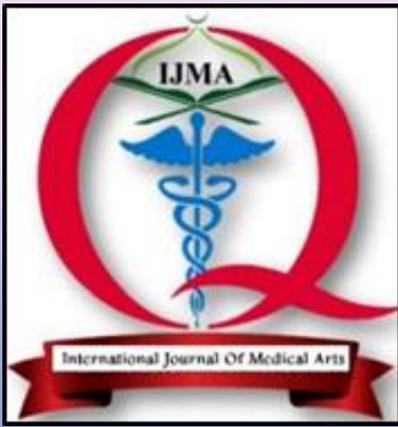
The injection of hypertonic saline can have multiple effects to achieve the desired outcome. It helps to move the tonsil away from the lateral pharyngeal wall, which minimizes the risk of injury to the muscles in that area. Additionally, it reduces the damage caused by electrocautery to the blood vessels in the lateral pharyngeal wall, preventing severe bleeding. It also absorbs some of the heat generated during the electrocautery technique, thus reducing thermal damage to the lateral pharyngeal wall. Furthermore, hypertonic saline increases the conductivity of the organ, enhancing the efficiency of electrocautery and allowing for the use of lower power while still achieving the desired cutting effect [18, 21].

Conclusion: Injecting hypertonic saline into the peritonsillar gap is an effective method for alleviating postoperative pain, decreasing analgesic needs and reducing intraoperative bleeding.

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