Mandour *et al.*
The Egyptian Journal of Otolaryngology (2023) 39:44
https://doi.org/10.1186/s43163-023-00407-1

The Egyptian Journal of Otolaryngology

ORIGINAL ARTICLE

Open Access

Effect of hot saline pack versus topical tranexamic acid in post adenoidectomy bleeding

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Abstract

Background Adenoidectomy is a popular surgical technique in the field of otolaryngology that is successful, safe, and effective. Diffuse microvascular post-adenoidectomy bleeding, on the other hand, is still a common concern.

Aim The objective of this study is to do a comparison between the efficacy of a hot saline pack versus topical tranexamic acid when administered topically in children who have had only adenoidectomy in terms of intra-operative blood loss and post-operative bleeding.

Methods This prospective case-control study contained a total of 180 patients, divided into three classes. Class A: This included 60 patients with application of a hot saline pack in control of intra-operative adenoidectomy bleeding. Class B: This included 60 patients with application of a topical tranexamic acid pack in control of intra-operative adenoidectomy bleeding. Class C: This included 60 patients with the use of a pack to hold intra-operative adenoidectomy bleeding

Results The mean intraoperative blood loss in class B was lower than classes A and C, the mean pre- and post-operative HB level was lower in class C than in classes A and B, the difference was statistically considerable between the three classes, comparison between classes showed statistically considerable differences between classes A and C and also between classes B and C, while there was a statistically non-considerable difference between classes A and B.

Conclusion The current study found that a topical tranexamic acid pack was more effective for post-adenoidectomy haemostasis than a hot saline pack, with a shorter time to haemostasis and fewer recurettage and electrocauterization procedures.

Trial registration Name of registration trial: Research ethics committee faculty of medicine Benha university. Registration number: Ms1-1-2020. Date of registration: 22-1-2021.

Keywords Tranexamic acid, Hot saline pack, Adenoidectomy, Bleeding

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Background

Adenoidectomy is a popular surgical technique in the field of otolaryngology that is successful, safe, and effective. Diffuse microvascular post-adenoidectomy bleeding, on the other hand, is still a common concern. When this happens, the patient will be terrified, the surgeon will be worried, and the patient's life may be jeopardised [1].

Using Beckman or LaForce adenotomes, the most often utilised approach today is still virtually blind. The surgeon assesses the adenoid tissue using palpation (or, in some cases, a mirror examination) [2].

Haemostasis is then established by applying pressure with posterior nasal tamponade and/or irrigation with saline. Hot water irrigation has been used for over a century to achieve haemostasis in obstetric prenatal and postnatal haemorrhage events [3].

Bleeding rates after adenoidectomy have been observed to range from less than 1% to as high as 8%. It is commonly divided into two categories: primary (lower than 24 h after surgery) and secondary (greater than 24 h, usually 5–10 days after surgery) [4].

Systemically used antifibrinolytics minimise intra-operative and post-operative bleeding during some operative procedures. Tranexamic acid (TA) is an antifibrinolytic medication that can be taken orally or given as an intravenous injection. Some researchers have recently utilised tranexamic acid topically to minimise intra- and post-operative bleeding [5].

The objective of this study was to compare the efficacy of a topical tranexamic acid pack to a hot saline pack for adenoidectomy haemostasis.

Methods

One hundred eighty patients aged from 2 to 8 years undergoing adenoidectomy due to nasal obstruction and snoring at Benha University Hospital, Faculty of Medicine, ENT Department at the period from March 2020 to March 2022 were included in this study. They were separated into three classes—class A: which contained 60 cases with the use of a warm saline pack in control of intra-operative adenoidectomy bleeding; class B: which included 60 cases with the use of topical tranexamic acid pack in control of intra-operative adenoidectomy bleeding; and class C: which included 60 cases with the use of a pack to hold intra-operative adenoidectomy bleeding. The patients were allocated to one of three classes at random. Local ethical committee approval and informed approval were taken from the parents earlier than the onset of the study. Children with recurrent adenoid hypertrophy, complex procedure (adenotonsillectomy), haemoglobin degree of 9 g/dL, bleeding disorders (e.g. haemophilia or thrombocytopenia), hepatic or renal morbidness, cleft palate, recognised hypersensitivity to TA, recent (7 days earlier than operative procedure) consumption of anti-platelets (e.g. aspirin, non-steroidal anti-inflammatory drugs), or heparin intake within 48 h of surgery were all excluded.

Surgical method

Palpating the palate, the size of the adenoid was measured subjectively using a mirror and rated using the same otolaryngologist who performed all of the procedures under general anaesthesia.

Each case was placed supine in the Rose position, with an extended neck and a shoulder roll set beneath the shoulders. Adenoidectomy curettes were used to accomplish the procedures. There was a Boyle-Davis gag introduced. A potential submucosal cleft was ruled out by Wormald and Prescott's three-level grading system [6]. The grade of choanal blockage induced by adenoids is utilised to grade this system.

Grade one (lower than one third of posterior choanae blocked), grade 2 (one third to two thirds of posterior choanae blocked), and grade 3 (greater than two thirds of posterior choanae blocked) are the three levels of grading. Digital palpation or endoscopic examination confirmed complete removal. A pack was used to apply pressure to the nasopharynx after the adenoidectomy. In class A, use of a hot saline pack (the pack soaked in 10 mL of saline at 50°C) in control of intra-operative adenoidectomy bleeding. In class B: use of topical tranexamic acid pack (the pack soaked in 1000 mg of TA diluted in 10 mL saline) in control of intra-operative adenoidectomy bleeding. In class C: use of a pack to hold intra-operative adenoidectomy bleeding. The nasopharyngeal pack was removed after 10 min. If the time limit of 10 min was exceeded, haemostasis was considered to have failed.

The existence of remaining adenoid tissue in the nasopharynx was evaluated in haemostasis failures.

In these cases, recurettage and/or bipolar electrocauterization were used.

The time between applying the mouth gag and removing it was considered as the surgery time.

Haemostasis duration was defined as the interval between the ending of the adenoidectomy operation and the accomplishment of haemostasis.

Statistical analysis

The data were aggregated, coded, and then analysed using the program SPSS (Statistical Package for Social Science) version 26 to obtain descriptive statistics calculated for the data in the form of mean, standard deviation (±SD) and counts and percentages. For statistical comparison between different cohorts, ANOVA (*F*-test) was used to compare between more than two cohorts of numerical (parametric) data, and post hoc test was used

to detect between cohort comparison. Paired *t*-test was used to compare the means of the two cohorts before and after the intervention. Comparison of categorical data between cohorts was performed by using chi-square test (X^2-value). A *P* value <0.05 was considered statistically significant.

Results

The youngest case in class A was 2 years old, and the Oldest was 7 years old (mean, 5.5 years; SD, 1.7 years) 53.3% of the cases were female and 46.7% of the cases were male. The youngest patient of class B was 2 and a half years old, and the oldest was 8 years old (mean, 5.3 years; SD, 1.4 years); 40% of the children were female and 60% of the children were male. The youngest patient of class C was 3 years old, and the oldest was 7 and half years old (mean, 5.2 years; SD, 1.6 years); 53.3% of the children were female and 46.7% of the children were male. Statistically, there were no significant differences in terms of age and sex in between the surgical classes (Table 1).

There was a statistically considerable difference in the mean intraoperative blood loss in between classes A, B, and C; between-classes comparison reveals that there was a statistically significant difference between classes A and B, between classes A and B, and also between classes B and C (Table 2).

The mean pre- and post-operative HB level was lower in class C than in groups A and B, the difference was statistically significant between the three classes, comparison between classes reveals that there was a statistically significant difference among classes A and C and also between classes B and C while there was a non-statistically significant difference among classes A and B. Regarding the difference between pre- and post-operative finding in each class, there was a statistically significant difference among pre- and post-operative HB level in all classes (Table 3).

The mean pre- and post-operative haematocrit value per cent was less in class A than in classes B and C, and the difference was non-statistically significant among the three classes.

Regarding the difference among pre-operative and post-operative findings in each class, there was a statistically significant difference between pre- and post-operative haematocrit value % in all classes (Table 4).

There was a non-statistically significant difference in the mean platelets count before and after surgery among classes A, B, and C. Regarding the difference in pre-operative and post-operative findings in each class, a statistically significant difference was observed between pre- and post-operative platelet count in classes A and B, but class C had no statistically significant difference (Table 5).

The mean pre- and post-operative partial thromboplastin time was less in class A than in classes B and C, and the difference was statistically significant among the three classes.

Between-class comparisons show that there was a statistically significant difference among classes A and B, between classes A and B, and also between classes B and C, except in the difference between classes B and C in post-operative partial thromboplastin time, the difference was non-statistically significant.

Regarding the difference between pre-operative and post-operative findings in each class, there was a statistically significant difference among pre-operative and post-operative partial thromboplastin time in all classes (Table 6).

Three children in class A suffered from primary haemorrhage, two of the children were treated conservatively, with the removal of nasopharyngeal blood clot using a blind-end wide-bore transnasal catheter and application of nasal decongestant drops locally, and only one patient needed 12 h of nasopharyngeal packing.

Blood transfusion was not necessary for any of the children who had a main haemorrhage (haemoglobin level was more than 9 g/dL). In this class, no secondary haemorrhage was detected. Only one child in class B suffered from a primary haemorrhage. This child was treated conservatively, with the removal of nasopharyngeal blood clot using a blind-end wide-bore catheter through the nose and transnasal decongestant drops applied locally. In class C, primary haemorrhage was observed in the 6 patients group, 4 children were treated conservatively without the need for transfusion of blood, and blood transfusions were necessary in two of the latter cases (Hb levels were lower than 7 g/dL).

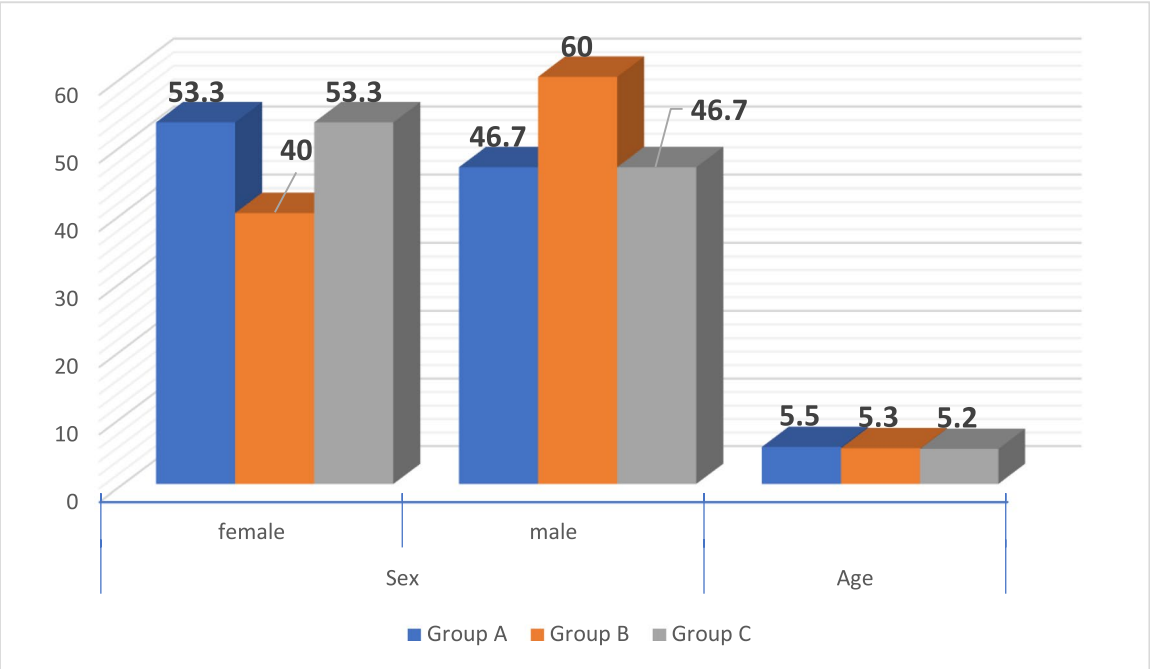
Only one case in class C experienced secondary haemorrhage 7 days after surgery, which was treated conservatively with broad-spectrum parenteral antibiotics, nasal decongestant drops, and systemic TA.

Discussion

Adenoidectomy is a common surgical procedure in children. Traditionally, haemostasis is achieved by tamponade with a posterior nasal pack and/or diathermy using a mirror. Modifications for more rapid and more effective haemostasis have been suggested in the literature. Adenoidectomy usually does not cause significant bleeding. Approximately 50 mL of blood loss was reported for curette adenoidectomy [7]. After adenoidectomy, some tissues may be damaged, as with any surgery. This may release enzymes that convert plasminogen to plasmin, promote fibrinolysis and activate the fibrinolytic system, such as tissue plasminogen activators. This is particularly noticeable during

Table 1 Comparison of the demographic data in the two study classes

Characteristics		Class A (Hot saline pack with irrigation) (n=60)	Class B (Topical tranexamic acid) (n=60)	Class C Control group (n=60)	Test of sig.	p-value
Age (mean ± SD)		5.5± 1.7	5.3 ± 1.4	5.2 ± 1.6	0.5	0.6
Sex No. (%)	Female	32 (53.3%)	24 (40%)	32 (53.3%)	2.8	0.3
	Male	28 (46.7%)	36 (60%)	28 (46.7%)		



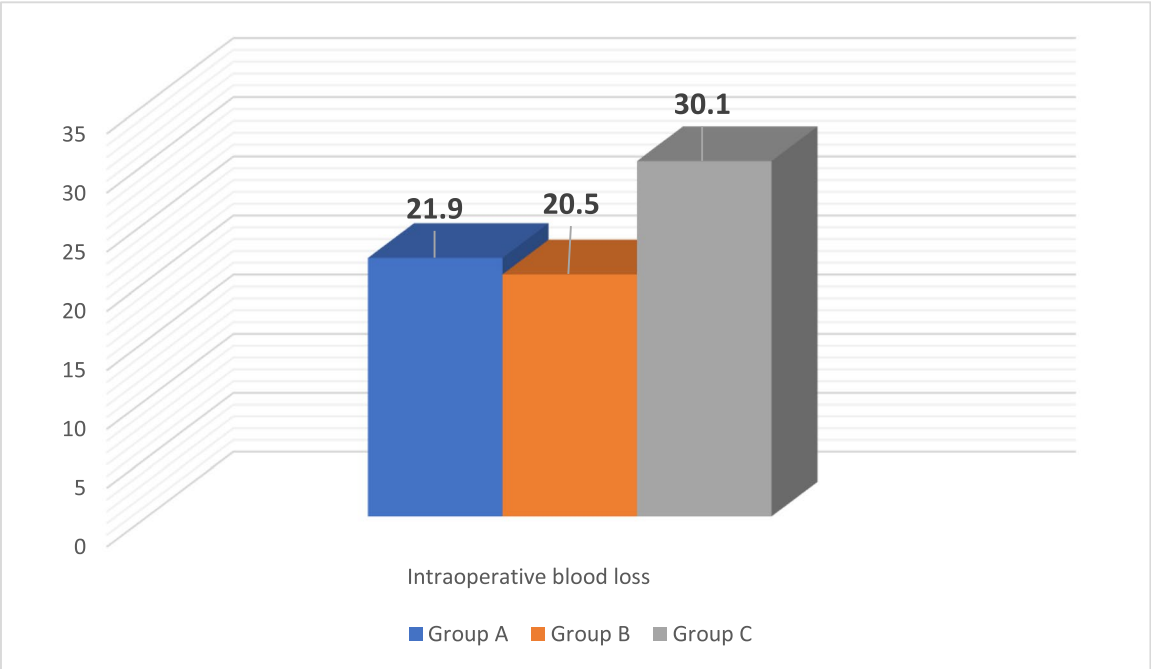
surgery and in the first few days after surgery [8]. A number of studies have addressed the issue of bleeding after adenoidectomy, but the evidence is limited due to a lack of data about the study plan and follow-up, an unspecified response rate to questionnaires, a small cases number, and difficulties comparing with studies on cases with no age limits [9]. Placing gauze packing in the nasopharynx and leaving it for a while is the most commonly used technique for haemostasis of intraoperative bleeding. If bleeding cannot be controlled by gauze packings, irrigation by saline, and packings with epinephrine, electrocautery can also be used [10].

Teppo et al. studied the effectiveness of the topical application of racemic adrenaline in adenoidectomy to control intraoperative bleeding and prevent post-operative bleeding. Adrenaline reduced surgeons' subjective estimates of intraoperative bleeding by a significant amount. Topical adrenaline was not proven to be as effective as hot saline irrigation, but topical adrenaline also harbours the risk of systemic side effects [11]. In

Table 2 Comparison of the intraoperative blood loss in the 2 study classes

Characteristics	Class A (Hot saline pack with irrigation) (n=60)	Class B (Topical tranexamic acid) (n=60)	Class C Control group (n=60)	F test	p-value	Inter class comparison
Intraoperative blood loss (mean ± SD)	21.9± 2.3	20.5 ± 1.7	30.1 ± 1.9	410.6	<0.001	P1<0.001
						P2<0.001
						P3<0.001

P1 () Gr A & Gr B, P2 () Gr A & Gr C, P2 () Gr B & Gr C



P1, Gr A and Gr B; P2, Gr A and Gr C; P2, Gr B and Gr C

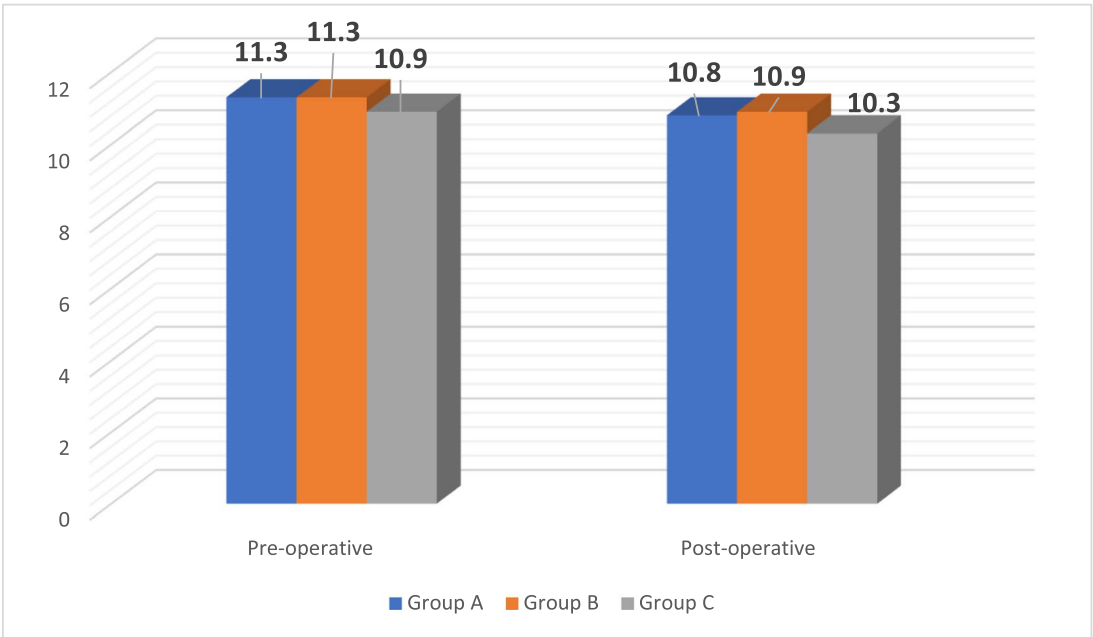
various sectors of medicine, hot (45°C) saline solutions were employed to stop bleeding.

In patients with posterior epistaxis, Stangerup et al. investigated the modified hot water irrigation and compared the results to pack therapy. Hot water irrigation was just as efficient as a pack, but it took a lot less time in the hospital, was less damaging to the nose, and was less painful [12]. On the basis of the temperature level, the technique of the haemostatic effect of hot water was discovered [13]. Stangerup and Thomsen investigated the histological changes in the nasal mucosa by applying hot water irrigation at temperatures ranging from 40 °C to 60 °C for 5 min intranasally in an experimental model of rabbits and reported a lack of histological changes for

Table 3 Comparison of the HB level (pre- and post-operative) in the two study classes

Characteristics	Class A (Hot saline pack with irrigation) (n=60)	Class B (Topical tranexamic acid) (n=60)	Class C Control group (n=60)	F test	P-value	Inter class comparison
Pre-operative (mean ± SD)	11.3± 0.4	11.3 ± 0.6	10.9 ± 0.5	13.1	<0.001	P1=0.08 P2<0.001 P3<0.001
Post-operative (mean ± SD)	10.8± 0.47	10.9± 0.49	10.3± 0.45	27.6	<0.001	P1=0.4 P2<0.001 P3<0.001
Paired t test	31.6	15.3	28.2			
P-value	<0.001	<0.001	<0.001			

P1 () Gr A & Gr B, P2 () Gr A & Gr C, P2 () Gr B & Gr C

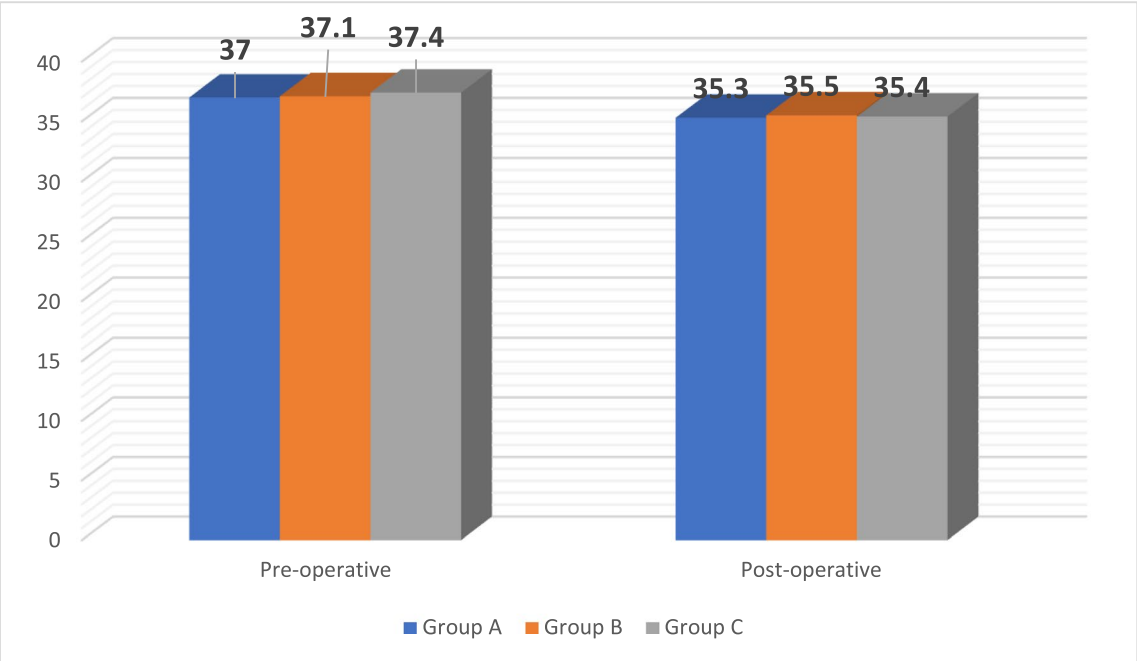


P1, Gr A and Gr B; P2, Gr A and Gr C; P2, Gr B and Gr C

Table 4 Comparison of the haematocrit value % (pre- and post-operative) in the two study classes

Characteristics	Class A (Hot saline pack with irrigation) (n=60)	Class B (Topical tranexamic acid) (n=60)	Class C Control group (n=60)	F test	P-value
Pre-operative (mean ± SD)	37± 2.9	37.1 ± 2.8	37.4 ± 3.1	0.3	0.8
Post-operative (mean ± SD)	35.3± 3.2	35.5± 3.4	35.4± 3.4	0.1	0.9
Paired t test	18.3	21.5	24.3		
P-value	<0.001	<0.001	<0.001		

P1 () Gr A & Gr B, P2 () Gr A & Gr C, P2 () Gr B & Gr C

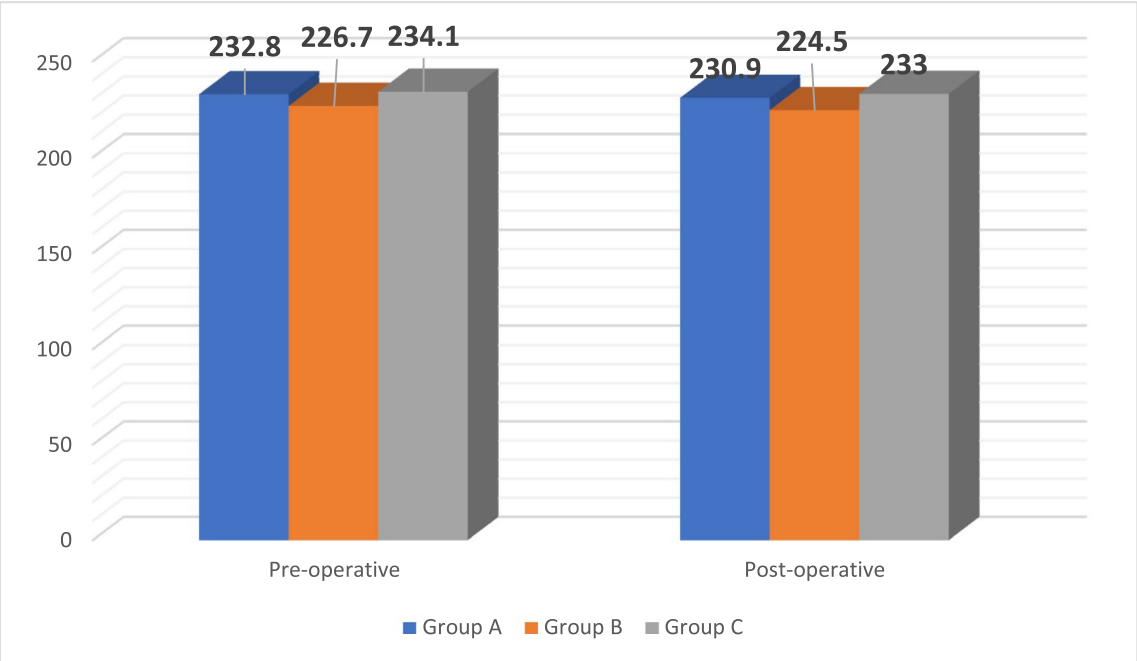


P1, Gr A and Gr B; P2, Gr A and Gr C; P2, Gr B and Gr C

Table 5 Comparison of the platelets count (pre- and post-operative) in the two study classes

Characteristics	Class A (Hot saline pack with irrigation) (n=60)	Class B (Topical tranexamic acid) (n=60)	Class C Control group (n=60)	F test	P-value
Pre-operative (mean ± SD)	232.8± 29.2	226.7 ± 31.6	234.1 ± 30.2	0.9	0.4
Post-operative (mean ± SD)	230.9± 29.3	224.5± 31.7	233± 31.4	1.2	0.3
Paired t test	14.9	18.6	1.8		
P-value	<0.001	<0.001	0.09		

P1 () Gr A & Gr B, P2 () Gr A & Gr C, P2 () Gr B & Gr C

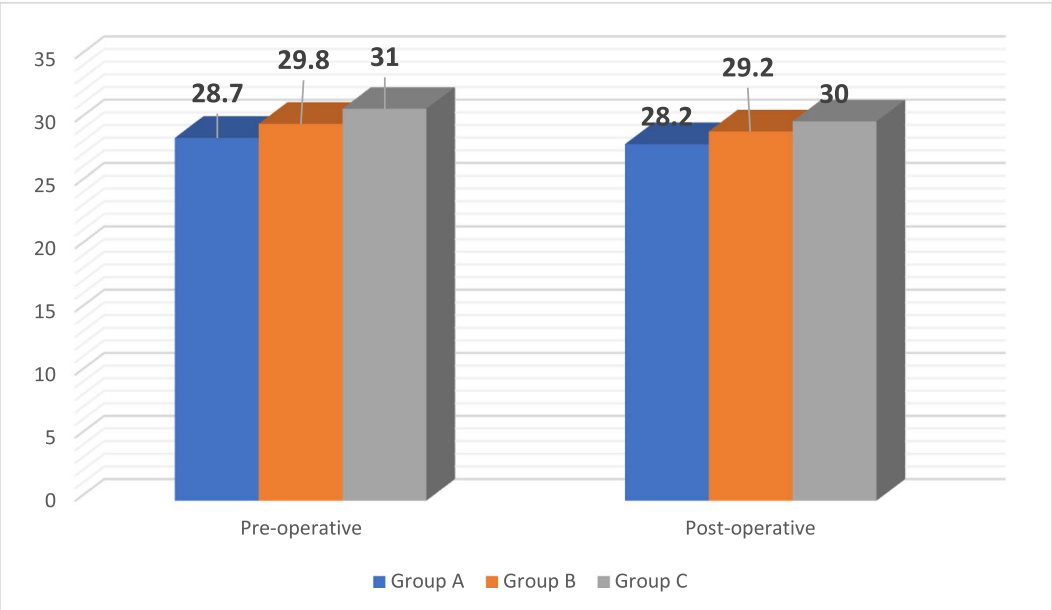


P1, Gr A and Gr B; P2, Gr A and Gr C; P2, Gr B and Gr C

Table 6 Comparison of the partial thromboplastin time (pre and post-operative) in the two study classes

Characteristics	Class A (Hot saline pack with irrigation) (n=60)	Class B (Topical tranexamic acid) (n=60)	Class C Control group (n=60)	F test	P-value	Inter group comparison
Pre-operative (mean ± SD)	28.7± 2.2	29.8 ± 1.9	31 ± 2.4	17.1	<0.001	P1=0.005 P2<0.001 P3=0.003
Post-operative (mean ± SD)	28.2± 2.3	29.2± 1.9	30± 2.5	9.7	<0.001	P1=0.02 P2<0.001 P3=0.06
Paired t test	4.9	9.4	12.1			
P-value	<0.001	<0.001	<0.001			

P1 () Gr A & Gr B, P2 () Gr A & Gr C, P2 () Gr B & Gr C



P1, Gr A and Gr B; P2, Gr A and Gr C; P2, Gr B and Gr C

irrigations with 40 °C and 46 °C while there was a narrowing of the intranasal lumen after vasodilation and oedema in the mucosa when the temperature of saline irrigation solutions raised between 46 °C and 52 °C. They further showed that irrigation at 52 °C and above leads to epithelial necrosis [13].

Ozmen and Ozmen demonstrated that the 50°C saline irrigation was more effective for post-adenoidectomy haemostasis in comparison to room-temperature (25°C) saline irrigation by providing a lesser haemostasis time and requiring lesser need of recurettage and electrocauterization [14]. By minimising the use of electrocautery, irrigation with hot saline could potentially minimise the risk of problems. Though the significance of cautery in the development of post-operative problems has yet to be determined, its importance in the development of neck pain or Grisel's syndrome has been recognised [15]. In any event, the use of electrocautery for haemostasis causes tissue injury, and electrocautery dissection produced more eschar than traditional "cold" procedures [16]. The pharmacology of tranexamic acid is well known, with its synthetic derivative of 4-(amino-methyl) cyclohexane carboxylic acid, which exhibits antifibrinolytic activity, having been discovered in 1964 and in common usage since the 1970s, competitively binds to the lysine-binding sites on plasminogen to prevent plasminogen from binding to fibrin and subsequent activation and conversion to plasmin, thereby preventing fibrinolysis and stabilising the thrombi [17]. Some authors have documented the topical administration of TA in otorhinolaryngology in their publications on endoscopic sinus surgery and epistaxis control [18]. Albirmawy et al. showed that topical application of tranexamic acid after adenoidectomy led to a significant reduction in blood loss during surgery and decreasing in the rate of postoperative bleeding as well as the need for postnasal packing and blood transfusion [19].

The reported incidence of bleeding after adenoidectomy differs widely, with some studies describing any episode of bleeding while others only reference patients who required surgical treatment under general anaesthesia [4]. Preoperative bleeding risk screening was attempted in this study by measuring the partial thromboplastin time and platelet count, as well as taking a full history of any bleeding disorders like haemophilia and thrombocytopenia. These are not, however, the most common causes of otolaryngology post-operative bleeding episodes. There was a non-statistically significant difference in the mean pre-operative and post-operative platelet count in among classes A, B and C. Regarding the difference between preoperative and post-operative findings in each class, there was a statistically significant difference among pre- and post-operative platelet count in classes A and B. While there was a non-statistically significant difference in class C, the mean pre- and post-operative partial thromboplastin time was lower in class A than in class B and C, the difference was statistically significant between the three classes, between-class comparison reveals that there was a statistically significant difference between classes A and B, between classes A and B, and also between classes B and C, except in the difference between classes B and C in post-operative partial thromboplastin time, the difference was non-statistically significant. Regarding the difference between pre- and post-operative findings in each class, there was a statistically significant difference between pre- and post-operative partial thromboplastin time in all classes, and there was a statistically significant difference in the mean intraoperative blood loss between classes A, B and C.

Between-classes comparison reveals that there was a statistical significance among between classes A and B, between classes A and B, and also among classes B and C.

Conclusion

The current study found that a topical tranexamic acid pack was more effective for post-adenoidectomy haemostasis than a hot saline pack, with a shorter time to haemostasis and fewer recurettage and electrocauterization procedures.

Acknowledgements
Not applicable.

Authors' contributions
YM and AE collected scientific data. MA wrote the manuscript. OA performed the procedure. MG performed the statistical analysis. All authors read and approved the final manuscript.

Funding
No external source of funding.

Availability of data and materials
Data are available on request.

Declarations

Ethics approval and consent to participate
This study was approved by the Research Ethics Committee, Faculty of Medicine, Benha University. Code of the study is Ms1-1-2020. Consent to participate: Informed written consent was obtained from all parents/guardians of patients below the age of 16 years.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Received: 3 December 2022 Accepted: 10 February 2023
Published online: 08 March 2023

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