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## ORIGINAL ARTICLE

# Effect of Tranexamic Acid and H<sub>2</sub>O<sub>2</sub> on Blood Loss During Functional Endoscopic Sinus Surgery

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## Abstract

**Background:** It might be dangerous and further obstruct the surgical field to have intraoperative bleeding during endoscopic sinus surgery (ESS). Tranexamic acid may be able to reduce bleeding during surgery.

**Aim:** Assess the effect of topical TXA and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) solution on bleeding and improvement of surgical field during functional endoscopic sinus surgeries (FESS) in patients with chronic sinusitis with or without sino nasal polyposis.

**Patients and methods:** 30 patients were included, for all the 30 patients, Pads soaked with TXA 5% was introduced in one side of the nasal cavity for 10 min then irrigation by 3% H<sub>2</sub>O<sub>2</sub> solution which was freshly prepared by a 50% dilution with a physiological saline solution. The other side of the nasal cavity was not receive pads of TXA nor H<sub>2</sub>O<sub>2</sub> and was only on controlled blood pressure during the operation.

**Result:** There was statistically significant difference between both sides with time reduced in applied side after the application of tranexamic acid and H<sub>2</sub>O<sub>2</sub> wash regarding surgical field by Boezaart grading, but it is non-significant in control side. There were statistically significant differences according to blood loss between both sides of the nose after application of tranexamic acid and H<sub>2</sub>O<sub>2</sub> wash either after 15, 30, and 45 min.

**Conclusion:** The application of topical TXA with the irrigation with 3% H<sub>2</sub>O<sub>2</sub> may be a useful method for providing a suitable surgical field.

**Keywords:** Endoscopic sinus surgery, Hydrogen peroxide, Tranexamic acid

## 1. Background

Most patients having endoscopic sinus surgery prefer general anaesthesia because nasal bleeding during the procedure might make it difficult to maintain and manage the airway. However, it has been speculated that by reducing capillary resistance, general anaesthesia could boost intraoperative bleeding during surgery. Another issue in endoscopic sinus surgery is bleeding that reduces intraoperative vision.<sup>1</sup>

Important anatomical landmarks and structures may be difficult to distinguish when there is bleeding, increasing the risk of intraoperative

problems, lengthening the procedure, and increasing the likelihood that the operation may be unsuccessful. Induced hypotension and the use of different anaesthetic and vasoconstrictive drugs are only a couple of the techniques that may be utilized to lessen intraoperative blood loss and enhance vision of the surgical region.<sup>2</sup>

Antifibrinolytic medication tranexamic acid can be used to lessen intraoperative bleeding. Tranexamic acid functions as a competitive binder at the lysine position on plasminogen throughout the clotting cascade. By halting fibrinolysis and stabilizing blood clots, this may help to stop additional bleeding. The outcomes of a number of recent

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studies regarding the use of tranexamic acid in endoscopic sinus surgery are positive.<sup>3</sup>

## 2. Patients and methods

This study include a comparison between the two sides of nasal cavity in 30 patients who are suffering from chronic rhinosinusitis with or without polypsis are indicated for Functional endoscopic sinus surgeries (FESS), presenting to the Al-Azhar University Hospitals (Al-Hussein & Sayed Galal).

Intraoperatively, for all the 30 patients, Pads soaked with TXA 5% will be introduced in one side of the nasal cavity for 10 min then irrigation by 3% H<sub>2</sub>O<sub>2</sub> solution which will be freshly prepared by a 50% dilution with a physiological saline solution. The other side of the nasal cavity will not receive pads of TXA nor H<sub>2</sub>O<sub>2</sub> and will be only on controlled blood pressure during the operation Fig. 1.

### 2.1. Inclusion criteria

Age: patients aged 18–60 years. Sex: Both males and females. Only those who undergoing FESS due to CRS with or without polyposis. Normal Hb (>10 mg/dl), clotting time (CT), bleeding time (BT), international normalized ratio (INR), prothrombin time (PT), Partial thromboplastin time (PTT).

### 2.2. Exclusion criteria

Patients with uncontrolled systemic illness. Patient with diathesis to hemorrhage such as (a) hemophilia; (b) thrombosis; (c) acute or chronic renal failure; (d) using heparin during 48 h before surgery; (e) using aspirin during 14 days before surgery. Previous history of nasal surgery, age group less than 18 years old or more than 60 years old, having nasal Tumors, known allergy to TXA.

All patients will be subjected to the following:

Written consent, Detailed history taking, E.N.T. Examination, Endoscopic Examination, CT nose and para nasal sinuses, Patients will be admitted one day before the surgery with routine baseline investigations like CBC, PT, PTT, INR, RBS, S. create and viral markers.

### 2.3. Outcome measures

- (1) The quality of the surgical field at 15, 30, and 45 min after the start of surgery using Boezaart grading<sup>4</sup> with 0–5 scores
- (2) Bleeding at 15, 30, and 45 min after the start of surgery using blood accumulated in the suction chamber after reducing the amount of normal saline used for washing and measurement of nasopharyngeal pack weight and converting the blood weight into ml.

### 2.4. Statistical analysis

The collected data was tabulated, and statistically analyzed using Statistical Package for Social Sciences program (SPSS) software version 26.0, Microsoft Excel 2016. The level of significance was taken at *P* value less than 0.05 is significant, otherwise is non-significant. The *P*-value is a statistical measure for the probability that the results observed in a study could have occurred by chance.

## 3. Results

The studied patients with chronic rhinosinusitis seen during the study period, included 13 (43.3%) women and 17 (56.7%) men (Fig. 2). The mean age was  $38.55 \pm 5.91$  years. The mean BMI was  $27.60 \pm 1.25$ . 40% patients had history of Asthma. 46.7% patients had history of smoking. The mean



Fig. 1. Showing tranexamic acid 5% and Hydrogen Peroxide 3%.

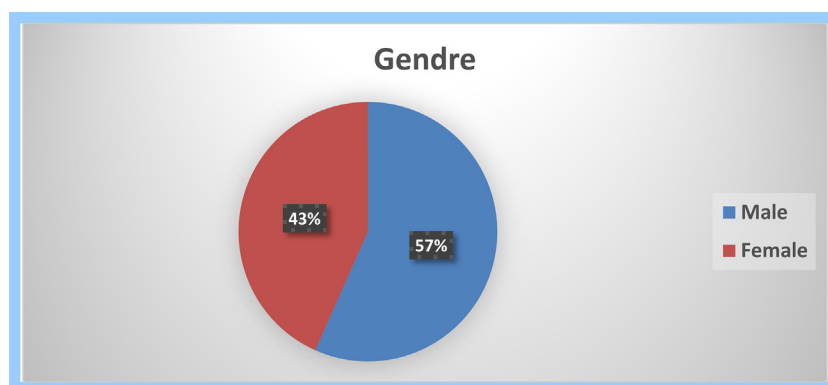


Fig. 2. Gender distribution.

duration of rhinosinusitis was  $7.70 \pm 1.99$  years (Fig. 3).

There were statistically significant differences according to surgical field by Boezaart grading between both sides of the nose after application of tranexamic acid and  $H_2O_2$  wash either after 15 min ( $P < 0.05$ ), 30 min ( $P < 0.001$ ) and 45 min ( $P < 0.001$ ). Also, there was statistically significant difference between both sides with time reduced in applied side after the application of tranexamic acid and  $H_2O_2$  wash regarding surgical field by Boezaart grading ( $P < 0.001$ ) but it is non-significant in control side ( $P = 0.236$ ) (Table 1).

Regarding the amount of bleeding there were statistically significant differences according to blood loss between both sides of the nose after application of tranexamic acid and  $H_2O_2$  wash either after 15 min ( $P < 0.05$ ), 30 min ( $P < 0.001$ ) and 45 min ( $P < 0.001$ ).

Also, there was statistically significant difference in both sides with time reduced in applied side after the application of tranexamic acid and  $H_2O_2$  wash

blood loss ( $P < 0.001$ ) but it is non-significant in control side ( $P = 0.278$ ) (Table 2).

#### 4. Discussion

In this current study we demonstrated the effect of application of topical Tranexamic acid with irrigation of nasal cavity with  $H_2O_2$  3%, to aid in hemostasis and the reduction of the amount of blood loss during FESS.

3%  $H_2O_2$  is utilized during nasal operations due to its antibacterial qualities and advantageous effects on hemostasis.  $H_2O_2$  irrigation has also been demonstrated to be beneficial in reducing the amount of time that surgically altered tissues need to recover Maghsoudipour and colleagues.<sup>5</sup>

Topical or systemic tranexamic acid lowers bleeding during surgery and enhances the operative field, according to prior meta-analyses Pundir and colleagues.<sup>6</sup> Which agreed with our findings. Because of this, topical usage may be helpful when it comes into touch with the clot surface.<sup>7</sup>

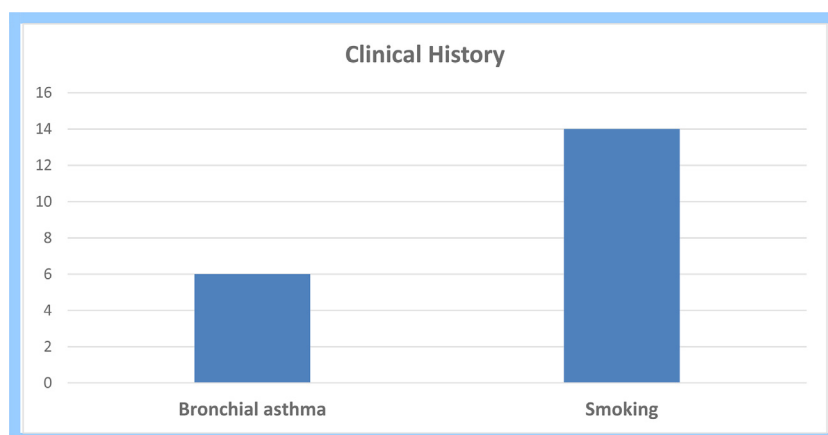


Fig. 3. Clinical history.

Table 1. Comparison between both sides regarding quality of surgical field.

Surgical field by Boezaart grading	Applied side (n = 30)	Control side (n = 30)	Mann-Whitney U test	
			Z <sub>MWU</sub>	P-value
At 15 min				
Mean ± SD	2.5 ± 1.5	3.5 ± 1	2.170	0.042
Median	3	4		
Range	2.0–4.0	3.0–5.0		
At 30 min				
Mean ± SD	2 ± 0.5	3.0 ± 1.5	3.623	<0.001
Median	2.5	4.5		
Range	2.5–1.5	3.0–5.0		
At 45 min				
Mean ± SD	1.5 ± 0.5	3.0 ± 1.0	3.486	<0.001
Median	2	3.5		
Range	1.0–2.5	3.5–5		
Wilcoxon Signed Ranks Test				
Z	4.802	0.264		
P-value	<0.001	0.236		

However, in a prior study, the beneficial effects of tranexamic acid on bleeding and the surgical field in various time periods tended to fade with passing time as a result of the decline in local concentration Jahanshahi and colleagues.<sup>8</sup>

Therefore, these time-dependent alterations would have a greater impact on operating time than total operative bleeding and surgical field quality. Tranexamic acid works as an anti-fibrinolytic agent by preventing tissue plasminogen activator from doing its job Jabalameli and Zakeri.<sup>9</sup> In order to minimise intraoperative bleeding, it can thus be administered topically to the nose or systemically via this mechanism in the coagulation cascade Shehata and colleagues.<sup>10</sup>

Table 2. Comparison between both sides regarding the amount of bleeding.

Blood loss	Applied side (n = 30)	Control side (n = 30)	Mann-Whitney U test	
			Z <sub>MWU</sub>	P-value
At 15 min				
Mean ± SD	15 ± 4.5	35 ± 9.5	4.182	<0.001
Median	18	44		
Range	12.5–20.0	30.0–55.0		
At 30 min				
Mean ± SD	12.0 ± 6.5	30.0 ± 7.5	5.398	<0.001
Median	15	35		
Range	8.0–15.0	30–40		
At 45 min				
Mean ± SD	8.5 ± 3.5	25 ± 9.0	7.906	<0.001
Median	11	28		
Range	7.5–12.5	20.0–35.0		
Wilcoxon Signed Ranks Test				
Z	6.401	0.141		
P-value	<0.001	0.278		

Furthermore, despite reports that tranexamic acid is tolerated and safe, concerns regarding its usage have historically been raised by the possibility of thrombosis Franchini and colleagues.<sup>11</sup> The application of tranexamic acid topically, however, may benefit locally from a reduced dosage needed and an anticipated reduction in systemic absorption that may lessen the likelihood of systemic adverse effects Kang and Hwang.<sup>12</sup>

In this study, topical tranexamic acid treatment had no discernible effect on intraoperative blood pressure or the incidence of postoperative emesis. Numerous studies have revealed that the side effects of tranexamic acid are dose-dependent when administered intravenously and uncommon when applied locally Baradaranfar and colleagues.<sup>13</sup>

The direct and local contact to the working field without systemic absorption would be the primary factor in the decreased likelihood of harmful consequences Athanasiadis and colleagues.<sup>7</sup> Although topical application could be partially absorbed systemically. It was previously reported that topical administration as a mouthwash had no discernible impact on plasma level Kang and Hwang.<sup>12</sup>

According to these findings, topical treatment during sinus surgery is a secure and reliable way to control postoperative bleeding. The effectiveness of tranexamic acid for intraoperative bleeding and other pathological conditions has been demonstrated in a number of recent research on endoscopic sinus surgery using topical administration of the medication Jabalameli and Zakeri.<sup>9</sup>

The goal of this study was to evaluate the effectiveness of tranexamic acid in conjunction with 3% H<sub>2</sub>O<sub>2</sub> irrigation of the operative field to enhance both the surgeon's and the patient's experience during sinus surgery. In this study, 30 patients with chronic rhinosinusitis were included. The patients' ages varied from 34 to 50 years old, with a mean of 38.55(5.91) years. Of the patients, 56.7% were men and 43.3% were women. The average rhinosinusitis illness lasted 7.70 (1.99) years.

This study demonstrated a considerable improvement in the surgical field at the applied side in terms of the quantity of blood loss and the requirement for intraoperative blood suction following the administration of TXA and 3% H<sub>2</sub>O<sub>2</sub> irrigation on the applied side of the nasal cavity during FESS. When compared with the controlled side of the nasal cavity, where there was more blood loss and a larger requirement for ongoing suction with less sight of the surgical field, there was a conscious improvement in the visual field visibility with a P value of (P 0.001).



Additionally, we observed that the applied side of the nasal cavity required less overall time to complete the procedure than the controlled side, which required significantly more time, with a  $P$  value of ( $P$  0.001) in comparison to ( $P$  0.278). In compared with the other controlled side of the nasal cavity, the applied side's surgical field quality has overall much improved.

This study demonstrated a significant decrease in blood loss and the need for intraoperative blood suction in the applied side of the nose treated with TXA and 3%  $H_2O_2$  as compared with the controlled side of the nasal cavity, with a  $P$  value of ( $P$  0.001). This finding was similar to that of the study conducted by Moise and colleagues<sup>14</sup> research demonstrated that the side of the nose getting 10 mg/kg tranexamic acid in 10 mL of saline solution had an ~50% lower total volume of intraoperative blood loss than the side receiving 10 mL of saline, with a  $P$  value of ( $P$  = 0.0001).

This study demonstrated a significant decrease in blood loss and the need for intraoperative blood suction in the applied side of the nose treated with TXA and 3%  $H_2O_2$  as compared with the controlled side of the nasal cavity, with a  $P$  value of ( $P$  0.001). This finding was similar to that of the study conducted by Kang and Hwang,<sup>12</sup> Results shown that the treated side's intraoperative blood loss was statistically considerably lower than the control side's, with a  $P$  value of ( $P$  = 0.0001).

The quality of the surgical field significantly improved based on Boezaart grading at 15, 30, and 45 min after the start of surgery with a  $P$  value of ( $P$  = 0.002) in the study conducted by Jahanshahi and colleagues,<sup>8</sup> which also included 30 patients. This study was done by application of pads of TXA plus phenylephrine in the applied side of the nasal cavity and phenylephrine alone in the controlled side.

In this investigation, the Boezaart grading estimate of the duration of operation decrease at 15 min revealed a  $P$  value of ( $P$  0.001), which is better than the study by Jahanshahi and colleagues<sup>8</sup> with a  $P$  value of ( $P$  0.002). Our research's estimate of the operating time reduction at 30 min revealed a  $P$  value of ( $P$  0.001), which is better than the study by Jahanshahi and colleagues,<sup>8</sup> which had a  $P$  value of ( $P$  = 0.003). In our investigation, the estimated Boezaart grading decrease in operating time at 45 min had a  $P$  value of ( $P$  0.001), which is better than the study by Jahanshahi and colleagues,<sup>8</sup> which had a  $P$  value of ( $P$  = 0.163).

The mean age of the 30 patients treated with TXA in the study by Baradaranfar and colleagues<sup>13</sup> was 38.6, which was similar to the study's mean age of (39.03 6.10). The mean average of the duration of

chronic rhinosinusitis in the study by Baradaranfar and colleagues<sup>13</sup> as regard the 30 patients treated with TXA was (15.73), in contrast to our study's mean average of ( $7.70 \pm 1.99$ ).

In the research of Baradaranfar and colleagues<sup>13</sup> According to Boezaart's scale, the surgical field quality findings had a  $P$  value of ( $P$  = 0.305) compared with our study's results, which had a superior  $P$  value of ( $P$  0.001). The overall operating time in this study significantly decreased with a  $P$  value of ( $P$  0.001), which is better than the  $P$  value of ( $P$  = 0.225) in the study by Baradaranfar and colleagues<sup>13</sup>

This study's findings were superior to those of a study by Baradaranfar and colleagues,<sup>13</sup> which found that intraoperative blood loss was statistically significantly lower in the group treated with TXA than the control. This study showed a significant reduction in the amount of blood loss and the suction of blood needed intraoperatively in the applied side of the nose treated with TXA and 3%  $H_2O_2$  as compared with the controlled side of the nasal cavity.

In this study, there were only a few instances of postoperative side effects such nausea, vomiting, and reduced colour vision. In the applied side of the nasal cavity, 13.3% of patients reported experiencing nausea, 6.7% reported vomiting, and 3.3% reported having reduced colour vision. 6.7% of patients on the controlled side had nausea, while 3.3% of patients experienced vomiting. Regarding the negative effects of the drug employed in this investigation, there was no statistically significant difference between the two sides of the nasal cavity ( $P$  > 0.05).

#### 4.1. Conclusion

The application of topical TXA in combination with the irrigation with 3%  $H_2O_2$  may be a useful method for providing a suitable surgical field.

#### Conflicts of interest

Authors declare that there is no conflict of interest, no financial issues to be declared.

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