

# Evaluation of Topical Tranexamic Acid on Intraoperative Bleeding in Endoscopic Sinus Surgery

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## Abstract

Tranexamic acid (TA) is an antifibrinolytic agent which reduces bleeding following certain surgical procedures. The present study was performed on 56 patients, scheduled for elective endoscopic sinus surgery under general anesthesia, to examine the effects of topical TA on providing a bloodless surgical field and evaluate the bleeding volume. The study comprised 26 patients who received topical TA and 30 patients used placebo. The hemodynamic endpoints were to maintain the mean arterial blood pressure at 30% below its preoperative level. Intraoperative bleeding was assessed using a six point scale. There was less bleeding volume in the TA group than in the placebo group ( $174.0 \pm 10.6$  vs  $229.1 \pm 23.8$  ml;  $P < 0.05$ ). The frequency of score 3 was 26% in TA group which was significantly lower than of placebo group (70%). The bleeding score of TA group was significantly lower than of placebo group ( $2.3 \pm 0.2$  vs.  $2.5 \pm 0.15$ ). In conclusion it seems that topical application of tranexamic acid reduces intraoperative bleeding in endoscopic sinus surgery.

**Iran J Med Sci 2006; 31(4): 221-223.**

**Keywords** • Tranexamic acid • bleeding • endoscopic sinus surgery

## Introduction

**T**he main consideration in sinus surgery is blood loss due to the highly vascular nature of the mucosa.<sup>1</sup> Operative bleeding may be arterial, capillary or venous and serious complications, usually result from impaired visibility of ruptured blood vessels due to excessive bleeding during surgery.<sup>2</sup> To avoid these complications, endoscopic sinus surgery can be performed under general anesthesia supplemented with controlled hypotension.<sup>3</sup>

Although, hypotensive anesthesia may decrease intraoperative bleeding, it is not confirmed by some studies.<sup>4</sup> Severe hypotension may occur by iv administration of potent anti-hypertensive drugs potent and rapid effects of and thus, direct monitoring of arterial pressure is mandatory. Tranexamic acid (TA) is an antifibrinolytic agent that may be administered orally or by iv injection to reduce bleeding following some procedures.<sup>5,6</sup> The drug inhibits transformation of plasminogen into plasmin. The present study was conducted to evaluate the effect of topical administration of TA on the intraoperative bleeding, the severity and the volume in sinus surgery.

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## Patients and methods

This clinical trial was performed on 56 patients with class I and II ASA (American Society of Anesthesiologist) patients scheduled for elective endoscopic sinus surgery under general anesthesia. The average ages of the patients were 18 to 55-years-old. They were not on medications affecting coagulation system. They had no history of thromboembolic events, disseminated intravascular coagulopathy, hemophilia, hypersensitivity to drugs and their renal function was normal.

After describing the procedure to the patients a written consent was obtained and then they were randomly assigned to TA (n=26) and placebo groups (n=30). All patients received a drop of nasal phenylephrine (0.5%) at 15 minutes before induction of anesthesia. Anesthesia was induced and maintained by 1.5% halothane (v/v) in a mixture of oxygen and nitrous oxide (50/50 v/v).

In order to maintain a desired hypotension, the mean arterial blood pressure (MAP) was considered as 30% below patient's preoperative mean pressure. The direct control of MAP was attained by increments of halothane up to a maximum of 1.5% (v/v) as needed, and if unsuccessful, after 10 minutes an intravenous bolus of 2 µg/kg Fentanyl was administered.<sup>7</sup> If during 10 minutes both drugs failed to achieve the desirable level of MAP, a bolus injection of hydralazine (100 µg/kg) was given intermittently, up to a maximum dose of 40 mg/kg. When MAP did not reach the end point, blood pressure was reduced by other agents, such as sodium nitroprusside. After reaching the target pressure, tranexamic acid (1000 mg diluted in 20 ml normal saline) or the same volume of normal saline was administered topically to patients of TA and placebo groups respectively. Intraoperative bleeding was assessed according to the classification of 6 points scale shown in Table 1.

than 1% needed in 4 (7.1%) patients and between 1 to 1.5% needed in 52 patients (92.9%).

As shown in Table 1, the frequency of bleeding and its severity with grade 1 and 2 in TA group was significantly more than that of placebo group ( $p < 0.05$ ) and there were significant differences between two groups with respect to mean bleeding volume and the grade of bleeding.

## Discussion

During endoscopic sinus surgery, excessive bleeding is an important and common complication.<sup>7</sup> Controlled hypotension is used as an aid to surgery to reduce bleeding in patients undergoing middle ear or nasal surgery.<sup>8</sup>

TA is a hydrophilic drug with antifibrinolytic property. It has also been claimed to exhibit anti-inflammatory and whitening effects for topical use.<sup>5</sup> The use of this agent is, however, contraindicated in patients with a history of thromboembolic diseases.<sup>5</sup> Topical use of this agent is reported in parotid surgery,<sup>5</sup> coronary artery bypass,<sup>9</sup> and hemophiliacs undergoing oral surgery.<sup>10</sup>

The results of our study indicate that the mean bleeding with category scale of 2 and 3 and also bleeding volume in TA group was significantly lower than that of placebo group (Table 2). Our results were similar to those of other studies indicating that employing topical TA for intraoperative hemostasis in surgical fields has reduced the severity and the volume of bleeding.<sup>5,9,10</sup> This may be due to local antifibrinolytic effect of the drug as opposed to induced topical fibrinolysis as a natural event that occurring hemorrhage.

**Table 1:** Intraoperative bleeding score classification according<sup>3</sup>

Score	descriptions
0	No bleeding
I	Slight bleeding, no suctioning of blood required
II	Slight bleeding, occasional required suctioning. Surgical field not threatened
III	Slight bleeding, frequent suctioning required. Bleeding threatens surgical field a few seconds after suction is removed
IV	Moderate bleeding, frequent suctioning required. Bleeding threatens surgical field directly after suction is removed
V	Severe bleeding, constant suctioning required. Bleeding rate is faster than its removal by suctioning as surgical field is severely threatened and surgery becoming impossible

## Results

The study comprised 38 males and 18 females. There were no significant differences between mean age, MABP, preoperative pulse rate, duration of surgery, and the operation indications. The precise criteria of hydralazine treatment were present in 47 (83.9%) of the patients. Halothane at concentrations lower

**Table 2:** The severity and the volume of bleeding of the two treated groups of Tranexamic acid (TA) and Placebo (PL).

Severity	PL	TA
	n (%)	n (%)
Grade I	1 (3.3)	5 (19.2)*
Grade II	8 (26.7)	14 (53.8)
Grade III	21 (70.0)	7 (26.9)
Mean±SD	2.53±0.15	2.31±0.20*
Volume (ml)	229.1±23.8	174.0±10.6*

\*values are significantly lower than of PL group ( $p < 0.05$ )

There are reports confirming the effectiveness of topical application of another haemostatic agent in reducing hemorrhage, such as following total knee arthroplasty,<sup>11</sup> or as enema to stop rectal bleeding.<sup>12</sup> In any surgical procedures, a large amount of tissues might be exposed to injury. This may release enzymes, such tissue plasminogen activators which convert tissue plasminogen to plasmin followed by promoting fibrinolysis and activates the fibrinolytic system.<sup>6</sup> The fibrinolytic response is mostly pronounced intra operatively and in early postoperatively.<sup>13</sup> TA is said to inhibit tissue plasminogen activators, and therefore, by preventing fibrinolysis. Although, we were not able to measure the plasma level of the drug to determine the degree of its systemic absorption, the prompt response of the patients to direct administration of the drug suggested beneficial local effects.

### Conclusion

Topical tranexamic acid provides a clear surgical field under general anesthesia with halothane and controlled hypotension during surgery. Its topical administration may also have the benefit of reducing the bleeding from surgical wounds without inducing systemic toxicity and thromboembolism.

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