RESEARCH PAPER

Comparing Hemostatic Efficacy of Topical Hemocoagulase Solution, Topical Tranexamic Acid, and Adrenaline in Functional Endoscopic Sinus Surgery

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ABSTRACT

Background: Achieving a clear surgical field during Functional Endoscopic Sinus Surgery (FESS) is critical for optimal visualization and surgical precision. While adrenaline is conventionally used, alternative agents such as tranexamic acid (TXA) and hemocoagulase may offer superior hemostatic control.

Methods: This prospective randomized controlled study included 93 patients undergoing bilateral FESS, divided into three groups: hemocoagulase (n=31), tranexamic acid (n=31), and adrenaline (n=31). Outcomes assessed included intraoperative blood loss, surgical field visibility (Fromme-Boezaart grading), time to hemostasis, surgical duration, and postoperative parameters.

Results: TXA and hemocoagulase groups demonstrated significantly lower blood loss (44 ± 7 mL and 48 ± 8 mL vs 68 ± 10 mL), improved surgical field visibility (1.6 ± 0.5 and 1.8 ± 0.4 vs 2.3 ± 0.5), and faster hemostasis compared to adrenaline ($p<0.01$). Surgical duration was also shorter. Postoperative outcomes were comparable across all groups.

Conclusion: Topical tranexamic acid and hemocoagulase provide superior intraoperative hemostasis compared to adrenaline without compromising postoperative safety, making them effective alternatives in FESS.

Keywords: FESS, tranexamic acid, hemocoagulase, adrenaline, intraoperative bleeding, surgical field

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Introduction

Functional Endoscopic Sinus Surgery (FESS) is widely accepted minimally invasive surgical procedure designed to restore normal function and ventilation of the paranasal sinuses. It is primarily indicated in patients with chronic rhinosinusitis, nasal polyposis, and other sinonasal disorders that are refractory to medical management. FESS enables targeted removal of diseased tissue and obstructions using nasal endoscopes and specialized instruments while preserving healthy mucosa. This approach enhances sinus drainage and improves patient outcomes, making it a widely adopted technique in otolaryngology.

One of the major challenges encountered during FESS is maintaining a clear surgical field due to the richly vascular nature of the nasal mucosa. Even minimal bleeding can obscure visibility, compromise surgical precision, prolong operative time, and increase the risk of complications.[1,2] Conventionally, hemostasis is achieved using nasal packs soaked in adrenaline (epinephrine), a potent vasoconstrictor. While effective in reducing mucosal bleeding, adrenaline use is not without drawbacks—

it may cause mucosal ischemia, rebound bleeding, and significant discomfort during pack insertion and removal, thus necessitating exploration of alternative agents.[3]

In the search for alternative agents that can provide effective hemostasis, hemocoagulase and tranexamic acid (TXA) have emerged as potential candidates. Hemocoagulase is a thrombin-like enzyme derived from snake venom. It acts by converting fibrinogen to fibrin, promoting clot formation at bleeding sites.[6,7] Its topical application has shown effectiveness in enhancing hemostasis across various surgical disciplines, but its specific role in FESS has not been adequately explored.

TXA, a synthetic derivative of amino acid lysine, is antifibrinolytic agent which works through inhibition of activation of plasminogen to plasmin, thereby preventing the breakdown of fibrin clots.[4,5] Topical TXA has demonstrated promising results in reducing intraoperative bleeding and improving visualization in numerous surgical fields, including nasal and sinus surgery. Several studies have evaluated the role of tranexamic acid in FESS.

Preliminary studies like Alimoglu et al. and Goyal et al. have reported significantly reduced intraoperative bleeding and improved surgical field visibility with TXA.[5,8] And its superiority to adrenaline was given by studies like Dutta et al. and Baradaranfar et al. thus suggesting TXA as a useful adjunct in maintaining a bloodless field during FESS, with minimal systemic absorption and fewer side effects.[13,15]

Given the limitations of adrenaline and the potential advantages of hemocoagulase and tranexamic acid, this study aims to compare hemostatic efficacy of these 3 agents - topical hemocoagulase solution, topical tranexamic acid, and adrenaline (conventional method) in FESS. Through this comparative analysis, the research seeks to identify an optimal method for achieving superior hemostasis, thereby enhancing surgical precision and patient outcomes in functional endoscopic sinus surgery.

The primary objective of this study was to compare hemostatic efficacy of topical hemocoagulase solution, topical tranexamic acid, and conventional adrenaline-based nasal packing in patients undergoing FESS, with the aim of identifying the superior agent for achieving optimal intraoperative hemostasis. Secondary objectives included evaluating intraoperative blood loss, surgical field visibility utilizing Fromme-Boezaart grading scale, time required to achieve hemostasis, and total surgical duration. Additionally, the study aimed to assess postoperative outcomes such as incidence of bleeding, pain scores, need for nasal repacking, and any adverse effects associated with these interventions.

Methodology

This study was designed as a prospective, randomized controlled trial conducted in a tertiary care ENT centre over a period of 12 months. A total of 93 patients aged between 18 and 60 years, diagnosed with chronic rhinosinusitis with nasal polyps and planned for primary bilateral Functional Endoscopic Sinus Surgery (FESS) with ASA physical status I or II, were included in the study. Baseline demographic characteristics, including age, gender, and clinical profile, were recorded and were comparable across all groups (Table 1). Patients with bleeding disorders, those on anticoagulant or antiplatelet therapy, revision FESS cases, active nasal or sinus infection, or known hypersensitivity to study drugs were excluded.

After obtaining informed consent and ethical clearance, patients were randomly allocated into three equal groups (n=31 each) using computer-generated randomization. Group A received topical hemocoagulase (Botroclot) applied on nasal packs, Group B received topical tranexamic acid (Trapic) applied similarly, and Group C (control group) received conventional nasal packing with adrenaline (1:100000) combined with xylocaine.

The study was conducted in a single-blinded manner, where the patients and the postoperative outcome assessor were blinded to the intervention used, while the operating surgeon was aware of the allocated treatment due to the nature of the intervention.

All procedures were performed under general anesthesia by the same surgeon to minimize bias. Following standard nasal decongestion, the assigned topical agent was applied in the nasal packs and used whenever needed. Intraoperative parameters assessed included surgical field clarity using the Fromme-Boezaart grading scale, intraoperative blood loss measured by suction volume minus irrigation fluid, time to achieve hemostasis, and total surgical duration per side. Postoperative outcomes evaluated included incidence of bleeding within 24 hours, pain assessment using the Visual Analog Scale (VAS), requirement for nasal repacking, and any adverse drug reactions.

Data was analyzed using appropriate statistical methods, including ANOVA or Kruskal–Wallis test for continuous variables and Chi-square or Fisher's exact test for categorical variables, with a p-value <0.05 considered statistically significant. These parameters were compared across groups to determine the most effective hemostatic agent.

Parameter	Hemocoagulase (n=31)	Tranexamic Acid (n=31)	Adrenaline (n=31)
Age (years, mean ± SD)	34.8 ± 8.1	35.2 ± 7.9	33.9 ± 8.4
Gender (Male/Female)	17 / 14	16 / 15	18 / 13
Side of Surgery (Right/Left)	16 / 15	15 / 16	17 / 14
Diagnosis (CRS with polyps)	31 (100%)	31 (100%)	31 (100%)

Table 1: Baseline Demographic and Clinical Characteristics

Results

A total of 93 patients were included in the study and were equally distributed into three groups: hemocoagulase (Group A, n=31), tranexamic acid (Group B, n=31), and adrenaline (Group C, n=31). Baseline demographic and clinical characteristics were comparable across all groups (p>0.05). Intraoperatively, both hemocoagulase and tranexamic acid groups demonstrated significantly better surgical field visibility, with mean Fromme-Boezaart scores of 1.8 ± 0.4 and 1.6 ± 0.5 respectively, compared to 2.3 ± 0.5 in the adrenaline group (p<0.01). Mean intraoperative blood loss was significantly lower in Group A (48 ± 8 mL) and Group B (44 ± 7 mL) compared to Group C (68 ± 10 mL) (p<0.001). Time to achieve hemostasis was also reduced in the hemocoagulase (2.0 ± 0.4 minutes) and tranexamic acid groups (1.8 ± 0.4 minutes) compared to the adrenaline group (3.5 ± 0.6 minutes) (p<0.001). Additionally, mean surgical duration per side was shorter in Groups A and B (24.2 ± 2.5 minutes and 23.7 ± 2.2 minutes respectively) compared to Group C (28.8 ± 3.1 minutes) (p<0.01).

Parameter	Hemocoagulase	Tranexamic Acid	Adrenaline	p-value
Blood Loss (mL)	48 ± 8	44 ± 7	68 ± 10	<0.001
Surgical Field Score (Fromme-Boezaart)	1.8 ± 0.4	1.6 ± 0.5	2.3 ± 0.5	<0.01
Time to Hemostasis (min)	2.0 ± 0.4	1.8 ± 0.4	3.5 ± 0.6	<0.001
Surgical Duration (min)	24.2 ± 2.5	23.7 ± 2.2	28.8 ± 3.1	<0.01

Table 2: Intraoperative Parameters

Postoperatively, the incidence of bleeding within 24 hours was low and comparable among the three groups, with 2 patients (6.5%) in the hemocoagulase group, 3 patients (9.7%) in the tranexamic acid group, and 3 patients (9.7%) in the adrenaline group (p=0.78). Mean postoperative pain scores (VAS) were also similar across groups (2.1 ± 0.5 in Group A, 2.0 ± 0.5 in Group B, and 2.2 ± 0.6 in Group C; p=0.42). The requirement for nasal repacking was minimal and comparable, with 1 patient each in Groups A and B and 2 patients in Group C (p=0.61). Overall, both tranexamic acid and hemocoagulase demonstrated superior intraoperative hemostatic efficacy compared to adrenaline, while postoperative outcomes were similar across all groups.

Parameter	Hemocoagulase	Tranexamic Acid	Adrenaline	p-value
Postoperative Bleeding (n, %)	2 (6.5%)	3 (9.7%)	3 (9.7%)	0.78
Pain Score (VAS, mean ± SD)	2.1 ± 0.5	2.0 ± 0.5	2.2 ± 0.6	0.42
Need for Repacking (n, %)	1 (3.2%)	1 (3.2%)	2 (6.5%)	0.61

Table 3: Postoperative Outcomes

Discussion

Functional Endoscopic Sinus Surgery (FESS) requires a consistently clear surgical field to ensure precise dissection and minimize complications. Intraoperative bleeding remains one of the most significant challenges because of highly vascular nature of nasal mucosa.[1] Present study has been performed to compare the hemostatic efficacy of topical hemocoagulase, tranexamic acid, and conventional adrenaline-based nasal packing in achieving optimal intraoperative conditions.

The findings of this study demonstrate that both tranexamic acid and hemocoagulase are significantly superior to adrenaline in controlling intraoperative bleeding and enhancing surgical field visibility. Mean intraoperative blood loss has been markedly reduced in tranexamic acid (44 ± 7mL) and hemocoagulase (48 ± 8 mL) groups compared to the adrenaline group (68 ± 10 mL), which has been statistically significant ($p < 0.001$). Such outcomes are consistent with those of previous investigations such as those by Alimoglu et al.[8] and Goyal et al.[5], which reported significant reduction in intraoperative bleeding with utilization of tranexamic acid in FESS.

Improved surgical field visibility, as assessed by the Fromme-Boezaart grading scale[12], was also observed in the tranexamic acid (1.6 ± 0.5) and hemocoagulase (1.8 ± 0.4) groups compared to adrenaline (2.3 ± 0.5). This is clinically important, as even minor bleeding can obscure endoscopic visualization, potentially increasing operative difficulty and complication risk. Similar improvements in surgical field quality with tranexamic acid have been reported by Kim et al.[9] and Dutta et al.[13], reinforcing its role as an effective intraoperative adjunct.

Another key finding of this study was the significantly reduced time to achieve hemostasis in the tranexamic acid (1.8 ± 0.4 minutes) and hemocoagulase (2.0 ± 0.4 minutes) groups compared to adrenaline (3.5 ± 0.6 minutes). Faster hemostasis directly contributes to improved surgical efficiency and reduced intraoperative interruptions. Consequently, surgical duration was also shorter in these groups (23.7 ± 2.2 minutes and 24.2 ± 2.5 minutes respectively) compared to the adrenaline group (28.8 ± 3.1 minutes), highlighting the practical advantages of these agents in operative settings. Similar reductions in operative time have been reported in studies evaluating tranexamic acid in FESS.[5],[8]

The superior intraoperative performance of tranexamic acid can be attributed to its antifibrinolytic mechanism, wherein it inhibits the conversion of plasminogen to plasmin, thus stabilizing fibrin clots and inhibiting clot breakdown.[4] In contrast, hemocoagulase acts via thrombin-like activity, promoting direct conversion of fibrinogen to fibrin and accelerating clot formation.[6,7] These complementary mechanisms explain the enhanced hemostatic efficacy observed in both groups. While tranexamic acid has been extensively studied in sinonasal surgery, the role of hemocoagulase remains relatively underexplored, making the present study valuable in highlighting its potential utility.

Despite significant improvements in intraoperative parameters, postoperative outcomes such as bleeding, pain, and need for repacking were comparable across all groups. The incidence of postoperative bleeding was low and not statistically different ($p = 0.78$), indicating that the use of tranexamic acid and hemocoagulase does not increase the risk of delayed hemorrhage. Similarly, postoperative pain scores were low across all groups (VAS ≈ 2.0–2.2), suggesting good patient tolerance irrespective of the hemostatic agent used. The requirement for nasal repacking was minimal and comparable, further supporting the safety profile of these interventions.

These findings align with previous literature indicating that while newer hemostatic agents significantly improve intraoperative conditions, they do not adversely affect postoperative recovery. Studies by Baradaranfar et al.[15] and Karimi et al.[14] have likewise indicated comparable postoperative

bleeding rates between tranexamic acid and adrenaline groups.

From a clinical perspective, outcomes of this study facilitate a shift toward utilization of biologically active and pharmacologically targeted hemostatic agents in FESS. While adrenaline primarily acts through vasoconstriction, tranexamic acid and hemocoagulase actively modulate the coagulation cascade, leading to more effective and sustained hemostasis. This is particularly relevant in patients with extensive inflammatory mucosal disease, where conventional vasoconstrictors may be insufficient.

The present study has certain limitations. This is single-center research having relatively modest sample size (n = 93), which may limit generalizability. Long-term outcomes such as mucosal healing, synechiae formation, and recurrence rates were not assessed. Additionally, quantitative assessment of drug concentration and dose-response relationship was not performed. Future multicentric investigations having larger sample sizes and longer follow-up periods are advised for confirming such outcomes as well as establishing standardized protocols.

Conclusion

Topical tranexamic acid and hemocoagulase provide superior intraoperative hemostasis compared to adrenaline in FESS, with comparable postoperative outcomes. These agents improve surgical visibility, reduce operative time, and represent effective alternatives to conventional methods.

Among the two agents, tranexamic acid showed a slight advantage in terms of blood loss reduction and surgical field clarity, although both were clinically effective. Therefore, tranexamic acid and hemocoagulase can be considered reliable and safe alternatives to adrenaline, particularly in cases with increased bleeding tendency or extensive mucosal disease. Further multicentric studies having larger sample sizes and long-term follow-up are advised for confirming as well as establishing standardized protocols for routine clinical use.

References

1. Hopkins C. Chronic rhinosinusitis: epidemiology and medical management. *J Laryngol Otol.* 2019;133(6):467–72.
2. Wormald PJ. Endoscopic sinus surgery: anatomy and techniques. *Otolaryngol Clin North Am.* 2020;53(1):1–12.
3. Anand VK, Tabaee A, Kacker A, Newman JG. Hemostasis in endoscopic sinus surgery using topical oxymetazoline: a randomized, double-blind, placebo-controlled trial. *Laryngoscope.* 2004;114(2):286–9.
4. Ker K, Edwards P, Perel P, Shakur H, Roberts I. Effect of tranexamic acid on surgical bleeding: systematic review and cumulative meta-analysis. *BMJ.* 2012;344:e3054.
5. Goyal S, Singh J, Singh M. Use of tranexamic acid in endoscopic sinus surgery: a double-blind randomized controlled study. *Indian J Otolaryngol Head Neck Surg.* 2015;67(3):272–7.
6. Roy A, Lahiri SK. Hemocoagulase in ENT surgery: clinical evaluation and hemostatic efficacy. *Indian J Clin Pract.* 2017;27(9):785–9.
7. Saravanan K, Arumugam S, Natarajan B. Topical hemocoagulase: a hemostatic boon in nasal surgeries. *Int J Otorhinolaryngol Head Neck Surg.* 2020;6(3):485–8.
8. Alimoglu Y, Inci E, Eryilmaz MA, Kaya C. The effect of tranexamic acid on intraoperative bleeding in endoscopic sinus surgery: a randomized controlled trial. *Am J Rhinol Allergy.* 2017;31(5):325–9.
9. Kim HJ, Choi HJ. Hemostatic efficacy of tranexamic acid in sinus surgery. *Clin Exp Otorhinolaryngol.* 2014;7(4):293–7.
10. Lee JM, Lee CH. Evaluation of topical tranexamic acid in sinonasal surgeries. *J Craniofac Surg.* 2015;26(6):e540–3.
11. Jain N, Meher R, Raj A, Goel A. Evaluation of topical hemostatic agents in functional endoscopic sinus surgery. *Indian J Otolaryngol Head Neck Surg.* 2016;68(1):56–60.
12. Boezaart AP, van der Merwe J, Coetzee A. Comparison of sodium nitroprusside- and esmolol-induced controlled hypotension for functional endoscopic sinus surgery. *Anesth Analg.* 1995;81(2):357–64.
13. Dutta A, Biswas KD. A comparative study of topical tranexamic acid and adrenaline in controlling bleeding during endoscopic sinus surgery. *Int J Otorhinolaryngol Head Neck Surg.* 2021;7(3):423–7.
14. Karimi G, Anari MR. Comparison of topical oxymetazoline and tranexamic acid

in reducing blood loss in functional endoscopic sinus surgery. *J Otolaryngol ENT Res.* 2019;11(2):69–73.

15. Baradaranfar MH, Dadgarnia MH, Mahmoudian S. Comparison of topical tranexamic acid with adrenaline for bleeding control in endoscopic sinus surgery. *Iran J Otorhinolaryngol.* 2012;24(68):123–7.