RESEARCH PAPER

Bipolar Electrocautery Versus Silver Nitrate Chemical Cautery for Recurrent Anterior Epistaxis in Children: A Prospective Comparative Study

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ABSTRACT

Background: Epistaxis is one of the most prevalent otolaryngological emergencies in pediatric populations. When conservative measures fail, cauterization remains the mainstay treatment for anterior epistaxis. Although chemical cautery with silver nitrate and bipolar electrocautery are widely utilized, comparative evidence regarding their relative efficacy, safety profiles, and recurrence rates remains limited, particularly in children.

Objective: To compare the effectiveness, recurrence rates, complication profiles, and follow-up outcomes of bipolar electrocautery versus silver nitrate chemical cautery in the management of recurrent anterior epistaxis in pediatric patients.

Methods: A prospective comparative study was conducted at a tertiary care hospital over a three-year period (January 2020–December 2022). Ninety pediatric patients aged 6–18 years with recurrent anterior epistaxis unresponsive to conservative therapy were enrolled and allocated into two groups: Group A (n = 45) received bipolar electrocautery, and Group B (n = 45) received chemical cautery with silver nitrate. Primary outcomes included cessation of bleeding and recurrence rates. Secondary outcomes encompassed complications (crusting, synechiae, septal perforation), need for re-intervention, and follow-up compliance. Categorical outcomes were compared using chi-square tests, with statistical significance set at $p < 0.05$.

Results: The recurrence rate after initial intervention was lower in the bipolar group (13.3%) than in the chemical cautery group (20.0%), although this difference did not reach statistical significance ($p = 0.38$). Overall complication rates were comparable between groups (15.5% vs. 11.1%, $p = 0.53$), with crusting being the most frequently observed complication. No cases of septal perforation were recorded in either group. Among patients requiring a second intervention, 98.9% remained symptom-free during long-term follow-up (mean: 3.0 years). Follow-up compliance was higher in the bipolar group (77.7%) compared with the chemical cautery group (68.8%).

Conclusion: Both bipolar electrocautery and silver nitrate chemical cautery demonstrated comparable effectiveness and safety for managing recurrent anterior epistaxis in children. The choice of modality should be guided by clinical context, resource availability, operator expertise, and individual patient characteristics. Future randomized controlled trials with larger sample sizes are warranted to delineate potential advantages of either technique.

Keywords: epistaxis; anterior nosebleed; chemical cautery; silver nitrate; bipolar electrocautery; pediatric otolaryngology; recurrence; cauterization

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INTRODUCTION

Epistaxis, commonly referred to as nosebleed, is among the most frequently encountered emergencies in otolaryngological practice. Epidemiological data indicate that up to 60% of the general population will experience at least one episode of epistaxis during their lifetime, although only 6–10% of affected individuals require medical intervention (Kasperek & Pollock, 2021). The condition demonstrates a bimodal age distribution, with peak incidences occurring in children aged 2–10 years and in adults older than 50 years, the latter group often presenting with comorbidities such as hypertension and anticoagulant therapy (Pinto & Sharma, 2023).

The etiology of epistaxis is broadly categorized into local and systemic causes. Local factors include digital trauma, mucosal desiccation, upper respiratory infections, and anatomical deviations, whereas systemic contributors encompass coagulopathies, hypertension, hepatic dysfunction, and inherited vascular anomalies (Pahl & Youssef, 2020). Anatomically, epistaxis is classified as anterior or posterior in origin. Anterior epistaxis, typically arising from Kiesselbach's plexus on the anteroinferior nasal septum, accounts for more than 90% of all episodes and generally carries a favorable prognosis (Oakley et al., 2018). Posterior epistaxis, although less common, tends to be more severe and may necessitate hospitalization or surgical intervention (Kasperek & Pollock, 2021).

When conservative measures—including sustained digital pressure, topical vasoconstrictors, and anterior nasal

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packing—fail to achieve adequate hemostasis, cauterization of the bleeding vessel represents the established next-line treatment. The two most widely employed cauterization modalities for anterior epistaxis are chemical cautery using silver nitrate applicator sticks and bipolar electrocautery (Tunkel et al., 2020).

Chemical cautery with silver nitrate is favored for its simplicity, low cost, and suitability for outpatient application, particularly in pediatric settings (Gifford et al., 2019). However, its efficacy is optimal on a dry mucosal surface and may be limited during active bleeding. Moreover, improper or bilateral application carries a risk of mucosal necrosis, synechiae formation, and, rarely, septal perforation (Monjur et al., 2022). Bipolar electrocautery, in contrast, delivers focused thermal energy to the target vessel, enabling effective coagulation even on wet or actively bleeding mucosa. Its precision minimizes collateral tissue damage relative to monopolar devices (Elahi et al., 2020).

Despite the widespread utilization of both modalities, the existing literature provides insufficient comparative evidence to establish the superiority of one technique over the other. Some investigations have suggested that bipolar cautery may confer lower recurrence rates and superior hemostatic control (Dutta et al., 2020), while others have highlighted the practical advantages and comparable efficacy of chemical cautery, particularly in resource-limited settings (Gifford et al., 2019). Furthermore, most published studies have been conducted in adult populations, and pediatric-specific data remain scarce.

Given this gap in the literature, the present study was designed to compare the effectiveness, safety, recurrence rates, and follow-up outcomes of bipolar electrocautery versus silver nitrate chemical cautery in the management of recurrent anterior epistaxis in a pediatric cohort. The findings are intended to contribute to evidence-based clinical decision-making and to optimize therapeutic outcomes in this vulnerable population.

METHODS

Study Design and Setting

This prospective comparative study was conducted at the Department of Otolaryngology–Head and Neck Surgery, a tertiary care referral hospital, over a three-year period from January 2020 to December 2022. The study protocol was reviewed and approved by the institutional ethics committee, and all procedures were performed in accordance with the ethical standards of the Declaration of Helsinki. Written informed consent was obtained from the legal guardians of all participants prior to enrollment.

Participants

A total of 90 consecutive pediatric patients presenting with recurrent anterior epistaxis and meeting the eligibility criteria were enrolled. Inclusion criteria were: (1) age between 6 and 18 years; (2) a documented history of recurrent anterior epistaxis, defined as two or more episodes per month over a minimum period of three months; and (3) failure of conservative management including sustained digital compression and topical vasoconstrictor therapy. Exclusion criteria comprised: (1) posterior epistaxis; (2) known coagulopathies or bleeding disorders; (3) epistaxis secondary to trauma, neoplasms, or recent nasal surgery; (4) concurrent anticoagulant or antiplatelet therapy; and (5) anticipated inability to comply with the follow-up protocol.

Group Allocation and Intervention

Participants were allocated into two equal groups of 45 patients each. Group A received bipolar electrocautery, and Group B received chemical cautery using silver nitrate applicator sticks. Allocation was performed based on clinical assessment by the attending otolaryngologist, taking into consideration the mucosal condition (dry versus wet field), bleeding activity at presentation, and patient cooperativeness.

All procedures were performed under standardized aseptic conditions using local anesthesia (4% lidocaine topical spray). The nasal cavity was examined using a nasal speculum under direct headlight illumination. In Group A, bipolar electrocautery was applied directly to the identified bleeding point for 2–3 seconds at the minimum effective power setting, with care taken to avoid bilateral cauterization during a single session. In Group B, a silver nitrate applicator stick was held against the bleeding mucosa for 5–10 seconds until the formation of a characteristic gray–white eschar was observed.

Postoperative instructions were standardized across both groups and included avoidance of nose blowing, strenuous physical activity, and hot beverages for 7–10 days. All patients were prescribed saline nasal irrigations and topical antibiotic ointment (mupirocin 2%) for the treated area.

Outcome Measures

The primary outcome was complete cessation of epistaxis without recurrence during the follow-up period. Secondary outcomes included: (1) the incidence and type of procedure-related complications, including mucosal crusting, synechiae formation, and septal perforation; (2) the need for repeat intervention (same or alternate modality); and (3) patient follow-up compliance rates.

Data Collection and Follow-Up

Baseline demographic and clinical data were systematically recorded for all participants, including age, sex, family history of epistaxis, laterality and frequency of bleeding episodes, mean duration of bleeding, and relevant laboratory parameters (prothrombin time/international normalized ratio). Follow-up evaluations were scheduled at 1 week, 1 month, 3 months, 6 months, and annually thereafter for up to three years. At each visit, the nasal cavity was examined for evidence of recurrence, mucosal healing status, and presence of complications.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, and categorical variables were presented as frequencies and percentages. Between-group comparisons for categorical outcomes were performed using the chi-square test or Fisher's exact test, as appropriate. A two-tailed p-value of less than 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

The study enrolled 90 pediatric patients with recurrent anterior epistaxis. Baseline demographic and clinical characteristics are summarized in Table 1. The cohort comprised 57 females (63.3%) and 33 males (36.7%). The mean age at symptom onset was 11.2 ± 2.5 years, while the mean age at treatment was 12.0 ± 2.6 years, indicating an approximate one-year interval between initial symptom onset and definitive intervention. A positive family history of epistaxis was reported in 16 patients (17.7%). Unilateral bleeding predominated, observed in 64 patients (71.1%), whereas bilateral involvement was documented in 26 patients (28.9%). The mean duration of individual bleeding episodes was 5.0 ± 2.2 minutes, and the mean frequency was 3.2 ± 1.5 episodes per month.

Table 1. ***Demographic and Clinical Characteristics of Participants (N = 90)***

Variable	Total (N = 90)
Sex, n (%)	
Male	33 (36.7)
Female	57 (63.3)
Mean age at onset, years (SD)	11.2 (±2.5)
Mean age at treatment, years (SD)	12.0 (±2.6)
Positive family history, n (%)	16 (17.7)
Laterality, n (%)	
Unilateral	64 (71.1)
Bilateral	26 (28.9)
Mean bleeding duration, min (SD)	5.0 (±2.2)
Mean episodes per month (SD)	3.2 (±1.5)

SD, standard deviation.

Treatment Outcomes

Treatment outcomes stratified by cauterization modality are presented in Table 2. The recurrence rate following the initial intervention was 13.3% (6/45) in the bipolar cautery group compared with 20.0% (9/45) in the chemical cautery group; however, this difference was not statistically significant (χ^2 test, p = 0.38). The overall complication rate was 15.5% (7/45) in the bipolar group versus 11.1% (5/45) in the chemical cautery group (p = 0.53). Crusting was the predominant complication in both groups. Notably, no cases of septal perforation were documented in either group. The requirement for repeat intervention was similar between groups (8.8% vs. 11.1%, p = 0.71).

Table 2. ***Treatment Outcomes According to Cauterization Modality***

Outcome	Bipolar Cautery (n = 45)	Chemical Cautery (n = 45)	p-value
Recurrence after 1st treatment, n (%)	6 (13.3)	9 (20.0)	0.38
Any complication, n (%)	7 (15.5)	5 (11.1)	0.53
Crusting	7	5	—
Septal perforation	0	0	—
Repeat intervention required, n (%)	4 (8.8)	5 (11.1)	0.71
Bleeding after 2nd intervention, n	0	1	—
Mean follow-up duration, years (SD)	3.0 (±0.0)	3.0 (±0.0)	NS

NS, not significant; —, not separately tested.

Follow-Up and Re-Intervention Outcomes

Table 3 summarizes the outcomes following second interventions. Among the 90 patients, 89 (98.9%) remained bleeding-free after a second intervention when required. A single patient (1.1%) experienced recurrence at three months following the second procedure, ultimately necessitating a third intervention. Long-term follow-up data demonstrated that 89 patients (98.9%) were symptom-free over the entire three-year observation period, confirming the durability of both cauterization approaches.

Table 3. ***Follow-Up and Second Intervention Outcomes***

Variable	Category	n	%	Remarks
Bleeding after 2nd intervention	No	89	98.9	High secondary success
	Yes	1	1.1	Single outlier case
Time to recurrence (2nd intervention)	Not applicable	89	—	No recurrence
	3 months	1	100*	Required 3rd intervention
Long-term bleeding-free status	3-year follow-up	89	98.9	Durable outcome

** Percentage of recurrences after second intervention.*

Complication Profile

The detailed distribution of complications is presented in Table 4. Of the total cohort, 79 patients (87.8%) experienced no complications, while 11 (12.2%) developed at least one adverse event. Crusting was the most common complication, occurring in 10 cases (11.1%). Septal perforation was observed in a single patient (1.1%) within the group that did not require further intervention, and no cases of mucosal dryness were recorded. Among patients who underwent repeat intervention, all six treated with bipolar cautery were complication-free, whereas four of six treated with chemical cautery experienced crusting.

Table 4. ***Distribution of Complications by Treatment Category***

Outcome	Bipolar (n)	Chemical (n)	No Further Trials (n)	Total
Total cases	6	6	78	90
No complication	6	2	71	79
With complication	0	4	7	11
Crusting	0	4	6	10
Dryness	0	0	0	0
Septal perforation	0	0	1	1

Follow-Up Compliance

Follow-up compliance differed between groups, with 77.7% of patients in the bipolar cautery group completing the scheduled follow-up protocol compared with 68.8% in the chemical cautery group. However, this difference was not subjected to formal statistical testing and should be interpreted with caution.

DISCUSSION

Recurrent anterior epistaxis represents a common yet impactful clinical problem in pediatric otolaryngology. While generally benign, the recurrent nature of the condition can substantially affect children's quality of life and generate considerable parental anxiety. The present study provides a direct comparison of two widely utilized cauterization modalities—bipolar electrocautery and silver nitrate chemical cautery—in a pediatric cohort with a standardized follow-up protocol extending to three years.

The principal finding of this study is that both cauterization techniques demonstrated comparable effectiveness in controlling recurrent anterior epistaxis, with no statistically significant differences in recurrence rates, complication profiles, or the need for re-intervention. These findings are concordant with prior comparative investigations. Sharifian et al. (2014) reported that silver nitrate cautery achieved symptom resolution in approximately 85% of pediatric cases after a single application, while El-Sayed and Nassar (2017) demonstrated equivalent success rates with bipolar electrocautery, particularly in cases of recurrent bleeding. Although not reaching statistical significance, the observed trend toward a lower recurrence rate in the bipolar group (13.3% vs. 20.0%) aligns with earlier reports by Maheshwar et al. (2007), who documented reduced recurrence following electrocautery compared with chemical agents. This trend may be attributable to the deeper and more targeted vascular coagulation achieved with bipolar energy, which facilitates more complete vessel obliteration at the submucosal level, thereby reducing the likelihood of rebleeding from the same vascular source.

Regarding the complication profile, both modalities exhibited favorable safety outcomes. Crusting was the most frequently encountered complication in both groups, consistent with findings reported by Faramarzi et al. (2013), who identified mild crusting as the predominant self-limiting adverse event following either cauterization technique. The absence of septal perforation in both treatment groups is a reassuring finding and corroborates earlier evidence that both methods are safe when applied unilaterally and with appropriate technique (Loughan et al., 2010). The slightly higher crusting rate observed in the bipolar group (15.5% vs. 11.1%) may reflect the greater depth of thermal tissue effect, though this difference was not clinically meaningful.

An interesting observation was the differential follow-up compliance between groups, with higher attendance rates in the bipolar cautery group (77.7% vs. 68.8%). This

finding echoes the observations of Tan et al. (2012), who reported that improved symptom control was associated with stronger adherence to post-treatment surveillance schedules. However, whether higher compliance reflects superior symptomatic outcomes or other unmeasured factors—such as patient perception of treatment efficacy or differing levels of postoperative concern—remains to be elucidated.

The crossover between treatment modalities observed in some patients underscores the importance of individualized therapeutic decision-making. As emphasized by Leong et al. (2005), management of pediatric epistaxis should not adhere rigidly to a single protocol but rather should be adaptable based on the initial treatment response, patient-specific anatomical considerations, and tolerance. This pragmatic approach is particularly relevant in pediatric practice, where patient cooperation and procedural tolerance are critical determinants of treatment success.

The well-balanced demographic and clinical characteristics between the two groups strengthen the internal validity of the current findings. Comparable mean ages at onset and treatment, bleeding duration, and monthly episode frequency—consistent with the epidemiological patterns described by Krempl and Stool (1999)—suggest that the observed outcome differences are more likely attributable to the intervention type rather than confounding patient-level variables.

While both techniques yielded favorable outcomes, the modest trend toward improved hemostatic control and lower recurrence in the bipolar group may support its preferential use in cases of more severe or recalcitrant epistaxis. Nevertheless, as noted by Sowerby et al. (2013), silver nitrate cautery remains a practical, cost-effective, and widely accessible option that is especially valuable in outpatient settings and resource-constrained environments.

LIMITATIONS

Several limitations of this study warrant acknowledgment. First, the relatively small sample size (n = 90) may have limited statistical power to detect clinically meaningful differences between the two groups, thereby increasing the risk of type II error. Second, group allocation was based on clinical judgment rather than formal randomization, which introduces the potential for selection bias and limits the strength of causal inferences. Third, the study did not incorporate validated patient-reported outcome measures, including pain assessment scales, quality-of-life instruments, or satisfaction questionnaires, which are increasingly recognized as essential components of treatment evaluation. Fourth, direct cost analyses and procedure duration comparisons were not performed, which would be relevant for health-economic assessments. Fifth, blinding of either the operator or the patient was not feasible given the inherent differences between the two procedures. Finally, this single-center study may limit the generalizability of findings to other clinical settings and populations. Future multicenter randomized controlled trials with larger sample sizes, standardized outcome measures, and health-economic evaluations are recommended to validate and extend these findings.

CONCLUSION

The findings of this study demonstrate that both bipolar electrocautery and silver nitrate chemical cautery are effective and safe modalities for the management of recurrent anterior epistaxis in pediatric patients, with comparable recurrence rates, complication profiles, and long-term outcomes. The selection of the appropriate technique should be individualized based on clinical presentation, equipment availability, operator expertise, and patient-specific factors. Further well-designed randomized controlled trials are warranted to clarify any potential differential advantages, assess patient-reported outcomes, and evaluate the cost-effectiveness of each approach.

DECLARATIONS

Ethics Approval and Consent to Participate

This study was approved by the Institutional Ethics Committee Written informed consent was obtained from the legal guardians of all participants. All procedures were conducted in accordance with the Declaration of Helsinki.

Consent for Publication

Not applicable. No individually identifiable patient data are presented.

Availability of Data and Materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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REFERENCES

1. Dutta, A., Sinha, R., Deb, A., & Biswas, S. (2020). Comparative study of chemical cauterization and bipolar diathermy in control of anterior epistaxis. Indian Journal of Otolaryngology and Head & Neck Surgery, 72(3), 296–300. https://doi.org/10.1007/s12070-019-01780-0
2. Elahi, M. M., Leonard, M., Donnelly, M., & Fenton, J. E. (2020). Bipolar diathermy vs. silver nitrate in the treatment of anterior epistaxis. Clinical Otolaryngology, 45(4), 528–532. https://doi.org/10.1111/coa.13545
3. El-Sayed, Y., & Nassar, A. (2017). Bipolar electrocautery versus chemical cautery in treatment of anterior epistaxis. International

Journal of Pediatric Otorhinolaryngology, 97, 103–106.
4. Faramarzi, A., Salamat, F., Sheikhha, M. H., & Derakhshandeh, V. (2013). Comparison of silver nitrate cautery and electrocautery in the treatment of anterior epistaxis in children. Iranian Journal of Otorhinolaryngology, 25(71), 99–104.
5. Gifford, T. O., Orvidas, L. J., & McDonald, T. J. (2019). The efficacy of silver nitrate cautery in treating anterior epistaxis. American Journal of Rhinology & Allergy, 33(2), 175–179. https://doi.org/10.1177/1945892418823120
6. Kasperek, Z., & Pollock, G. (2021). Epistaxis: Outpatient evaluation and management. American Family Physician, 103(5), 277–284.
7. Krempl, G. A., & Stool, S. E. (1999). Epistaxis in children: A retrospective review of 506 cases. International Journal of Pediatric Otorhinolaryngology, 49(1), 69–73.
8. Leong, S. C., Roe, R. J., & Karkanevatos, A. (2005). A randomized controlled trial of topical antiseptics vs cautery in pediatric anterior epistaxis. The Laryngoscope, 115(8), 1456–1459.
9. Loughan, T., McGarry, G. W., & Hanif, J. (2010). Management of epistaxis in the pediatric population. Pediatrics International, 52(2), 252–256.
10. Maheshwar, A. A., Milling, M. A., & Kumar, M. (2007). A prospective study of the efficacy of electrocautery in controlling epistaxis. Clinical Otolaryngology, 32(4), 278–281.
11. Monjur, M., Islam, M. N., & Alam, M. M. (2022). Outcome of anterior nasal packing vs. silver nitrate cautery in anterior epistaxis. Bangladesh Journal of Otorhinolaryngology, 28(1), 33–39. https://doi.org/10.3329/bjo.v28i1.60393
12. Oakley, G. M., Barham, H. P., & Harvey, R. J. (2018). Epistaxis: An overview of current management. Otolaryngologic Clinics of North America, 51(5), 831–845. https://doi.org/10.1016/j.otc.2018.05.002
13. Pahl, M., & Youssef, T. (2020). Management of epistaxis. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470431/
14. Pinto, J. M., & Sharma, A. (2023). Epistaxis: Etiology and current management strategies. Current Otorhinolaryngology Reports, 11(1), 12–20. https://doi.org/10.1007/s40136-022-00280-z
15. Sharifian, A., Farsam, T., & Mohebbi, S. (2014). Silver nitrate cauterization for anterior epistaxis in children: A retrospective review. Annals of Otolaryngology, 123(4), 273–278.
16. Sowerby, L. J., DeSerres, J. J., Engel, S. H., & Rudmik, L. (2013). Epistaxis management in the emergency department: A comparison of techniques. Journal of Otolaryngology–Head & Neck Surgery, 42(1), 1–5.
17. Tan, L. K., Calhoun, K. H., & Curlee, M. P. (2012). Outcomes of chemical versus electrocautery for anterior epistaxis in children. American Journal of Otolaryngology, 33(2), 154–158.
18. Tunkel, D. E., Anne, S., Payne, S. C., Ishman, S. L., Rosenfeld, R. M., Abramson, P. J., ... & Monjur, T. M. (2020). Clinical practice guideline: Nosebleed (epistaxis). Otolaryngology–Head and Neck Surgery, 162(1_suppl), S1–S38. https://doi.org/10.1177/0194599819900827