A Comparison of Bipolar Electrocautery and Chemical Cautery for Control of Pediatric Recurrent Anterior Epistaxis

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No sponsorships or competing interests have been disclosed for this article.

Abstract

Objective. To compare the outcome of children with anterior epistaxis treated intraoperatively with either bipolar electrocautery or silver nitrate chemical cautery.

Study Design. Case series with chart review.

Setting. Tertiary-care pediatric otolaryngology practice.

Subjects. Children aged 2 to 18 years treated with either intraoperative bipolar electrocautery or silver nitrate chemical cautery of the anterior nasal septum for recurrent anterior epistaxis.

Methods. Any reported bleeding event after surgery was recorded. The mean time from surgery to recurrent epistaxis was compared between groups.

Results. Fifty patients underwent bipolar electrocautery, while 60 patients underwent silver nitrate chemical cautery. Within 2 years, 1 (2%) patient in the bipolar electrocautery group and 13 (22%) patients in the silver nitrate chemical cautery group had recurrent epistaxis (P = .003). Two years after treatment, there was no difference between treatment groups. Overall, 4 patients (8%) had recurrent epistaxis postoperatively in the bipolar electrocautery group at a mean of 4.34 years after treatment, while 17 (28.3%) patients recurred after a mean of 1.53 years of treatment in the silver nitrate chemical cautery group (P = .01).

Conclusion. Compared to those treated with chemical cautery, those treated with bipolar electrocautery had a longer nosebleed-free period and a lower incidence of recurrent epistaxis within 2 years of treatment. Beyond 2 years, the treatment methods are equivocal. Bipolar electrocautery may be a superior treatment in children who will not tolerate in-office chemical cautery, in those with a risk of severe bleeding, or when it can be combined with other operative procedures.

Keywords

epistaxis, sinonasal disorders, pediatric otolaryngology

Introduction

Epistaxis is a common medical condition in childhood. It is one of the most common reasons for referral to an otolaryngologist. Thirty percent of children under age 5 years and more than 50% of children between ages 6 to 15 years experience nosebleeds.¹ In children, the most common bleeding site is the anterior nasal septum.² The etiology of epistaxis is diverse and includes trauma, medications, allergic rhinitis, dehumidification, septal perforation, neoplasm, hereditary hemorrhagic telangiectasia (HHT), or an acquired or congenital bleeding disorder.³

It has been demonstrated that children with recurrent anterior epistaxis (RAE) are more likely to have nasal colonization with Staphylococcus aureus than controls.⁴ In addition, S. aureus colonization may induce inflammation, crusting, and irritation that promote septal neovascularization and increase the risk of recurrent epistaxis.² Therefore, the application of antistaphylococcal ointments may be useful in the treatment of epistaxis.

A review of the literature demonstrated that the treatments offered most often for pediatric RAE are the application of topical antibiotic ointments and silver nitrate cautery. A study by Calder et al demonstrated subjective improvement of epistaxis symptoms with silver nitrate cautery followed by antibiotic ointment twice daily for 4 weeks compared to antiseptic cream alone in an office setting.⁵ A Cochrane review in 2012 concluded that the optimal management of children with anterior epistaxis is unknown and requires more research.⁶ Since children are less likely to tolerate in-office intranasal procedures for multiple reasons including pain, fear, and risk of uncontrolled bleeding, the optimal treatment option is still unknown.

Many studies have shown that bipolar cautery is safe and effective in pediatric tonsillectomy, minimizing intraoperative

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blood loss. However, very few studies have evaluated bipolar cautery and its efficacy for treating epistaxis. Ghaferi et al studied bipolar cautery in patients with HHT as an adjunctive treatment to laser treatments or as a stand-alone technique. In the HHT series, bipolar cautery was well tolerated, was free of morbidity unique to the technique, and provided effective treatment. Other adult studies have demonstrated good success with bipolar cautery under endoscopic control for the management of epistaxis. Ahmed and Woofford had an 89% success rate in controlling anterior and posterior epistaxis in a mixed patient population, with no patients requiring repeat treatment. O’Donnell et al evaluated 44 adult patients who underwent bipolar cautery for the management of epistaxis, and only 1 patient required repeat cautery to control epistaxis.

The purpose of this study was to compare the outcome of children who underwent intraoperative treatment by either bipolar nasal septal electrocautery or silver nitrate chemical cautery for RAE.

Methods

The State University of New York at Buffalo’s Children and Youth Institutional Review Board approved this study. The electronic medical record of a tertiary-care pediatric otolaryngology practice was used to search for all patients with Current Procedural Terminology codes 30901 (anterior epistaxis control, simple), 30903 (anterior epistaxis control, complex), and 31238 (nasal/sinus endoscopy, operative; with control of nasal hemorrhage). All patients who underwent intraoperative management of RAE were identified, and data were collected from the patients’ electronic office charts and operative reports. Inclusion criteria were an initial clinic visit between 2000 and 2013, the diagnosis of RAE, age between birth and 18 years, and presentation to their postoperative follow-up visit. Patients having undergone previous nasal or septal surgery, had previous nasal trauma, had nasal steroid use, or had a history of allergies were included. Exclusion criteria included insufficient follow-up (ie, no initial follow-up appointment), a known acquired/hereditary coagulopathy, or epistaxis due to systemic disease. Patients undergoing chemical cautery in an office setting were not included in this study.

Each patient’s medical record was reviewed, and demographic information as well as the presence of comorbid medical conditions was recorded. The patients in each treatment group were compared regarding sex, age at onset, age at treatment, frequency of bleeding, bleeding duration, environmental allergies, nasal steroid use, nasal trauma, presence of abnormal blood work, patient history of abnormal bleeding, family history of epistaxis, previous nasal cautery, and whether nasal cautery was combined with an additional surgical procedure.

All study patients had failed medical management such as humidification, antibacterial ointment, and nasal saline spray or gel. Patients were not evaluated for nasal staphylococcal colonization. Patients were not preselected by any specific criteria for either treatment group. Patients were scheduled, by a receptionist in a random manner, for evaluation and treatment by 1 of 2 pediatric otolaryngologists. One surgeon performed strictly bipolar electrocautery, and the other performed only silver nitrate chemical cautery. All nasal cautery procedures, whether chemical or bipolar, were performed in the operating room under general anesthesia. Cautery procedures were either carried out alone or in combination with other otolaryngologic procedures but not with other septal surgical procedures. The technique for bipolar cautery was performed using loupe magnification and the bipolar cautery device set at 15 or 20 watts. Bipolar cautery was performed after decongestion of the nose with oxymetazoline-soaked pledgets. In most cases, only one side of the nose was cauterized. Prominent nasal vessels were cauterized on the anterior nasal septum in a distal to proximal fashion, taking care to target feeding vessels along the floor of the nose. Those cauterized areas were then covered with an antiseptic ointment. The technique for silver nitrate cautery was performed after nasal decongestion with topical oxymetazoline on cotton pledgets. The silver nitrate was directly applied to prominent nasal vessels on the anterior septum. In cases where prominent nasal vessels were visualized on the septum bilaterally, both sides were treated. Again, following cautery, an antiseptic ointment was applied. Antibiotic ointment was recommended postoperatively in all patients for at least 6 weeks.

Any reported bleeding event following cautery, documented in the patients’ charts, that required an intervention was considered a recurrent epistaxis event during the follow-up periods. Interventions included holding pressure on the nose for greater than 5 minutes, additional cautery, or nasal packing. Nasal oozing that resolved without intervention or digital pressure was not considered a recurrent epistaxis event. In patients treated only on one side of the nose, postoperative epistaxis from the nontreatment side was not considered a recurrent epistaxis event. The primary end points were defined as any bleeding event prior to the first follow-up appointment and any recurrent bleeding events that occurred after the postoperative follow-up visit. The secondary end point was any surgical complication such as septal perforation. The mean time from surgery to recurrent epistaxis was also compared between groups.

Statistical analysis was conducted using version 11.00.01 of SYSTAT (Systat Software, Chicago, Illinois, USA). A P value less than .05 was considered significant for all statistical tests. The Fisher exact test, a 2-sample t test, or the Mann-Whitney test was used for all statistical testing. Microsoft Excel (Redmond, Washington, USA) was used for data entry and analysis.

Results

Fifty of 97 (52%) patients underwent bipolar cautery and kept their initial postoperative appointment, making them eligible for this study. In the silver nitrate group, 60 of 132 (45%) patients kept their initial postoperative appointment and were included in this study. There was no difference in the percentage of patients who kept their follow-up appointment between groups (P = .36). Table 1 contains the
The demographics were similar in each group, with the exception that in the bipolar treatment group, patients were older in age (mean, 9.0 years vs 7.4 years, respectively; \( P = .03 \)), had a more significant family history of epistaxis (n = 9 vs 1, respectively; \( P = .01 \)), and had fewer combined procedures (46% vs 67%, respectively; \( P = .04 \)) in comparison to the silver nitrate cautery group. There were no significant differences between the 2 groups regarding the frequency of epistaxis, duration of bleeding, environmental allergies, nasal steroid use, previous nasal trauma, abnormal blood work prior to treatment, patient history of easy bruising/bleeding, and previous nasal cautery.

The results are summarized in **Table 2**. The mean initial follow-up time was similar between groups: 5.8 weeks for the bipolar group and 6.9 weeks for the silver nitrate group. The vast majority of patients had a resolution of epistaxis at the initial follow-up visit with no significant bleeding events. Only 1 patient in each group had an epistaxis event prior to the first follow-up appointment.

Of the total recurrent epistaxis events in the bipolar group, 4 patients (8%) had recurrent epistaxis at a mean of 4.34 years after treatment. Overall, 17 patients (28.3%) in the silver nitrate group had recurrent epistaxis at a mean of 1.53 years after treatment. Within 1 year after treatment, 7 patients in the silver nitrate group had recurrent epistaxis compared to 1 patient in the bipolar group (\( P = .07 \)). Within 2 years following treatment, 1 patient in the bipolar group had recurrent epistaxis compared to 13 in the silver nitrate group. This difference was statistically significant (\( P = .003 \)). After 2 years of treatment, 3 patients in the bipolar group and 4 patients in the silver nitrate group had recurrent epistaxis (\( P = 1.00 \)).

The rate of follow-up between the 2 study populations was similar. Thirty of the 50 patients (60%) in the bipolar cautery group and 30 of the 60 patients (50%) in the silver nitrate group were only seen at the initial follow-up visit (\( P = .29 \)). The remaining patients visited the practice for either other complaints or continued epistaxis. When comparing the length of follow-up between the groups, there are no quantitative differences. The percentage of patients without recurrent epistaxis in each group is summarized in **Figure 1**. Patients seen only at the initial postoperative visit were considered to have resolution of their epistaxis.

Preoperative clotting studies were obtained in 30 of 60 (50%) patients undergoing silver nitrate cautery and in 47 of 50 (94%) patients who underwent bipolar cautery. A clotting profile included complete blood count with differential, prothrombin time/partial thromboplastin time (PTT), platelet function studies, and von Willebrand panel. Two patients in the silver nitrate group had an elevated PTT but no diagnosed bleeding diathesis. Patients in each group experienced demographic information of the study population. The demographics were similar in each group, with the exception that in the bipolar treatment group, patients were older in age (mean, 9.0 years vs 7.4 years, respectively; \( P = .03 \)), had a more significant family history of epistaxis (n = 9 vs 1, respectively; \( P = .01 \)), and had fewer combined procedures (46% vs 67%, respectively; \( P = .04 \)) in comparison to the silver nitrate cautery group. There were no significant differences between the 2 groups regarding the frequency of epistaxis, duration of bleeding, environmental allergies, nasal steroid use, previous nasal trauma, abnormal blood work prior to treatment, patient history of easy bruising/bleeding, and previous nasal cautery.

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### Table 1. Patient Demographics.

<table>
<thead>
<tr>
<th></th>
<th>Bipolar Group</th>
<th>Silver Nitrate Group</th>
<th>Odds Ratio (95% CI)</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, n</td>
<td>50</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at onset, y</td>
<td>(Mean 95% CI)</td>
<td>6.9 (5.8-7.9)</td>
<td>6.2 (5.3-7.2)</td>
<td>( .37^a )</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>7.0</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Age at treatment, y</td>
<td>(Mean 95% CI)</td>
<td>9.0 (7.9-10.1)</td>
<td>7.4 (6.5-8.3)</td>
<td>( .03^{a,b} )</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>8.0</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>Duration of follow-up, d</td>
<td>(Mean 95% CI)</td>
<td>428 (240-617)</td>
<td>362 (253-471)</td>
<td>( .28^c )</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>54</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>Male sex, n (%)</td>
<td>29 (58)</td>
<td>41 (68)</td>
<td>0.64 (0.29-1.40)</td>
<td>( .32^d )</td>
</tr>
<tr>
<td>Environmental allergies, n (%)</td>
<td>10 (20)</td>
<td>8 (13)</td>
<td>1.63 (0.59-4.5)</td>
<td>( .44^d )</td>
</tr>
<tr>
<td>Nasal steroid use, n (%)</td>
<td>3 (6)</td>
<td>2 (3)</td>
<td>1.85 (0.30-11.5)</td>
<td>( .66^d )</td>
</tr>
<tr>
<td>Nasal trauma, n (%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1.2 (0.02-61.5)</td>
<td>( 1.00^d )</td>
</tr>
<tr>
<td>Abnormal blood work, n (%)</td>
<td>0 (0)</td>
<td>2 (7)</td>
<td>0.12 (0.006-2.6)</td>
<td>( .15^d )</td>
</tr>
<tr>
<td>Patient history of easy bleeding, n (%)</td>
<td>1 (2)</td>
<td>0 (0)</td>
<td>3.67 (0.15-92.0)</td>
<td>( .46^d )</td>
</tr>
<tr>
<td>Family history of epistaxis, n (%)</td>
<td>9 (20)</td>
<td>1 (2)</td>
<td>13.0 (1.58-106.2)</td>
<td>( .01^{b,d} )</td>
</tr>
<tr>
<td>Previous nasal cautery, n (%)</td>
<td>6 (12)</td>
<td>6 (10)</td>
<td>1.23 (0.37-4.1)</td>
<td>( .77^d )</td>
</tr>
<tr>
<td>Combined procedure, n (%)</td>
<td>23 (46)</td>
<td>40 (67)</td>
<td>0.31 (0.20-0.92)</td>
<td>( .04^{b,d} )</td>
</tr>
<tr>
<td>Bleeding episodes per week (95% CI)</td>
<td>2.06 (1.5-2.7)</td>
<td>2.79 (2.2-3.4)</td>
<td>( .09^a )</td>
<td></td>
</tr>
<tr>
<td>Minutes of bleeding per episode (95% CI)</td>
<td>12.9 (9.2-16.7)</td>
<td>9.9 (8.0-11.8)</td>
<td>( .14^a )</td>
<td></td>
</tr>
</tbody>
</table>

\( ^a \) t test.  
\( ^b \) \( P < .05. \)  
\( ^c \) Mann-Whitney test.  
\( ^d \) Fisher exact test.
about 2 nosebleeds per week. The bipolar group reported a longer duration of bleeding (13 minutes vs 10 minutes, respectively), but this was not significant ($P = .14$).

There were no associated risk factors found in the patients who failed treatment in either group compared to those who were successfully treated (Table 3). There were no postoperative complications in either group.

**Discussion**

Epistaxis in pediatric patients is most often self-limited or resolves with simple measures such as digital pressure or antibiotic ointment application. More severe or recurrent cases require treatment from a health professional; however, a consensus on treatment algorithms is lacking. A Cochrane review published in 2012 found no single treatment method to be significantly better than any other for recurrent idiopathic epistaxis in children.

In this study, we noted that children treated intraoperatively with either silver nitrate or bipolar cautery had minimal rebleeding during the first 6 weeks. Those treated with silver nitrate cautery were more likely to have recurrent epistaxis within 2 years of treatment. We expect the effect of treatment to be greatest during the initial 2 years after treatment. Over longer periods of time, the treatment is no longer protective, and unknown factors will affect any study population.

Over time, unknown intrinsic or extrinsic factors may impact the incidence of epistaxis in children who are constantly growing and changing. These factors may include changes in environment, habits, growth and development, anatomic changes, rhinitis, and nasal digital trauma. All of these factors could not be controlled for in a retrospective review.

We observed that children with RAE who failed medical therapy (saline spray, humidity, or antibiotic ointment) and underwent intraoperative bipolar electrocautery were less likely to have recurrent epistaxis compared to those treated with silver nitrate within the 2-year period following cautery in the operating room. No previous studies have compared bipolar cautery to other forms of treatment for RAE in children. When compared directly, patients treated with bipolar electrocautery had fewer postoperative bleeding events and a longer symptom-free interval before recurrent epistaxis during the first 2 years following cautery in the operating room. We believe that bipolar cautery, along with loupe magnification, may be more effective in visualizing and sealing visible septal and feeding vessels when compared to topical silver nitrate without magnification.

Many practitioners perform in-office silver nitrate cautery of the septum in all age groups without visual magnification. This is considered safe and efficacious as a standard method of treatment for anterior epistaxis. In this study, loupe magnification was used with bipolar electrocautery to precisely identify and cautere prominent septal vessels and feeding vessels. The physician treating with silver nitrate...
cautery did not use loupe magnification due to personal preference and the belief that prominent vessels could be identified and treated without magnification. The difference between techniques in their use of magnification potentially favors the bipolar cautery treatment group. This disparity is due to the retrospective nature of this study. The effect of adding magnification to chemical cautery for epistaxis is unknown. Our goal was to report the relative effectiveness of a new technique.

In this study, both techniques were performed exclusively in the operating room, allowing the physicians to maximize the application of cautery and not be limited by the child’s tolerance of the procedure while awake. It is possible that children undergoing silver nitrate cautery while awake with topical local anesthesia will have worse outcomes than in the silver nitrate intraoperative study group because the physician may have less control. Other benefits to the intraoperative bipolar technique may include the avoidance of chemical exposure and pain and less need for future treatments.

The major disadvantage of bipolar cautery is that it requires exposing the child to a general anesthetic. Some children can tolerate silver nitrate cautery with local anesthesia; however, a large percentage of children will not tolerate cautery while awake. In the population of children who need general anesthesia, bipolar cautery is an excellent treatment option and should be strongly considered. In children who can tolerate silver nitrate cautery while awake, intraoperative bipolar cautery can still be considered, especially if epistaxis is severe. Another application for the bipolar technique may be for children who have already failed attempts of in-office chemical cautery. In these children, the benefit of decreased recurrent epistaxis may outweigh the risks associated with general anesthesia. In addition, bipolar cautery is an excellent option for children undergoing another surgical procedure under the same anesthetic.

This study has limitations inherent in a retrospective chart review such as incomplete and nonsystematic data. The possibility of responder/recall bias exists; all study patients were children, and the clinical history was obtained from chart reviews of parent responses. Attempts were made to avoid selection bias by checking P values for confounding factors. Another limitation of the study is the lost to follow-up assumptions. Fifty percent of the bipolar group and 60% of the silver nitrate group were only seen once at the initial postoperative visit. This occurred at a mean of 5.8 weeks for the bipolar group and 6.9 weeks for the silver nitrate group. Many patients from each group were seen additional times in the practice for other problems, and this helped identify recurrent epistaxis events in both groups. Because the attrition rate was similar in both treatment groups, this helps to validate our results.

The use of visual magnification may be important to identify the septal and feeding vessels more accurately. Since magnification was used in the bipolar technique but not in the chemical cautery group, it may have affected the results of this study. The effect of magnification on outcomes after both operative and office-based chemical cautery is a question for further study.

### Conclusion

No previous studies have compared intraoperative bipolar electrocautery to silver nitrate chemical cautery. While both silver nitrate cautery and bipolar cautery are safe and effective for treating epistaxis, in this study, bipolar electrocautery resulted in fewer episodes of recurrent epistaxis during the first 2 years after treatment. The benefit of additional epistaxis control must be carefully weighed against the risk of general anesthesia necessary for the procedure. Children who require general anesthesia for a procedure to control their epistaxis are excellent candidates for this technique. Future prospective studies are needed to compare bipolar electrocautery to silver nitrate and other treatment modalities.

### Acknowledgments

The authors thank Jerry Behar, MS, MBA, for critically reviewing the article.

### Author Contributions

Nathan Johnson, conception, data acquisition and analysis, drafting, final approval, accountability for all aspects of the work; John Faria, data analysis, drafting, final approval, accountability for all

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Table 3. Recurrent Epistaxis Risk Factors.

<table>
<thead>
<tr>
<th></th>
<th>Rebleeding Group</th>
<th>No Bleeding Group</th>
<th>Odds Ratio (95% CI)</th>
<th>P Valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, n</td>
<td>21</td>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any 2 risk factors, n (%)</td>
<td>1 (5)</td>
<td>6 (7)</td>
<td>0.69 (0.08-6.07)</td>
<td>1.00</td>
</tr>
<tr>
<td>Any risk factor, n (%)</td>
<td>6 (29)</td>
<td>25 (28)</td>
<td>1.02 (0.36-2.94)</td>
<td>1.00</td>
</tr>
<tr>
<td>Environmental allergies</td>
<td>3 (14)</td>
<td>15 (17)</td>
<td>0.82 (0.21-3.15)</td>
<td>1.00</td>
</tr>
<tr>
<td>Nasal steroid use</td>
<td>0 (0)</td>
<td>5 (6)</td>
<td>0.36 (0.02-6.72)</td>
<td>.58</td>
</tr>
<tr>
<td>Nasal trauma</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>4.16 (0.08-216)</td>
<td>1.00</td>
</tr>
<tr>
<td>Abnormal blood workb</td>
<td>1 (7)</td>
<td>1 (2)</td>
<td>4.36 (0.26-74)</td>
<td>.35</td>
</tr>
<tr>
<td>Patient history of bleeding</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>1.37 (0.05-35)</td>
<td>1.00</td>
</tr>
<tr>
<td>Previous nasal cauter</td>
<td>3 (14)</td>
<td>9 (10)</td>
<td>1.48 (0.36-6.03)</td>
<td>.70</td>
</tr>
</tbody>
</table>

aFisher exact test.
bFifteen patients in the rebleeding group and 62 in the no bleeding group had preoperative laboratory work completed.
aspects of the work; Philomena Behar, conception, data analysis, drafting, final approval, accountability for all aspects of the work.

Disclosures
Competing interests: None.
Sponsorships: None.
Funding source: None.

References