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Joint Laser Photocoagulation and Bipolar Electrocautery in Treating Epistaxis

*Jing Zhang**

Departments of Facial Plastic Surgery, Eye, Ear, Nose and Throat Hospital, Fudan University, Shanghai, China

Abstract

Objectives: To assess the effectiveness of Nd:YAG laser photocoagulation alone and bipolar electrocautery alone compared to joint application in the management of epistaxis.

Materials and Methods: Prospective clinical research. Ninety-three successive patients with epistaxis were randomly allocated to receive treatment consisting of Nd:YAG laser photocoagulation (Group 1), bipolar electrocautery (Group 2) or joint application (Group 3) in an outpatient setting. Main outcome measures: Including bleeding intensity, bleeding frequency at 4 weeks and 20 weeks after treatment, patient perception of discomfort during treatment (grade 0 to 10), treatment duration and complications.

Results: The time of therapy of the laser group was significantly longer than other two groups (P<0.05). The outcome scores at 4 weeks after therapy showed no significant difference between these three groups. However, the outcome scores at 20 weeks after therapy showed a significant difference between the three groups (P<0.05). The effect on the bipolar cautery group was relatively poorer than those on the laser group and joint group.

Conclusion: This study demonstrates that Nd:YAG laser plus bipolar electrocautery treatment in epistaxis is a safe and simple therapy that is relatively superior to Nd:YAG laser photocoagulation or bipolar cautery alone.

Keywords: Epistaxis; Nd:YAG laser; Photocoagulation; Bipolar Electrocautery; Optimal

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Correspondence:
Jing Zhang, Departments of Facial Plastic Surgery, Eye, Ear, Nose and Throat Hospital, Fudan University, No. 83, Fenyang Road, Postal Code: 200031, Shanghai, China, Tel: 86-13816653516;
E-mail: gracezj28@hotmail.com

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Introduction

Epistaxis is a common disease that occurs in 60% of people during their lifetime. Most epistaxis is spontaneous (~70%) and only a few are caused by trauma or neoplasm [1]. It most commonly occur in the nasal anterior septum (Kiesselbach's area) and is usually managed conservatively [2]. Posterior nasal bleeding (Woodruff's plexus) accounts for 5% to 10% of all patients [2]. Previous studies have confirmed that only about 0.5% of patients are serious enough to go to the emergency department, and 0.2% requires hospitalization [1]. Many mild epistaxis are cured by lifestyle and diet changes [3], and most can be resolved by local compression or topical medication [4,5]. Additionally, Many lasers (Nd:YAG (Neodymium: Yttrium-Aluminum-Garnet), KTP (Potassium-Titanyl-Phosphate) and PDL (Pulsed Dye Laser) lasers) have been shown to be effective in treating epistaxis. Many recently published guidelines for epistaxis have missed this method. The French guidelines point out that chemical or electric cauterization with local anesthesia is referred in the patients with Kiesselbach's plexus bleeding. For patients with treatment failure or bleeding elsewhere, electric cauterization is used [6]. Chinese guidelines for epistaxis indicate that cautery usually provides definitive treatment once the bleeding point is identified. There are two main types of cautery, chemical cautery (silver nitrate) or electric cautery (hotwire or bipolar cautery) [7]. These guidelines still omit laser treatment. For the more than past 10 years, we have used Nd:YAG laser (1064 nm) alone to treat epistaxis. We found that treatment was very satisfactory. Certainly, laser treatment directed at the larger telangiectasias often results in blasting bleeding, making further treatment difficult. An optimal treatment for epistaxis is still needed. Therefore, we used an Nd:YAG laser (HuaGong company, Wuhan, China) plus bipolar coagulation to treat epistaxis and compared the results to those of laser therapy or bipolar coagulation therapy alone.

Materials and Methods

It was conducted a prospective, randomized, double-blinded study. Ninety-nine patients with anterior epistaxis were included in this study. The sequential patients went to the ENT laser

Department at the EENT Hospital, Fudan University, between March 2016 and May 2016. The ethics of this study was approved by the EENT Hospital Ethics Committee (2016025-1).

All procedures occurred in this study were in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All individual participants of this study signed informed consent. Following these, all patients with anterior epistaxis were determined by anterior rhinoscopy and endoscopy. The blood counts and coagulation function of all patients were normal.

There are some exclusion criteria in this study including nasal neoplasm; pregnancy; serious active hemorrhage posing a danger to life; epistaxis after a nasal operation; Hereditary Hemorrhagic Telangiectasia (HHT); a systemic disease, such as a known bleeding disorder; silver nitrate cautery within one month; and posterior epistaxis, which was evaluated by endoscopy. The patients were randomly assigned to one type of treatment. Another doctor with blinded followed up and assessed all of the patients. All patients were treated as outpatients.

Trial design

All sequential patients were randomly assigned to one of three treatment groups via closed envelopes. Randomization involves a computer-generated random list by a dedicated statistician, and then sends the group number in a sealed envelope to each patient. Patients in first group received Nd:YAG laser photocoagulation once, patients in second group received bipolar electrocautery once, and patients in third group received Nd:YAG laser plus bipolar electrocautery once.

All the patients received routine clinical care, including recording medical history, physical examination, tests, and nasal endoscopy in every group. The patients were revisited at 4 and 20 weeks after treatment. All patients in this study were treated by one senior doctor.

Nd:YAG laser and bipolar electrocautery treatment methodology

All therapy was performed in the outpatient treatment room under local anesthesia. First, we used mild saline to moisten the nose and remove the scabs and blood clots from the nasal cavity. Then, we used a local anesthetic (1% tetracaine) to anesthesia. We performed laser cautery under endoscopy by Nd:YAG laser (HGL-MY100C, Wuhan, China) using a contactless technique. If there is intraoperative bleeding, a topical epinephrine pledget is inserted into the nasal cavity and maintained pressure applied to stop the bleeding; then, we used the laser when the bleeding alleviated and repeated this process as needed. Laser output power is 3 W to 6 W and at a continuous mode. The average output power was 4 W. The fiber was very fine (1 mm diameter), and the fiber should be kept 1 mm to 2 mm away from the nasal mucosa.

Bipolar cautery was carried out under endoscopic visualization and bipolar forceps is equipped with suction device. The average setting was 10 watts to 12 watts.

The Nd:YAG laser plus bipolar cautery treatment was performed endoscopically with a Nd:YAG laser first, using a bipolar to remove high-flow bleeding and perform cautery when treatment-associated bleeding occurred. If no treatment-associated bleeding occurred, we used Nd:YAG laser photocoagulation first and then bipolar electrocautery. Only one person is required to perform the treatments for these procedures allow both hands to be free.

Data collection and follow-up

Before and after treatment all participants accomplished a questionnaire. They need to record multiple messages including sex, age, frequency of bleeding, intensity of bleeding, duration of symptoms, known predisposing factors, and discomfort after treatment. It ranked the intensity of bleeding as defined by Bergler et al. [5] (1= stains on napkin, 2= soaked napkin, and 3= bowl required) and the frequency of bleeding (1= less than once per month, 2= once per month, 3= once per week, and 4= once every day or more). We collected data including demographic parameters, bleeding intensity, treatment number, bleeding frequency, pain experienced during therapy, and complications. We used 10-point Visual Analog Scale (VAS) to evaluate the pain experienced during treatment (0= no discomfort, and 10= unbearable). We also measured the outcomes as the bleeding intensity and bleeding frequency after treatment (0= no bleeding, 1= reduced, 2= the same, and 3= worse). Each patient was followed up 4 and 20 weeks after treatment.

Statistical analysis

The data were analyzed by the SPSS 23 software program (IBM, New York, USA). The demographic data were revealed as means ± SD. Several independent samples and a paired-samples T test were used for means. Percentages was used by the chi-square test. One-way ANOVA and Tamhane's T2 were used for therapy duration and VAS of discomfort. Kruskal-Wallis test was used for outcome scores at four and 20 weeks after treatment. P values less than 0.05 and a 95% confidence interval were considered significant.

Results

There are 99 consecutive patients (men, 44; women, 55) of anterior epistaxis were included in the trial. Three patients in each group were excluded after loss to follow-up. Finally, 93 patients (men n=41, women n=52) completed the trial. One third of all patients were assigned to group 1, another one third were assigned to group 2, and the remaining 31 were included in group 3. After five months we evaluated the primary results. The follow-up rate was 94%. The baseline variables of each group were listed in Table 1. This information indicates that the characteristics of all groups were well matched. There were no statistically significant differences in these three groups about these characteristics. The indices for the risk of bleeding as the intensity of bleeding, frequency of bleeding and duration of symptoms were well matched in the three groups.

Table 2 shows pain during treatment, duration of treatment, and bleeding. In all groups, the course of treatment is relatively short and well tolerated. However, the therapy duration of each group was different. The duration of the laser group was significantly longer than that of the other two groups. All patients returned home that day and resumed their daily routines. Nasal packing was not required after surgery. Usually, patients did not experience any discomfort after surgery and it did not affect their daily life. The differences in the intensity and frequency of bleeding before and after treatment (20 weeks) among all groups are showed in Table 3. The difference between pretreatment and post-treatment status in all groups (multi-independent-samples test) was significant.

Table 4 shows that at four weeks after treatment, there was no statistically significant difference between the three groups (multi-independent-samples test) (P=0.14, P>0.05). However, at 20 weeks

Table 1: Patient characteristics in each experimental group.

	Group 1	Group 2	Group 3	P
Randomized	31	31	31	
Excluded	2	2	2	
Age (mean ± SD)	55.84 ± 19.03	53.0 ± 18.78	57.39 ± 14.94	0.57
F/M	15/16	20-11	17/14	1
Intensity of bleeding (mean ± SD)	1.77 ± 0.72	1.71 ± 0.82	1.74 ± 0.73	0.95
Frequency of bleeding (mean ±SD)	2.87 ± 1.02	3.13 ± 0.81	3.19 ± 0.83	0.33
Duration of symptoms (weeks) (mean ± SD)	123.18 ± 244.23	72.83 ± 153.99	233.94 ± 643.5	0.29
Associated Factors				
Idiopathic	20 (65%)	20(64%)	11(35%)	
Hypertension	6 (19%)	3(10%)	13(42%)	
Antiplatelet (aspirin)	1 (3%)	1(3%)	3(10%)	
Inflammation (allergic rhinitis)	4 (13%)	7(23%)	4(13%)	
Others	0 (0%)	0(0%)	0(0%)	
Bleeding source				
Nasal septum	25 (81%)	27 (87%)	24 (77%)	
Inferior turbinate	4 (13%)	3 (10%)	4 (13%)	
lateral nasal wall	1 (3%)	1 (3%)	2 (6%)	
olfactory cleft	1 (3%)	0 (0%)	1 (3%)	

Table 2: Intra-operative pain experienced, therapy duration, and bleeding occurrence.

	Group 1	Group 2	Group 3	P		Statistics	value
Therapy duration (min) mean ± SD	7.1 ± 6.87	2 ± 1.16	2.97 ± 2.88	G1 & G2	0.001	One-way ANOVA, Tamhane's T2	F=12.0
				G1 & G3	0.011		
				G2 & G3	0.247		
VAS of discomfort mean ± SD	3.55 ± 1.88	3.10 ± 2.02	3.63 ± 1.68	0.48		One-way ANOVA	F=0.73
Intra-operative bleeding	14	8	11	0.35		Chi-square test	X_2=1.0
No bleeding	17	23	20				

after treatment, there was a statistically significant difference between these groups (P=0.047, P<0.05). There was significant difference between group 1 and group 2 or group 2 and group 3, but no difference between group 1 and group 3. Table 5 shows that there was no causal relationship between recurrence and the risk of epistaxis. The number of recurrences according to the risk of epistaxis is not statistically significant difference between the three groups, P=0.33 (P>0.05).

All groups have no complications, such as visible nasal scars, nasal adhesions, or perforation of the nasal septum. However, one patient in group 2 and one patient in group 3 reported a dry sensation in the nasal cavity.

Discussion

Repeated nosebleeds are not life-threatening but is always alarming to patients and influences their daily lives. We have used a Nd:YAG laser alone to treat nosebleeds for the past 10 years and have found this treatment to be relatively effective. But laser treatment directed at larger telangiectasias always cause explosive bleeding, making further treatment difficult and taking longer time. Meantime, we can also use the vascular active bleeding caused by laser to identify the potential range of diseased blood vessels. Because many rebleeding after treatment due to the incomplete scope of treatment of blood vessels. Unlike laser therapy, bipolar cautery head we used can quickly seal the bleeding site while removes high-flow bleeding, making later treatment simple and convenient. Compared with laser, bipolar cautery is more likely to cause nasal septum perforation due to the greater thermal damage. We have applied these two treatments jointly in epistaxis and compared their pros and cons.

There were no complications in all three groups in our experiment. The results showed good effects in all three groups. As measured by intensity and frequency of epistaxis, there was a significant difference between pre-treatment and post-treatment status in all groups. The mean ± SD pain levels experienced during the office laser treatment, bipolar cautery operation and joint application were 3.55 ± 1.88, 3.10 ± 2.02 and 3.63 ± 1.68, respectively, which are levels that can be tolerated (P>0.05). And it had no statistically significant differences among the three groups (P=0.73). However, the therapy durations were different. There was a significant difference between the three groups. The therapy duration of the laser group was clearly longer than that of the other two groups (P<0.05). This result suggests that treatment-induced bleeding due to the laser will prolong the therapy duration. Laser irradiation directed at the larger telangiectasias can easily cause active bleeding, which can make later treatment difficult. Laser treatment directed at the central lesions of larger often results in high-flow bleeding from the coalescent lesion, making further

Table 3: Pre-treatment and post-treatment (20 weeks) intensity of bleeding (0= no bleeding, 1= stains on napkin, 2= soaked napkin, and 3= bowl required) and frequency of bleeding (0= no bleeding, 1= less than once per month, 2= once per month, 3= once per week, and 4= once every day or more).

		Number of patients (%)						
		Intensity score						
		0	1	2	3		Mean Rank	P-value
Group 1	Pre-treatment intensity	0 (0%)	12 (39%)	14 (45%)	5 (16%)		47	P<0.001
	Post-treatment intensity	31 (100%)	0 (0%)	0 (0%)	0 (0%)		16	
Group 2	Pre-treatment intensity	0 (0%)	16 (52%)	8 (26%)	7 (22%)		46.23	P<0.001
	Post-treatment intensity	28 (90%)	3 (10%)	0 (0%)	0 (0%)		16.77	
Group 3	Pre-treatment intensity	0 (0%)	13 (42%)	13 (42%)	5 (16%)		46.79	P<0.001
	Post-treatment intensity	30 (97%)	1 (3%)	0 (0%)	0 (0%)		16.21	
		Frequency score						
		0	1	2	3	4	Mean Rank	P-value
Group 1	Pre-treatment frequency	0 (0%)	3 (10%)	9 (29%)	8 (26%)	11 (35%)	47	P<0.001
	Post-treatment Frequency	31 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	16	
Group 2	Pre-treatment frequency	0 (0%)	0 (0%)	8 (26%)	11 (35%)	12 (39%)	47	P<0.001
	Post-treatment frequency	28 (90%)	3 (10%)	0 (0%)	0 (0%)	0 (0%)	16	
Group 3	Pre-treatment frequency	0 (0%)	1 (3%)	5 (16%)	12 (39%)	13 (42%)	46.98	P<0.001
	Post-treatment frequency	30 (97%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)	16.02	

Table 4: Outcome scores at four and 20 weeks after treatment (0= no bleeding, 1= reduced, 2= the same, and 3= worse).

		Number of patients (%)						
		Outcome score						
Outcome measure	Type of treatment	0	1	2	3	P-value		
4 weeks after treatment	Group 1	28 (90%)	3 (10%)	0 (0)	0 (0%)	P=0.137		
	Group 2	24 (77%)	7 (23%)	0 (0%)	0 (0)			
	Group 3	29 (94%)	2 (6%)	0 (0%)	0 (0%)			
20 weeks after treatment	Group 1	31 (100%)	0 (0%)	0 (0%)	0 (0%)	P=0.047	G1 & G2	P=0.032
	Group 2	28 (90%)	3 (10%)	0 (0%)	0 (0%)		G2 & G3	P=0.032
	Group 3	31 (100%)	0 (0%)	0 (0%)	0 (0%)		G1 & G3	P=1.0

Table 5: Patient recurrence and success according to the risk of epistaxis (low risk: intensity of bleeding+ frequency of bleeding ≤ 4; moderate risk: intensity of bleeding+ frequency of bleeding 5-6; and high risk: intensity of bleeding + frequency of bleeding 7).

	Risk of epistaxis	No. of patients	Recurrence	Success
Group 1	Low	16	2	14
	Moderate	11	1	10
	High	4	0	4
Group 2	Low	13	2	11
	Moderate	13	2	11
	High	5	3	2
Group 3	Low	11	1	10
	Moderate	16	1	15
	High	4	0	4

*Patient number according to the risk of epistaxis between three groups, P=0.57 (P>0.05)

*Recurrence number according to the risk of epistaxis between three groups, P=0.33 (P>0.05)

treatment difficult. High-flow bleeding absorbs most of the energy of the laser, the effect of laser treatment is affected and the treatment time is prolonged. In contrast, bipolar cautery can simultaneously coagulate and remove high-flow bleeding, shortening the therapy duration. Opposite to 4 weeks after treatment, the outcome scores at four weeks after treatment showed no significant difference between the three groups. However, the outcome scores at 20 weeks after treatment showed a significant difference between the three groups. The effect in the bipolar cautery group was relatively poorer than that in the laser and joint groups (P<0.05). This result suggests that the long-term effect of bipolar cautery alone is comparatively disappointing. The Nd:YAG laser has great potential because of they absorb more hemoglobin and less epidermal melanin and water [6]. Wavelength 1,064 has less absorption of melanin than an argon (488 nm to 514 nm) or KTP (532 nm) laser, and it penetrates deeper and has a larger inflammatory response zone because of its longer wavelength [9]. The vascular active bleeding caused by laser to identify the potential range of diseased blood vessels is also helpful which can define curvaceous scope of treatment. This study demonstrated that Nd:YAG laser photocoagulation, bipolar cautery and joint application are safe, effective, and simple procedures in the outpatient setting associated with minimal bleeding and tolerated. This treatment allows the patient to return to work and daily life in the shortest period of time (the same day). However, these three applications differ slightly. The therapy duration of Nd:YAG laser photocoagulation was comparatively longer. However, the long-term effects of laser treatment and joint application are relatively better. Furthermore, bipolar cautery owning to the larger heat damage will crusting, damage mucous membrane and reduce

mucociliary function. Laser therapy is more widely used because it targets telangiectasia with minimal peripheral tissue damage and is recommended for the treatment of recurrent epistaxis in Hereditary Telangiectasia (HHT) [10]. There were no complications (blood transfusion, hospitalization, visible nasal scars, nasal adhesions, or perforation of the nasal septum) in the three groups. Only one patient in group 2 and one patient in group 3 had a dry sensation in the nasal cavity after treatment.

Conclusion

Because a single clinician conducted this study, the results may be influenced by the clinician's individual techniques and experience with the two treatments. However, there are certain weaknesses of this study. The study demonstrates that Nd:YAG laser plus bipolar electrocautery treatment in epistaxis is a safe and simple therapy and relatively superior to Nd:YAG laser photocoagulation or bipolar cautery alone, not only in terms of therapy duration but also long-term effect. This method could be elective. Future clinical studies with larger samples and longer follow-up periods will reduce bias.

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