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Research Article

Diode Laser *versus* Trichloroacetic Acid Local Cauterization for Treatment of Anterior Epistaxis in Children

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Abstract

Background: Epistaxis is one of the most common emergencies detected in the otorhinolaryngology unit. Although it's mostly benign, sometimes it can lead to life-threatening conditions; however, there was no specific local cauterization available for the controlling of little-area anterior epistaxis in children. ***Objective***: To evaluate the outcome of diode laser versus trichloroacetic acid in local cauterization of anterior epistaxis in children. ***Methods***: A prospective randomized comparative study, conducted on 60 children with anterior epistaxis, where the bleeding point was identified in a little area of the nasal septum at the otorhinolaryngology unit, was divided into 2 groups: Group "A" included 30 children treated by diode laser, and group "B" included 30 children treated by trichloroacetic acid (TAC) in a 1-year study duration. ***Results***: The mean age was 10.5±2.2 years in group A and 10.1±2.5 years in group B, with bleeding according to age groups (p>0.05), most of the children were 10 years old, being 26.66% in group A and 23.33% in group B. Males were 68.33%, and females were 31.67%. The efficacy of local cauterization (yes/no) was significant for males and females (p<0.05). The recurrence rate of epistaxis after 3 months of follow-up in group A was 16.7%, and in group B, 66.7% (p=0.0001). ***Conclusions***: Diode laser local cauterization had significantly better results in the management of pediatric anterior epistaxis regarding bleeding site in comparison with that of trichloroacetic acid.

Keywords: Epistaxis; Diode laser; Trichloroacetic acid.

الليزر مقابل الكي الموضعي بحمض ثلاثي كلورو أسيتيك لعلاج الرعاف الأمامي لدى الأطفال

الخلاصة

الخلفية: الرعاف هو أحد أكثر الحالات الطارئة شيوعا التي يتم اكتشافها في وحدة طب الأنف والأذن والحنجرة. على الرغم من أنه في الغالب حميد، إلا أنه أحيانا قد يؤدي إلى حالات تهدد الحياة؛ ومع ذلك، لايوجد علاج موضعي محدد للتحكم في الرعاف الأمامي الصغير في الأطفال. **الهدف:** تقييم نتائج استخدام الليزر مقابل حمض ثلاثي كلورو أسيتيك في الكي الموضعي الأمامي لدى الأطفال. **الطرائق:** دراسة مقارنة عشوائية مستقبلية، أجريت على 60 طفلا مصابين بالرعاف الأمامي، حيث تم تحديد نقطة النزيف في منطقة صغيرة من الحاجز الأنفي في وحدة طب الأنف والأذن والحنجرة، تم تقسيم المشاركين إلى مجموعتين: المجموعة "أ" شملت 30 طفلا عولجوا بالليزر، والمجموعة "ب" شملت 30 طفلا عولجوا بحمض ثلاثي كلورو أسيتيك (TAC) خلال فترة دراسة لمدة سنة واحدة. **النتائج:** كان متوسط العمر 10.5±2.2 سنة في المجموعة أ و10.1±2.5 سنة في المجموعة ب، مع نزيف حسب الفئات العمرية (p>0.05)، وكان معظم الأطفال في عمر 10 سنوات، حيث بلغ 26.66٪ في المجموعة أ و23.33٪ في المجموعة ب. كان الذكور 68.33٪، والإناث 31.67٪. كانت فعالية الكي الموضعي (نعم/لا) ذات دلالة كبيرة للذكور والإناث (p<0.05). كان معدل تكرار الرعاف بعد 3 أشهر من المتابعة في المجموعة أ 16.7٪، وفي المجموعة ب، 66.7٪ (p=0.0001). **الاستنتاجات:** كان للكي الموضعي بالليزر الديودي نتائج أفضل بشكل ملحوظ في علاج الرعاف الأمامي لدى الأطفال فيما يتعلق بموقع النزيف مقارنة بحمض ثلاثي كلورواستيك.

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INTRODUCTION

Epistaxis is regarded as one of the most commonly encountered clinical emergencies in the otolaryngology department, which sometimes needs hospital admission. Recurrent epistaxis is a common condition in the pediatric age group with significant implications on quality of life and health care burden [1]. Epistaxis can be categorized as anterior or posterior epistaxis, depending on the source site [2]. In children, anterior epistaxis is more common than posterior [3]. The anterior epistaxis mainly originates either from Kiesselbach's plexus, which is "a rich vascular anastomotic area created by artery ends," or from the retro-columellar vein [4]. Despite most cases being idiopathic, benign, and self-limiting, an attack often requires intervention, especially when conservative management, such as nasal lubrication or nasal saline irrigation, fails [5]. Epistaxis in children is frequently associated with local factors like inflammatory, infective, nasal trauma, dryness, and prominent vasculature of Kiesselbach's plexus; less commonly, it may indicate systemic disorders like coagulopathies or hereditary hemorrhagic telangiectasia [6]. Hemophilia A is an X-linked recessive inherited bleeding illness [7], and it causes a decrease in the blood's ability to coagulate, which in turn results in an

increased risk of delayed bleeding, which in turn results in serious and perhaps life-threatening health problems [8]. Different types of treatment methods are available for the management of epistaxis, ranging from applied local pressure, topical vasoconstrictors, nasal packing, and cauterization (chemical, laser, and electrical) to embolization or ligation of offending vessels. Its management at any age group starts with resuscitation, identification of the bleeding site, controlling bleeding, and treating the underlying reason; however, there is no definite protocol for epistaxis management [9]. Cauterization was regarded as an important treatment for recurrent localized epistaxis that usually does not respond to first-line medical treatment. There are many modalities for cauterizing the bleeding points, including chemical cautery, which is most commonly done with silver nitrate and trichloroacetic acid (TCA), and also thermal cautery by using different types of lasers like diode, CO_2, and KTP [10]. TCA is widely available and has been used for decades to achieve hemostasis by chemically ablating mucosa. Despite its effectiveness, TCA can cause mucosal irritation, chemical burning, and post-cauterization discomfort, raising concern about its safety in children [11]. Laser cauterization by using diode, CO_2, and other modalities provides technologies that offer more precise control over tissue ablation and coagulation with minimal damage to the surrounding mucosa. These advantages make diode laser a promising alternative for the treatment of recurrent epistaxis or anatomically challenging cases; however, there are limitations for widespread adoption of this technology, like higher cost or the need for specialized equipment [12]. Also, the diode laser mechanism of action was via photothermal coagulation, which effectively causes sealing of blood vessels with minimal damage to adjacent tissues. The 980 nm wavelength diode laser was particularly suited for hemoglobin absorption, ensuring efficient obliteration of vascular anomalies [13]. On the contrary, the TCA mode of action is by chemical burning of the mucosal surface, leading to superficial vessel coagulation. Also, it has a limited penetration depth that may leave underlying vascular structures unaffected, leading to a higher recurrence rate. This limitation, combined with potential variability in application techniques, could account for the suboptimal outcomes observed with TCA [14]. Despite the clinical significance of both modalities, there is limited comparative study about their efficacy, safety, and patient outcomes in pediatric age groups. The aim of this study is to evaluate the outcomes of laser versus TCA local cauterization in the management of anterior epistaxis in children.

MRTHODS

Study design and setting

This is a randomized comparative prospective study in which 60 children with bothersome epistaxis from the little area of the nasal septum were enrolled. The study was conducted at the otorhinolaryngologic unit, and the duration of the study was 1 year.

Patient selection

Taken the agreement from the child's parents after explaining to them the results and purpose of the procedures and their possible side effects, as well as the aim and purpose of the current study. A consecutive sampling technique was done to include those 60 children who fit the inclusion criteria, divided randomly into 2 groups: group “A” included 30 children in whom local diode laser cauterization was used, and group "B" was where local TCA cauterization was used. All the children included in the current study were complaining of anterior epistaxis with resultant social embarrassment, like pillow and sleeping sheet wetting or bleeding during social activities or school lessons. Actually, the children's parents asked for radical fruitful solutions for their sibling problem.

Inclusion criteria

Children with a history of anterior epistaxis exclusively from the Kiesselbach plexus in the little area as documented by rhinoscopy (bleeding from the nose, sudden onset, identifiable bleeding points on the spectrum “range” of examination), those without satisfactory results (like ointment or nasal wash application for 4 weeks), and those who benefit from conventional treatment to stop epistaxis.

Exclusion criteria

Children who had epistaxis from other sites apart from the Little's area, or those with nasal septal deviation, and those due to the use of local corticosteroids, in which epistaxis was one of their side effects, and age above 12 years, and also those with systemic diseases like bleeding tendency or hematologic diseases, such as hypertension, diabetes, coagulopathies, tumors, and post-traumatic or postoperative.

Intervention and outcome measurements

After taking a precise history from the patient's parents and a full Ear, Nose, and Throat (ENT) examination, including anterior rhinoscopy and nasal endoscopy using a 2.7 rigid endoscope, crustation was found on the little area to confirm that epistaxis originated from this site exclusively. The age taken for study was from 6 to 12 years, because it was difficult to keep the child under control during the procedure below this 6-year age. Laboratory investigations were done for all children, including a complete blood picture (CBC), bleeding profile, and virology screen. First, a local anesthetic was used in the form of a cotton-wool pack sprayed with lidocaine solution and xylometazoline drops, the latter used to decongest the nasal septal mucosa and ease the procedure. The cotton-wool pack is removed 5 minutes later, and the procedure of cautery is started. In group A, a low-intensity diode laser was used, starting with a laser with a 980 nm wavelength (2 watts) in continuous mode by the non-contact method (the probe didn’t touch the target site) with a distance of not more than 3 mm

(piezoelectric transducers are used in ultrasonic surgery instruments), an ultrasonic nasal probe, and a surgical probe (I2S, product code: 9090-7012), with all safety procedures used for protection. In TCA group B; 25% solution of TCA on cotton wool was rolled on the serrated end of the Jobson-Horne probe, but the rolling of the agent was done around the bleeding site. All children, after local cauterization, were instructed to avoid touching the operated area and avoid coughing or sneezing with a closed mouth. This might be possible since we applied nasal anesthetic medicine prior to the procedures. Then after we finished the procedures, a local Vaseline ointment and analgesic, as well as paracetamol 15 mg/kg per dose, were prescribed for all children, and they were instructed to come for follow-up visits after the 2nd week, 1 month, 2 months, and 3 months. The parameter taken for comparison between the two groups was the recurrence of epistaxis with follow-up 3 months after the procedures.

Ethical considerations

The current study was conducted in accordance with the ethical principles of the Helsinki Declaration, and verbal consent of the child's parents' approval was taken. Also, this study was approved by the institutional ethics committee, protocol number 137, on 3-1-2024.

Method of randomization

All the studied children were divided into 2 groups by utilizing block randomization style, in which the children were randomized within blocks. Randomly, by this method, the studied groups were allocated according to the basic consequence-correlated mannerism.

Statistical analysis

The collected data were coded, entered, presented, and analyzed by computer using the available database software program statistical package of IBM SPSS-29 (IBM Statistical Packages for Social Sciences- version 29, Chicago, IL, USA). Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum values). The significance of the difference of quantitative data was tested using Students-t-test, and between percentages using the Pearson chi-square test. Statistical significance was considered whenever the P value was equal to or less than 0.05.

RESULTS

In this study, which was conducted on 60 children, the age group was between 6 and 12 years, with a mean age of 10.5 ± 2.2 years in group A and 10.1 ± 2.5 in group B. In the studied groups, there were 41 males' children (68.33%) and 19 females' children (31.67%), and the efficacy of local cauterization in both groups regarding the gender was shown in table 1, as there was a significant difference ($p< 0.05$). Bleeding according to age groups with no statistically significant differences, with $p> 0.05$, as it is shown most of the children at age 10 were (26.66%) in group A and (23.33%) in group B (Table 2).

Table 1: Local cauterization efficacy according to gender in both groups

Study groups	Efficiency (Male)		*p*-value	Total (n=60)
	Yes	No		
Group A	20	2	0.026	41
Group B	18	1		
Study groups	Efficiency (Female)			
	Yes	No		
Group A	9	1	0.031	19
Group B	8	1		

*Significant difference between two independent means using Students-t-test.

Table 2: Bleeding according to both studied age groups

Bleeding according to age		Diode Laser group A (n=30)	TCA group B (n=30)	*p*-value
Age (years)	6	4(13.330	3(10)	0.41
	7	3(10)	2(6.7)	0.41
	8	2(6.66)	4(13.3)	0.27
	9	1.0(3.33)	3(10)	0.34
	10	8(26.66)	7(23.3)	0.41
	11	7(23.3)	6(20)	0.41
	12	5(16.66)	5(16.66)	0.15
	Mean±SD (Range)	10.5±2.2 (6-12)	10.1±2.5 (6-12)	0.48

Values were expressed as frequency, percentage, range, and mean±SD.

The recurrence rate after the third month of epistaxis in diode laser group A was 16.7%, and in TCA group B it was 66.7%. As shown in Table 3, the recurrence rates are shown during the follow-up period. No post-local cauterization complications were detected in either study group.

DISCUSSION

There are different modalities of epistaxis management; these modalities might include local cauterization, either by chemical or by laser cauterization. The observed superiority of diode laser cauterization aligns with other studies emphasizing its precision and efficacy in vascular

conditions, as in Karapantzos *et al*. [15], who reported that diode lasers are highly effective in targeting specific vascular anomalies with minimal thermal injury to surrounding tissues; making them ideal for sensitive regions like the nasal septum.

Table 3: Recurrence rate of epistaxis in both studied groups during follow-up period

Recurrent bleeding		Diode laser group A (n=30)	TCA group B (n=30)	*p*-value*
After 2nd week	Yes	5(16.7)	7(23.3)	0.519
	No	25(83.3)	23(76.7)	
After 1st month	Yes	3(10)	17(56.7)	<0.0001
	No	27(90)	13(43.3)	
After 2nd month	Yes	2(6.7)	12(40)	0.002
	No	28(93.3)	18(60)	
After 3 months	Yes	5(16.7)	20(66.7)	<0.0.000
	No	25(83.3)	10(33.3)	

Values were expressed as frequency and percentage. * Pearson Chi-square test.

In another study, using the International Quality of Life Assessment Questionnaire verified these results and found that management of epistaxis by laser leads to better and long-lasting considerable refinement in the outcomes of mental health and life quality [15]. The same results of diode laser effectiveness in managing nasal vascular lesions and recurrent epistaxis were reported in a study by Kun *et al*. [16]. In addition, the relatively high recurrence rates observed with chemical cauterization are consistent with previous reports by Ikram *et al*. [17]. They attributed this to chemical cautery's superficial action, which may leave deeper vessels untreated, thereby increasing the likelihood of revascularization and recurrence. Furthermore, chemical cautery's potential to cause mucosal irritation and inflammation may exacerbate the risk of recurrent bleeding, as noted in other studies [18.19]. Diode laser had gained important portability and affordability; also, it had more tissue penetration, as well as effective controlled coagulation at the surgical site [20]. While, in study done by Felek *et al*. [21] showed that the effectiveness of chemical cautery showed that full control of epistaxis was obtained after the initial chemical cauterization. Laser had been implicated in the management of epistaxis, being helpful in recurrent nose bleeding that results from vascular abnormalities, like hereditary hemorrhagic telangiectasia [22]. Epistaxis is considered one of the most common emergencies seen in ENT; all ages might be involved. However, mainly the etiology remains undetected and so is labeled as idiopathic, yet most of those patients were managed simply by conservative methods, such as nasal packing, when the bleeding point was not identified, or local cauterization of the bleeding point, whereas, in intractable conditions, a surgical intervention is frequently needed [23].

Study Limitations

Relatively small sample size, single study center, cost-effectiveness, short follow-up period, and comparison between various laser types.

Conclusion

The current study showed the effectiveness in control of epistaxis and the superiority of the diode laser, with a lower recurrent bleeding rate over a 3-month follow-up period, so the diode laser group exhibited significantly lower recurrence rates of epistaxis at each follow-up interval compared to the TCA group.

Conflict of interests

The authors declared no conflict of interest.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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