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# Microwave ablation: A new technique for the prophylactic management of idiopathic recurrent epistaxis

Zheng-cai Lou

*Department of Otorhinolaryngology, Yiwu Central Hospital, 699, Jiangdong Road, Yiwu City, Zhejiang Province, China*

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ABSTRACT

*Objective:* The objective of this study was to compare the re-bleeding of idiopathic recurrent epistaxis with no definite bleeding site treated with either prophylactic microwave ablation (MWA) or continuous observation.
*Study design:* Case series with chart review.
*Subjects and methods:* 61 patients with idiopathic recurrent epistaxis but no definite bleeding sites in the first operation were assigned to prophylactic MWA group ($n = 39$) and continuous observation group ($n = 22$). Patients in prophylactic MWA group were given prophylactic MWA at the common bleeding sites. Patients in continuous observation group were only observed in the ward. The bleeding sites, re-bleeding and complications were evaluated during 3 months follow-up period.
*Results:* Rebleeding was experienced by 7 of the patients (17.9%) who were treated with prophylactic MWA whereas, 13 of the patients (59.1%) who used continuous observation had rebleeding. The rebleeding rate for patients undergoing prophylactic MWA group was lower than that for the observation-only group ($p < 0.01$). All the ablations were completed for the patients with known bleeding site within 1–2 min. These patients only had the complain of slight postoperative pain, no serious complications (including nasal adhesion, crust, septal perforation, etc.) were found in the follow-up period.
*Conclusions:* MWA is a simple, convenient, rapid, and definite hemorrhage control method with minimally invasive therapeutic technique. Prophylactic MWA at the common bleeding sites helps to significantly reduce the rate of rebleeding in patients in whom no definite bleeding sites have been identified.

## 1. Introduction

Idiopathic recurrent epistaxis is commonly encountered in the rhinology clinic, the identification of bleeding point is often difficult and sometimes impossible, especially for inactive epistaxis. The ideal treatment for recurrent epistaxis with unknown bleeding site has not been elucidated. Some scholars recommended anterior and posterior nasal packing or the ligation/embolization of offending vessel [1,2]; others scholars suggested continuous observation [3,4]. Although continuous observation had the property of spontaneous healing, recurrent epistaxis resulted in that the patients frequently returned to the hospital or the operating room. Microwave ablation (MWA) is a minimally invasive therapeutic technique, that had been used to urgent hemostasis of active hemorrhage of livers [5,6]. In recent years, we used MWA to treat the arterial epistaxis and obtained high success rate and minimal side effects [7,8]. This study retrospectively analyses the re-bleeding rate between MWA and continuous observation for 61 recurrent epistaxis with unidentified bleeding sites.

## 2. Materials and methods

### 2.1. Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethical Review Board of Wenzhou Medical College-Affiliated Yiwu Hospital in Yiwu, Zhejiang, China. Informed consent was obtained from all participants.

Clinical records of idiopathic intractable epistaxis who presented to the Otolaryngology Outpatient Clinic in Wenzhou Medical College-Affiliated Yiwu Hospital in China between January 2011 and December 2016 were accessed through the Records Department of the hospital. All datas were collected from the patients' electronic office charts and operative reports. Cases that met the following inclusion criteria were retrieved for analyses: (1) Idiopathic epistaxis in adult with or without nasal cavity packing; (2) The bleeding site wasn't identified endoscopically at initial visit; (3) at least 6 months follow-up; (4) no previously known local or systemic disease that might cause bleeding, not receiving any anticoagulant medication; (5) The patients received

*E-mail address:* louzhengcai@163.com.

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the treatment of either microwave ablation or continuous observation on the ward. Exclusion criteria: (1) insufficient follow-up (i.e., no initial follow-up appointment); (2) inadequate documentation of ENT examination findings a known; (3)patients with post-traumatic epistaxis, or secondary bleeding after nasal surgery; (3) epistaxis due to systemic disease.

## 3. Technical details

### 3.1. Prophylactic microwave ablation group

We performed prophylactic MWA for the prominent vessels or similar varicose veins for recurrent epistaxis with unidentified bleeding sites using MWA (EBH-IV microwave therapy, Shanghai Xiyu Electromechanical System Co. Ltd., China) equipped with a 2450 MHz cooled-shaft antenna with 60 W output power.

The EBH-IV MWA device can use different types of single cooled-shaft microwave antenna attachments. The microwave antenna tip is designed as either a contact- or insertion-type. The microwave antenna is 9 cm in length and 3 mm in outer diameter, and the length of the exposed and non-insulated antenna tip is 5 mm. The contact-type antenna is used to treat epistaxis in this study; the antenna tip is a split-type double needle with an upward portion. The width of the double needle is 1 mm and the length of the upward portion of the antenna tip is 2 mm (Fig. 1). We used the upward portion of the antenna tip to contact the nasal mucosa or bleeding point and treat epistaxis, but did not directly insert the tip into the lesion. The detail of MWA application had been previously described [7]. The size and length of microwave antenna was similar in size to the monopolar with suction apparatus commonly used to control epistaxis, that can reach different region of nasal cavity (Fig. 2). A footplate-operated switch was used to control the ablation time, and length, width, and depth of penetration of the thermal lesion. The microwave application time was 1–3 s for each ablation, repeated ablation could be performed on the same bleeding point region. MWA was stopped when the color of the ablated zone changed from normal to gray-white (Fig. 2). One or more regions of nasal cavity were proactively ablated based on the prominent vessels at the common bleeding sites, included the middle meatus, inferior meatus, olfactory cleft, Woodruff's plexus, and deviation part of nasal septum. None of nasal packing was used for all the patients. These patients were transferred to the ward after MWA.

### 3.2. Continuous observation group

No further treatment was adopted because that the bleeding site couldn't be identified endoscopically, these patients were directly transferred to the ward for observation.

All patients were transferred to the ward for 72-h observation without any other interventions in two groups. They were discharged from the hospital if no further re-bleeding occurred. If it did recur, they underwent a second operation. The nasal cavity was re-examined endoscopically for the patients with rebleeding. The follow-up was scheduled at one week and 6 months after the first treatment.

## 4. Data analyses

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, nasal side of bleeding, with or without comorbid conditions and bleeding duration. *Re*-bleeding was defined as that required an surgical intervention during the follow-up periods in this study. Interventions included additional cautery or ablation, arterial ligation, and nasal packing. The chi-squared test and *t*-test were used to compare certain categorical variables, differences were considered significant if the $P$ value was $< 0.05$. Statistical analyses were carried out using SPSS software (version 19.0 for Windows; SPSS, Inc., Chicago, IL, USA).

## 5. Results

The total of 61 patients met the inclusion criteria in this study. Of these cases, 39 cases (63.9%) were in the MWA group while 22 cases (36.1%) in the continuous observation group. The demographic data of patients in these 2 groups of treatment categories are presented in Table 1. The average age, sex, nasal side of bleeding, with or without comorbid conditions and bleeding duration were matched in both groups ($P > 0.05$) (Table.1).

Of the 39 patients in the MWA group, the prophylactic ablation was completed successfully within 10–20 s in all the patients, only one region of nasal cavity were ablated in 11 patients, two regions in 23 patients, and three regions in 5 patients. Rebleeding was experienced by 7 of the patients (17.9%) who were treated with prophylactic MWA whereas, 13 of the patients (59.1%) who used continuous observation had rebleeding. The rebleeding rate for patients undergoing prophylactic MWA group was lower than that for the observation-only group ($p < 0.01$). Of these cases, 7 patients in Group prophylactic MWA underwent reoperation for further bleeding. The bleeding sites were found on the anterior end of the lateral wall of the inferior meatus (1 patients), anterior nasal cavity roof (1 patient), anterosuperior part of the cartilaginous septum (2 patients) (Fig. 3), Woodruff's plexus (1 patient), and the anterior face of the sphenoid sinus (2 patients). Of the 7 patients, gelatin sponge packing was used in 2 patients and the others patients for re-MWA.

In Group observation-only, 13 patients experienced further bleeding. The bleeding sites in 12 patients were found on the olfactory cleft (6 patients), middle meatus region (1 patient), the fornix of inferior meatus (2 patients), posterior lateral wall of the inferior meatus (1 patient), concave area of deviation of nasal septum (1 patient), and the posterosuperior area of nasal septum (1 patient). Of the 13 patients, 12 patients with known bleeding site underwent MWA treatment, 1 patient was transferred to the ward for continued observation and no further bleeding was experienced.

No patients received blood transfusions. These patients only had the complain of slight postoperative pain, no serious complications (including nasal adhesion, crust, septal perforation, etc.) were found in the follow-up period.

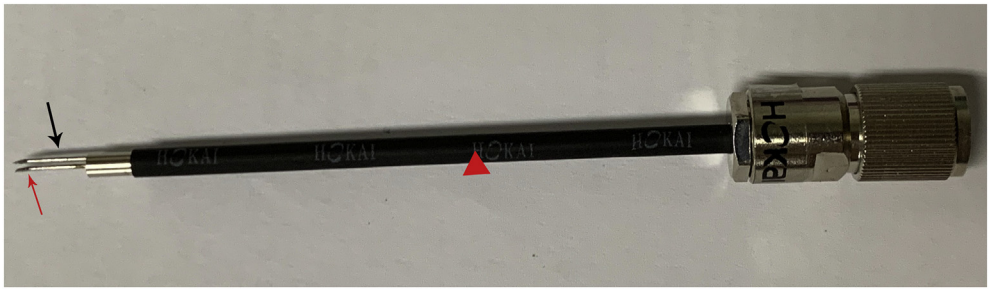

**Fig. 1.** The structure of the cooled-shaft antenna of MWA device. Red arrows indicate the length and width of the upward portion of the antenna tip; black arrows indicate the antenna tip; the red triangle indicates the antenna shaft. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

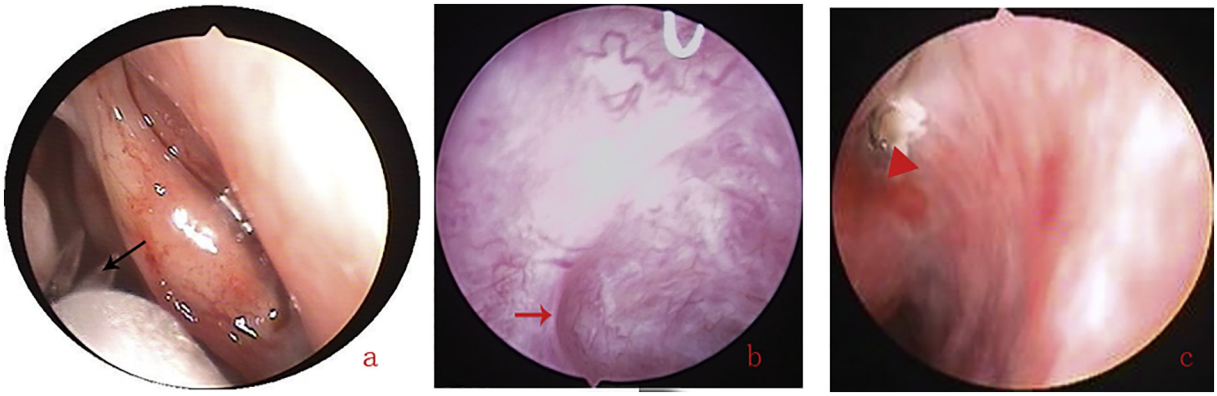


**Fig. 2.** The antenna of MWA reached the region of the olfactory cleft (a); prominent vessels (b); microwave ablation coagulation (c). Black arrows indicated the antenna of MWA; Red arrows indicated the prominent vessels; Red triangle indicated the ablation zone. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

**Table 1**
The comparison of demographic variables among two groups.

| | MWA group | Observation group | P value |
|---|---|---|---|
| No. | 39 | 22 | |
| Age | 49.6 ± 10.2 | 51.3 ± 9.4 | 0.532[b] |
| Sex (M vs F) | 28:11 | 14:8 | 0.476[a] |
| Side of bleeding(L:R) | 22:17 | 12:10 | 0.573[a] |
| Duration of epistaxis | 3.9 ± 2.7 | 4.1 ± 1.2 | 0.541[b] |
| With or without comorbid conditions | 8:31 | 3:19 | 0.642[a] |

$P < 0.05$ was considered statistically significant.
[a] $x^2$ test.
[b] *t*-test.

## 6. Discussion

Most of rhinologists like to choose nasal packing to avoid the patients returning frequently the hospital or operation room for recurrent epistaxis with unknown bleeding site [9], or sometimes choose the ligation/embolization of offending vessel for severe epistaxis [1,2]. However, a few rhinologists suggested continuous observation because the patients were afraid of pain and complications [3,4]. Many articles have identified the sites of bleeding, but the results are controversial. Some authors believed that intractable epistaxis mainly originated from the septum [2,3]. In this study, the second endoscopic inspection in observation group also found that 83.3% (10/12) of bleeding sites were on the side of septum of olfactory cleft, the inferior meatus, and the middle meatus, except that the bleeding site wasn't identified in 1 patient. The results were inconsistent with those reported [3,4,10]. Thus, it is appropriate to perform prophylactic microwave ablation for prominent vessels at these bleeding sites.

MWA is a new therapeutic technique, it can locally obtain a consistently higher tissue temperature 65 °C–100 °C in the targeting tissue, allowing faster ablation time and larger area of coagulation [5,6]. MWA has been widely used to control various acute hemorrhage with minimal complications [5–8]. We performed prophylactic MWA for prominent vessels in 39 recurrent epistaxis with first unidentified bleeding sites, the rebleeding rate for patients undergoing prophylactic MWA group was lower than that for the observation-only group (17.9% vs 59.1%, $p < 0.01$). Thus, prophylactic MWA significantly reduced the risk of rebleeding. In this study, the number of potential bleeding sites addressed per patient was variable in the MWA group, the variability was based on the obvious vessels encountered at the common bleeding sites but not the clinical suspicion of the surgeon. In the study by Thornton et al. [3], no definite bleeding point was found in 7 of 43 patients, and no rebleeding was observed in these patients without further treatment [6]. This might have been because the number of patients included was small and the followup period was short. Liu et al. [4]also found that the rebleeding rate of prophylactic electrocoagulation (8.8%) was lower than that of observation Group (38.5%) ($p < 0.01$). In addition, the ablation time is about 10–20 s and the medical cost of microwave treatment is only $13 per occasion in china, it didn't significantly increase additional medical cost and additional time for the patients undergoing endoscopic inspection under the same anesthetic. This study showed that most of patients had only complaints of slight pain, crust, septal perforation, and nasal adhesion weren't observed. However, the flaw of this study is an retrospective study but not randomized controlled trial.

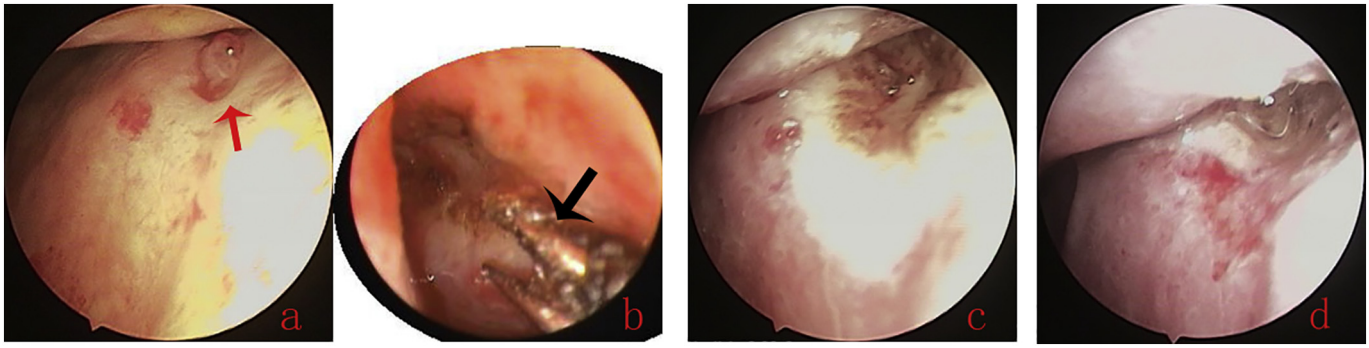


**Fig. 3.** A-44 years female patients with idiopathic recurrent epistaxis: the bleeding site was on the anterosuperior part of the cartilaginous septum in the second endoscopic inspection (a); the antenna of MWA (b); microwave ablation coagulation (c); 10 days after ablation (d). Red arrows indicated the bleeding points; Black arrows indicated the antenna of MWA. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

## 7. Conclusions

MWA is a simple, convenient, rapid, and definite hemorrhage control method with minimally invasive therapeutic technique. Prophylactic MWA helps to significantly reduce the rate of rebleeding and didn't significantly increase additional time and medical cost. Thus, it is an excellent option and should be strongly considered for the patients undergoing endoscopic inspection or another surgical procedure (e.g. shifting of the middle or inferior turbinate was simultaneously performed to enhance endoscopic visualization) to obviate the need for reoperation for recurrent epistaxis with unidentified bleeding sites. However, avoid excessive ablation to lateral nasal wall in this technique is crucial to avoid unexpected orbit injury or tissue necrosis.

## Fund disclosure

None.

## Declaration of Competing Interest

None.

## References

[1] Iimura J, Hatano A, Ando Y, Arai C, Arai S, Shigeta Y, et al. Study of hemostasis procedures for posterior epistaxis. Auris Nasus Larynx 2016;43:298–303.
[2] Supriya M, Shakeel M, Veitch D, Ah-See KW. Epistaxis: prospective evaluation of bleeding site and its impact on patient outcome. J Laryngol Otol 2010;124:744–9.
[3] Thornton MA, Mahesh BN, Lang J. Posterior epistaxis: identification of common bleeding sites. Laryngoscope 2005;115:588–90.
[4] Liu J, Sun X, Guo L, Wang D. Posterior epistaxis: common bleeding sites and prophylactic electrocoagulation. Ear Nose Throat J 2016;95:E18–22.
[5] Zhou H, Wu J, Ling W, Zhu D, Lu L, Wang X, et al. Application of microwave ablation in the emergent control of intraoperative life-threatening tumor hemorrhage during hepatic surgeries. Int J Hyperthermia 2018;34:1049–52.
[6] Guo J, Tian G, Zhao Q, Jiang T. Fast hemostasis: a win-win strategy for ultrasound and microwave ablation. Onco Targets Ther 2018;11:1395–402.
[7] Lou Z-C, Dong Y, Lou Z-H. Microwave ablation for the treatment of arterial epistaxis: “how I do it”. Int Forum Allergy Rhinol 2019. https://doi.org/10.1002/alr.22304. Jan 31. [Epub ahead of print].
[8] Lou Zhengcai, Wei Hong, Lou Zihan. Identification of bleeding sites and microwave thermal ablation of posterior epistaxis. Acta Otolaryngol 2019. https://doi.org/10.1080/00016489.2018.1552016.
[9] Bhatnagar RK, Berry S. Selective surgicel packing for the treatment of posterior epistaxis. Ear Nose Throat J 2004;83:633–4.
[10] Paul J, Kanotra SP, Kanotra S. Endoscopic management of posterior epistaxis. Indian J Otolaryngol Head Neck Surg 2011;63:141–4.