ORIGINAL CONTRIBUTION

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Prevention of ultrasonic coagulator-mediated mucoperiosteal flap injury and defects by using a clip manipulation in the resection of the posterior nasal nerve*

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SUMMARY

We previously reported on the clinical effectiveness of functional inferior turbinosurgery utilizing modified vidian neurectomy, the resection of the posterior nasal nerve (PNN), combined with inferior turbinoplasty. In order to prevent re-innervation of the PNN after resection and to avoid postoperative massive hemorrhage - presumably resulting from insufficient fixation and unexpected exposure of the bony or cartilaginous fragments covered on the resected neurovascular bundle containing the sphenopalatine vessels and the PNN - we designed a surgical technique during which a vascular clip was used in order to provide traction of the mucoperiosteal flap. Then we compared it with the previous procedure (without the use of the clip). The injury and defects of the mucoperiosteal flap were evaluated by the degree of exposure to the bony or cartilaginous fragments and scored on a scale of 0 to 2 points. The defects of the mucoperiosteal flap were reduced by using a vascular clip. The average score of the defects was 0.97 ± 0.73 ($n = 64$) in the conventional procedure without any manipulation and 0.27 ± 0.45 ($n = 60$) in the procedure using a vascular clip. The difference observed between the two gropups was statistically significant ($p < 0.001$). These results demonstrated that this is a safe technique to prevent injury and defects of the mucoperiosteal flap in gaining access to expose the PNN. This should promote early wound healing, reduce the chance of recurrence and of postoperative massive hemorrhage.

Key words: posterior nasal nerve, sphenopalatine artery, mucoperiosteal flap, ultrasonic coagulator, vascular clip

INTRODUCTION

We reported on the clinical effectiveness of modified vidian neurectomy, the resection of the posterior nasal nerve (PNN), combined with inferior turbinoplasty, resulting in minimal side effects [1]. Transnasal vidian neurectomy appears to offer the most direct approach to the nerve with minimal surgical morbidity [2,3]. However, it has a risk of causing bleeding and ophthalmoplegia, and there are sometimes difficulties in finding the nerve [4]. In order to resolve these problems, we developed a new, innovative surgical modality to advance vidian neurectomy [1,5]. Our technique can also apply to endoscopic sphenopalatine artery ligation or diathermy [6,7].

The efficacy of submucosal reduction of the inferior turbinate and resection of the PNN was evaluated for 56 patients with resistant chronic rhinitis with a follow-up period of 6 months to 4 years [1]. The symptomatic scores showed a remarkable improvement of 80 % or more with a significant improvement of rhinomanometry and nasal provocation testing. Thus, modified vidian neurectomy combined with inferior turbinoplasty provided an optimal surgical outcome as a treatment for intractable chronic rhinitis as evidenced by a relatively long-term follow-up.

In order to prevent re-innervation of the PNN after resection, the bony or cartilaginous fragments must cover the resected surface of the PNN. Simultaneously, the accompanying sphenopalatine vessels to the PNN must be resected, which ensures a corrected resection of the PNN and seems to be essential to cover the resected surface of the PNN. This neurovascular bundle containing the sphenopalatine vessels and the PNN can be safely resected using an ultrasonic coagulator (Harmonic scalpel, Ethicon, Endo-Surgery, Cincinnati, OH, USA), resulting in minimal bleeding from the nasal cavity [8,9].

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However, the mucoperiosteal flap, which was dissected to visualize the neurovascular bundle, is often injured by the ultrasonic coagulator, which may eventually result in insufficient fixation and unexpected exposure of the bony or cartilaginous fragments covering the resected neurovascular bundle, as well as delay of wound healing. Thus, we have developed a novel surgical technique in order to prevent the damage of the mucoperiosteal flap during the PNN resection.

In the present paper, we report on our new surgical technique, during which a vascular clip is used to provide traction of the mucoperiosteal flap, and we compare this with the previous, standard procedure (without the clip).

MATERIALS AND METHODS

Patients

A total of 62 patients with perennial allergic and vasomotor rhinitis were recruited. The conventional procedure using resection of the neurovascular bundle containing the PNN was performed from August 2006 to March 2007 including 32 patients (23 males and 9 males, aged 28.6 ± 9.9 years). The other group using surgical manipulation to prevent the damage of the mucoperiosteal flap during the PNN resection was operated on from April 2007 to November 2007 and included 30 patients (19 males and 11 males, aged 33.2 ± 15.1 years). All patients in both groups were operated upon by the same surgeon (K.I). The indications for surgery were resistant allergic or vasomotor rhinitis despite 1) use of topical inhalant steroids, oral antihistamine and antileukotrene treatment or 2) cauterization of the surface epithelium of the inferior turbinate using an argon plasma coagulator.

Surgery

The basic surgical procedure was performed according to the previous report [1]. Briefly, the posterior portion of the middle meatus is visualized by using a 0 degree, 4-mm nasal endoscope and the middle turbinate is seen to attach to the lateral nasal wall. A 20-30-mm vertical incision is then made approximately 5 mm anterior to the insertion of the middle turbinate into the lateral nasal wall. An elevator dissects the mucoperiosteal flap posteriorly until the crista ethmoidalis in the perpendicular plate of the palatine bone is reached. Gentle dissection above and below the crista ethmoidalis allows for better visualization of the neurovascular bundle emerging just from the sphenopalatine foramen, which distributes to the middle and inferior turbinates and the fontanelle. In the initial period from August 2006 to March 2007, the neurovascular bundle containing the sphenopalatine vessels and the PNN was resected using an ultrasonic coagulator (Harmonic scalpel, Ethicon, Endo-Surgery, Cincinnati, OH, USA) without manipulation of the mucoperiosteal flap. In the latter period from April 2007 to November 2007, the mucoperiosteal flap was grasped with a vascular clip, which was connected with a thread for traction (Figure 1). The thread was pulled up from the opposite nares through the choana, nasopharynx, and opposite nasal cavity, which enabled enough space to insert the ultrasonic coagulator without its making contact with the mucoperiosteal flap. Finally, in both techniques, the bony or cartilaginous fragments derived from the nasal septum were inserted into the space between the resected surface of the neurovascular bundle corresponding to the sphenopalatine foramen and the mucoperiosteal flap.

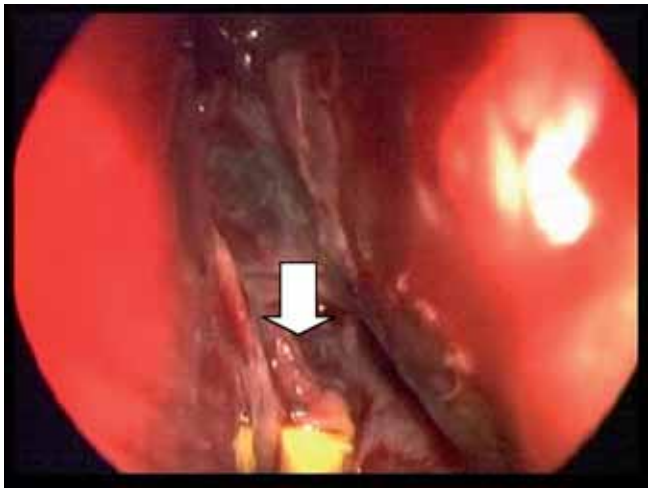

Figure 1. Endoscopic photograph (upper) and a schematic drawing (lower) during the surgery of the left nasal cavity. The mucoperiosteal flap is grasped with a vascular clip.

Scoring

The injury and defects of the mucoperiosteal flap were evaluated by the degree of exposure to the bony or cartilaginous fragments and scored on a scale of 0 to 2 points. Namely, score 0 indicated less than 25% exposure to bony or cartilaginous fragments, score 1 indicated 25 to 50% exposure, and score 2 indicated more than 50% exposure.

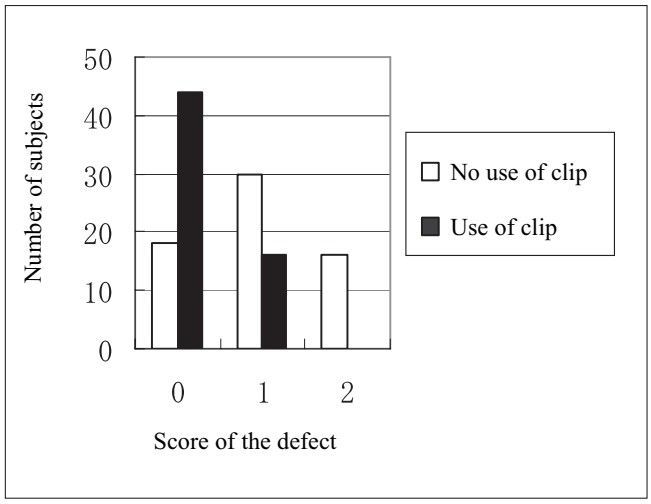

Figure 2. The distribution of subjects having defects of the mucoperitosteal flap after the posterior nasal nerve resection with (closed columns) and without (open columns) use of the clip.

Statistics

Data values were expressed as mean ± SD, and the statistical significance of differences was tested by using the paired Student's *t* test. Difference was estimated to be significant when the p-value was less than 0.05.

RESULTS

There was no significant age difference between the two groups. Figure 2 shows the distribution of the subjects with mucoperitosteal flap defects after PNN resection. It is obvious that mucoperitosteal flap defects were reduced by the use of a vascular clip. The average score of the defects was 0.97 ± 0.73 ($n = 64$) in the conventional procedure without any manipulation and 0.27 ± 0.45 ($n = 60$) in the procedure using a vascular clip. The difference observed between the two groups was statistically significant ($p < 0.001$).

DISCUSSION

We previously reported that functional inferior turbinosurgery using surgical procedures for both physical and functional elimination of the effector organs or tissues in intractable and severe chronic rhinitis resulted in patients being almost totally free of symptoms in 58% of the cases and significant reduction of symptoms in a further 28% [(1)]. The current study revealed that the underlying pathophysiological mechanisms of the PNN resection involved the suppression of secretagogue motor and the inhibition of neurogenic inflammation induced by parasympathetic and sensory denervation [(1)]. No significant deterioration of the outcome was recognized over time in the follow-up period of as long as 4 years, which is expected to suppress the re-innervation of the PNN by covering the resected PNN with the bony or cartilaginous fragments. However, 2 of the 50 patients complained of late failures at about 1 year after the operation. This long-term failure might have been brought about by the insufficient fixation of the bony or cartilaginous fragments resulting from the defect of the mucoperiosteal flap. Actually, in the previous report mucosal tears, including injury or defects in the mucoperiosteal flap, were observed in approximately 30% of the patients operated on [(1)]. A significant improvement in the prevention of injury or defects of the mucoperiosteal flap was observed following the development of the meticulous technique described in the present report.

Another advantage gained through preventing injury or defects of the mucoperiosteal flap is the avoidance of postoperative bleeding from the resected sphenopalaine artery or its branches. In our previous experience, one patient required hospitalization 2 weeks after surgery for severe and excessive nasal bleeding [(1)], which was thought to be due to the insufficient fixation of the bony or cartilaginous fragments to the resected neurovascular bundle. Sufficient and firm covering of the resected vessels with the intact mucoperitosteal flap will result in early scar formation and epithelization.

In conclusion, the present report demonstrated a safe and effective technique which can prevent injury and defects of the mucoperiosteal flap while providing access to expose the PNN, thus promoting early wound healing, reduced chance of recurrence and postoperative hemorrhage.

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