Modified Hemostatic Technique Using Microfibrillar Collagen Hemostat in Endoscopic Endonasal Transsphenoidal Surgery: Technical Note

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Abstract

Microfibrillar collagen hemostat (MCH) is accepted as an effective topical hemostatic agent during endoscopic endonasal transsphenoidal surgery (EETS), particularly to achieve venous hemostasis; however, handling MCH may be troublesome because of its adherence to gloves and instruments. We describe here a method of “injection” of MCH suspension using a syringe applicator. This technique allows a rapid and precise delivery of MCH to the bleeding points and thereby results in effective hemostasis; in addition, it is easy to prepare and it is also inexpensive.

Key words: endoscopic endonasal transsphenoidal surgery, microfibrillar collagen hemostat, topical hemostat

Introduction

Various topical hemostatic agents have been developed for neurosurgery, because electrocoagulation is not effective in many situations to achieve hemostasis. In endoscopic endonasal transsphenoidal surgery (EETS), it may be sometimes difficult to precisely deliver a topical hemostat to the bleeding points, because handling commonly employed hemostats with forceps may be troublesome because of the narrow and deep surgical field. We describe here a simple method of “injection” of microfibrillar collagen hemostat (MCH) in a suspended form. Hemostatic technique using an MCH suspension has been previously described in cardiovascular and spine surgeries, although there are no reports referring specifically to its application in EETS.

Materials and Methods

From January 2012 to December 2013, we performed EETS for pituitary lesions using binostril approach with two-surgeon technique in 10 consecutive patients. The injection method of MCH suspension was performed for hemostasis in all cases when we encountered bleeding from the dura mater of the sella floor, the cavernous sinus, the bony margins of exposure, and the tumor bed; bleeding could not be controlled by the standard hemostatic techniques using oxygenized regenerated cellulose (Surgicel®, Ethicon Inc., Johnson & Johnson Company, Somerville, New Jersey, USA), gelatin sponge (Gelfoam®, Pharmacia and Upjohn Company, Kalamazoo, Michigan, USA), bone wax, or electrocautery. We also applied the MCH suspension in place of swollen Surgicel® or Gelfoam® that interfered continued procedures. We received informed consent from all patients before surgery.

Hemostatic technique using MCH suspension

A pasty mixture was prepared by aseptically mixing 1 g of Avitene® flour MCH (Davol Inc, Woburn, Massachusetts, USA) with 9 mL of saline, filled into a 10-mL syringe, which was connected...
with another empty syringe using a three-way stopcock, and agitated by a pumping motion to turn the mixture into a suspension (Fig. 1A). The hemostat suspension was subsequently injected into the bleeding points through the nostril using a cannula (2 mm diameter) (Figs. 1B and 2A, B, E). This optimal volume of saline for making the mixture had been determined according to a viscosity that was enough for the suspension not only to be injected smoothly through the cannula, but also to remain where it was placed. A surgical patty was immediately layered over the hemostat and gently compressed using a suction tube through which excess moisture was absorbed (Fig. 2C). Reapplication of the hemostat was possible in cases of persistent bleeding. Once hemostasis was achieved (Fig. 2D), excess hemostat was removed by irrigation with saline flow and careful suction.

Results

The patients' characteristics are shown in Table 1. There were 6 male and 4 female patients, ranging in age from 12 years and 71 years (mean, 48 years). The pathology of the patients included 8 patients with non-functioning pituitary adenomas, one with Rathke's cleft cyst and one with germinoma. Bleeding from the cavernous sinus during resection of the tumor was encountered in two cases (Case 1 and Case 7). The follow-up period was between 2 months and 24 months (mean: 10 months). The time taken to prepare MCH suspension was approximately 3 min. The quantity of one injection was approximately 1 mL for the bleeding from the dura mater or bony margins and 2 mL for that from the cavernous sinus.

Fig. 1 Preparation of microfibrillar collagen hemostat (Avitene®) suspension. A: A pasty mixture prepared by mixing Avitene® flour with 9 mL of saline filled into a 10-mL syringe connected with another empty syringe using a three-way stopcock. The paste is agitated by pumping motion to turn it into a suspension. B: Syringe applicator containing Avitene® suspension for the injection method.

Fig. 2 Procedures of injection of Avitene® suspension to achieve hemostasis (A–D: Case 1, E: Case 2). A: Venous bleeding from the dura mater covering cavernous sinus during exposure of the right lateral portion of the sella. B: Injection of Avitene® suspension to the bleeding point. C: Application of a surgical patty over the Avitene® suspension, followed by compression using a suction tube. D: Complete hemostasis is achieved after the application of compression for a few minutes. E: Injection of the Avitene® suspension into the tumor bed to control venous oozing after tumor removal. A: applicator tip, CS: cavernous sinus, D: dissector, DM: dura mater, DS: diaphragm sellae, F: forceps, S: suction tube.
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The total volume of the injected MCH suspension ranged from 2 mL to 6 mL. The MCH suspension was easily and precisely applied at the bleeding points, and effective hemostasis was achieved in all cases. Furthermore, only small amount of the MCH remained on the point after irrigation, resulting that it did not prevent the further procedures. Applying the suspension on the dura mater of the sella floor or bony margins, hemostasis was typically achieved approximately in 2 min, while for hemostasis of the cavernous sinus it took between 3 min and 5 min after attempt of hemostasis using the standard techniques. The injection of MCH suspension was sometimes repeated twice on the same bleeding sites. No perioperative complication was encountered with the use of the MCH suspension. In Case 4, visual disturbance developed postoperatively probably due to chiasmal apoplexy, which might be caused by impaired blood flow of perforators after sudden collapse of the chiasm, without relation to this hemostatic technique.

**Discussion**

The procedure to achieve hemostasis in EETS is important, but it can be challenging because of a small access orifice diameter and a confined surgical space. In particular, bleeding from the cavernous sinuses sometimes cannot be easily halted; thus, topical hemostatic agents play a crucial role in these situations. However, the insertion of topical hemostats using forceps can be hindered by the nasal mucosa and turbinates along the surgical route, which may result in hemostat contact with blood or body fluids. Furthermore, release of bloody or moist hemostats at the bleeding points can also be difficult because of its adhesion to tip of forceps, and the swollen hemostats by moisture may make it difficult to perform the further procedures.

MCH is one of the most widely used topical hemostatic agents. It is made from purified bovine collagen and available as dry loose flour. When in contact with a bleeding surface, it promotes platelet aggregation, resulting in clot formation. Hemostatic benefits of MCH have previously been demonstrated in various laboratory and clinical studies. Moreover, MCH has been used in surgeries for decades to achieve hemostasis. However, this hemostat has a greater affinity for moist surfaces, such as gloves and any instruments, than do other agents. Kassam et al. recently reappraised this product as an effective hemostat to achieve venous hemostasis in EETS using the “sandwich” method, in which MCH was sandwiched in a surgical patty, thus overcoming its adherence.

Currently, a gelatin–thrombin matrix hemostatic sealant (FloSeal®; Baxter Healthcare Corp, Fremont, Californai, USA or Surgiflo®; Ethicon Inc., Johnson &
bleeding point, and procedure used for the removal of moisture from the suspension at the bleeding point may have compensated for the reduction of the hemostatic effect.

Conclusion

With the advancement of EETS, not only for pituitary lesions but also for ventral skull-base lesions, more situations of bleeding have been frequently encountered. In this technical note, we described a method of injection of an MCH suspension and suggest that this technique may be useful to control the venous bleeding in EETS because of its simple, effective, and low-cost properties.

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Conflicts of Interest Disclosure

All of authors have nothing to be disclosed as Conflicts of Interest (COI). Yasunori Fujimoto, Akatsuki Wakayama, and Toshiki Yoshimine are members of the Japan Neurosurgical Society, and their COI status have been disclosed to the COI committee of the society. Taisuke Kobayashi, Masahiro Komori, Pedro Mariani, Edson Bor-Seng-Shu, and Manoel Jacobsen Teixeira are not members of the society, and they have nothing to be disclosed as COI.

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