



Clinical Study

Sealing of cerebrospinal fluid leakage during conventional transsphenoidal surgery using a fibrin-coated collagen fleece



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ABSTRACT

The prevention of cerebrospinal fluid (CSF) leakage is a key feature of the transsphenoidal approach (TSA) to the pituitary fossa. Although fibrin-coated collagen fleece (Tachosil, Nycomed, Linz, Austria) is a powerful topical hemostatic agent whose usage is increasing in open neurosurgery, the use of Tachosil in TSA surgery has not yet gained wide clinical acceptance. We retrospectively evaluated whether the lone use of Tachosil without additional packing material or postoperative lumbar drainage was effective to prevent CSF leakage in TSA surgery in 101 patients. Additionally, we compared it to a conventional sellar closure technique in 54 patients. Only two (1.9%) of the patients in the Tachosil application group developed postoperative CSF rhinorrhea. No other postoperative complications occurred, including infection or material detachment. However, in the conventional packing group, five (9.3%) patients developed postoperative CSF rhinorrhea and one (1.9%) developed meningitis during the postoperative period. The mean length of postoperative hospital stay was significantly shorter in the Tachosil treatment group than in the standard closure group. These results may indicate that sellar repair using Tachosil can be effective to prevent CSF leakage after TSA surgery, and obviate the need for an autologous tissue graft or postoperative lumbar drainage.

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1. Introduction

The transsphenoidal approach (TSA) is the most common operative technique for pituitary tumors or other lesions in the sellar turcica and parasellar areas. It can be performed safely, with low morbidity compared to craniotomy. However, postoperative complications such as cerebrospinal fluid (CSF) leakage may result in serious sequelae, including meningitis and tension pneumocephalus [1,2]. CSF leakage can be prevented with a watertight dural closure technique, but this is a complicated procedure because of the deep and narrow surgical field and inadequate microsurgical instruments.

Numerous techniques and materials have been described for sellar reconstruction. Most techniques utilize autologous tissue grafts of fat, muscle, or fascia lata, with or without the use of postoperative lumbar CSF drainage [3–6]. Various adhesive substances that locally reinforce sellar CSF leak repairs are currently in use, including cyanoacrylate, fibrin glue, and collagen-based compounds [7]. However, the harvest of autologous tissue requires an additional surgical wound and postoperative lumbar drainage, causing unnecessary discomfort to the patient.

Tachosil (Nycomed, Linz, Austria) is a fibrin-coated collagen fleece that was originally developed for topical hemostatic use in cardiac, thoracic, and hepatic surgeries. Tachosil consists of a sheet of collagen coated on one side with human fibrinogen, human thrombin, and riboflavin [8]. Riboflavin is included as a yellow coloring that marks the coated side to be applied directly to the bleeders. The preparation is ready to use, requires no thawing or blending, and can be applied directly to target tissue [9]. Although Tachosil has been increasingly used in neurosurgery [10], its use during TSA has not yet gained wide clinical acceptance.

We have used Tachosil as the final layer of sellar reconstruction in conventional TSA since 2010. The purpose of this study was to evaluate the usefulness of Tachosil alone during TSA based on the authors' experience over the past 3 years.

2. Methods

2.1. Patients

This study was approved by the Internal Review Board of Severance Hospital, Yonsei University College of Medicine. Between 2007 and 2013, a total of 150 patients with pituitary tumors of Hardy grades I to III and five patients with chordoma in the upper clivus underwent TSA surgery at our institution. Between 2007 and

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2009, 54 patients underwent TSA surgery with conventional closure using autologous fat graft and fibrin glue, with or without postoperative lumbar drainage. The Tachosil application technique without postoperative lumbar drainage was first used in 101 consecutive patients commencing in January 2010. The operative notes and other medical records were reviewed to identify procedure-related complications. The mean follow-up periods were $15 \pm$ standard deviation (SD) of 10.4 months in the Tachosil application group and 24 ± 12.7 months in the conventional packing group.

2.2. Surgical technique

All patients underwent an endonasal TSA using an operating microscope with or without endoscope assistance. The bony keel of the sphenoid was removed bilaterally as it was progressively exposed. A custom-made Hardy speculum was passed through the nostril up to the face of the sphenoid. A wide removal of the sellar floor was followed by a low curvilinear dural opening. This opening was typically extended bilaterally in a cephalad direction or in a cruciate fashion as tumor removal progressed. Dura with obvious tumor invasion was removed; however, in most instances, a large dural window was not removed. Tumor removal proceeded in the standard fashion using micro-ring curettes.

After complete tumor removal, the sellar cavity was explored for evidence of a CSF fistula, the presence of which was easily determined in most cases. One or two Valsalva maneuvers were performed to confirm the presence of a leak. In the instance of a small CSF leak without evidence of a large arachnoidal defect, only a small piece of Tachosil was applied to the arachnoidal defect. In some instances, resection of suprasellar extended tumors resulted in detachment of the normal pituitary gland margin from the dural edge, tearing the anterior superior arachnoid membrane. In this situation, as along with conventional packing group, simple intrasellar packing with fat or synthetic material may have pushed the normal gland posteriorly, enlarging the gap between the normal gland margin and the dural edge, and increased the chance of CSF leakage. Thus, a complete seal between the dural margin and the normal pituitary gland was critical to prevent this. In the Tachosil application group, dried fleece was cut to size then moistened and applied over the exposed diaphragma sellar and residual normal pituitary gland in the cephalad direction. The other Tachosil patches were prepared in the same fashion and placed bilaterally in the caudal direction like a 'sandwich'. The sellar cavity dead space was filled with fibrin glue (Greenplast, Green Cross P.D. Company, Yongin, Korea). A final Tachosil patch covered the entire sellar face in a single layer. A schematic drawing of the Tachosil repair with sellar floor reconstruction is shown in Figure 1. The bony defect of the cranial base was reconstructed with a porous polyethylene implant (Medpor; Portex Surgical, Newnan, GA, USA). Neither sphenoid packing nor postoperative lumbar CSF drainage were performed in any patient. Nasal packing was removed within 2 days of surgery.

2.3. Statistical analysis

The Statistical Package for the Social Sciences version 22 (SPSS, Chicago, IL, USA) was used to calculate the *t*-test, the Mann-Whitney *U*-test, and the chi-squared test. A *p* value of less than 0.05 was considered significant.

3. Results

Patient demographic and clinical characteristics are shown in Table 1. There were no statistically significant differences between

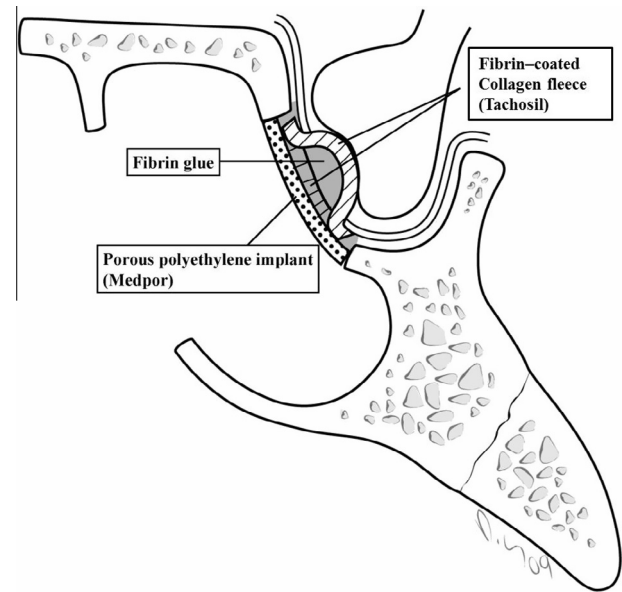


Fig. 1. Schematic drawing of a lateral view of the sellar floor, depicting Tachosil (Nycomed, Linz, Austria) repair with sellar floor reinforcement using a porous polyethylene implant (Medpor; Portex Surgical, Newnan, GA, USA). The first piece of Tachosil sheet is cut to size, moistened, and applied over the exposed diaphragma sellar and residual normal pituitary gland in the cephalad direction. The other Tachosil patches were placed bilaterally in the caudal direction. The sellar cavity dead space was filled with fibrin glue. The final patch covered the entire sellar face in a single layer.

groups with respect to age, sex, functioning or non-functioning adenomas, or modified Hardy classification.

All patients tolerated the procedure well. Intraoperative CSF leaks were identified in 18 patients (17.8%) in the Tachosil application group and in 15 (27.8%) in the conventional packing group. In the Tachosil application group, only two (1.9%) patients developed postoperative CSF rhinorrhea, and no other complications were reported during the follow-up period. However, in the conventional packing group, five (9.3%) patients developed postoperative CSF rhinorrhea and one (1.9%) developed meningitis during the postoperative period. In the conventional packing group, postoperative lumbar drainage was performed in 22 of 54 patients (40.7%). The mean postoperative hospital stay was significantly shorter in

Table 1
Demographics and baseline variables

Baseline variable	Tachosil ^a application group (n = 101)	Conventional packing group (n = 54)
Male	59	32
Female	42	22
Age, years (mean \pm SD)	47 \pm 9.4	45 \pm 11.5
Non-functioning adenoma	58	36
Functioning adenoma	38	18
GH-secreting adenoma	5	6
Prolactin-secreting adenoma	31	12
ACTH-secreting adenoma	2	0
Hardy classification		
I	32	19
II	53	28
III	11	7
Chordoma	5	0

No statistically significant differences between the groups were found.

^a Nycomed, Linz, Austria.

ACTH = adrenocorticotropicin, GH = growth hormone, SD = standard deviation.

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