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Sellar reconstruction with resorbable vicryl patches, gelatin foam, and fibrin glue in transsphenoidal surgery: a 10-year experience with 376 patients

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Object. Closure of the sella turcica after transsphenoidal surgery is mainly accomplished with autologous muscle fascia and fat or muscle; this requires a second surgical incision. The authors review the results of using resorbable vicryl patches, gelatin foam, and fibrin glue for sellar reconstruction.

Methods. A review was conducted of 376 consecutive patients who underwent surgery for pituitary adenomas, cysts, or subdiaphragmatic craniopharyngiomas in the sella turcica that the senior author (R.W.S.) had performed or directly supervised over the last 10 years. The sellar reconstruction was performed with a commercially available, synthetic absorbable patch composed of polyglactin 910/poly-p-dioxanone, gelatin foam, and fibrin glue. The patch is essentially resorbed in 2 to 3 months and replaced by fibrous collagen tissue. There were 117 small, 112 medium-sized, and 147 large lesions. The overall nonendocrine postoperative morbidity rate was 2.8%, and included visual deterioration, meningitis, secondary epistaxis, nasal septum complication, and cerebrospinal fluid (CSF) leakage. Two patients with macroadenomas needed reoperation for persistent CSF leakage, which comprised 0.5% of the whole series or 0.8% of the 259 patients with medium-sized or large lesions. There was no mortality and no morbidity related to the implanted material, and in particular no delayed empty sella syndrome.

Conclusions. Closure of the sella turcica with a synthetic absorbable vicryl patch, gelatin foam, and fibrin glue after transsphenoidal surgery is safe and very effective in preventing postoperative CSF fistulas. The use of this technique obviates the need for a second surgical incision and shortens the operating time. Because of the progressive resorption of the substitute material, the interpretation of postoperative magnetic resonance studies was not significantly hindered.

KEY WORDS • transsphenoidal surgery • sella turcica • vicryl patch

SINCE the classic description of the transsphenoidal approach by Hardy,[4] most neurosurgeons have used fascia lata, muscle, or fat supported by a piece of nasal cartilage or bone for the reconstruction of the pituitary fossa and the prevention of postoperative CSF leakage. The use of autologous tissue requires a separate surgical incision, prolongs the operating time, and causes additional discomfort to the patients. Because many of them are young women, scars on the abdominal wall or thigh should be avoided for cosmetic reasons. Furthermore, the presence of nonresorbable material in the sella turcica and in the sphenoid sinus complicates the interpretation of postoperative neuroradiological studies. The aim of the technical modification presented here was to circumvent these disadvantages by using a resorbable vicryl patch (polyglactin 910/poly-p-dioxanone, Ethisorb dura patch; Ethicon, Inc., Somerville, NJ) instead of fascia lata; gelatin foam (Spongostan; Johnson & Johnson Medical Ltd., Skipton, UK) for packing the pituitary fossa; and fibrin glue (Tissucol; Baxter AG, Vienna, Austria) for sealing and supporting the sella turcica. We report our 10-year experience with this technique in 376 patients.

Abbreviations used in this paper: CSF = cerebrospinal fluid; Gd-DTPA = gadolinium diethylenetriamine pentaacetic acid; MR = magnetic resonance.

Clinical Material and Methods

Patient Population

Between 1989 and 1999, 376 consecutive patients with pituitary adenomas, cysts, or intrasellar subdiaphragmatic craniopharyngiomas underwent transsphenoidal operations performed or supervised by the senior author (R.W.S.). The lesions were classified according to their greatest diameter as small (1–10 mm), medium-sized (11–20 mm), or large (> 20 mm). This corresponds to the currently used classification of pituitary adenomas as micro-, meso-, or macroadenomas. There were 117 small, 112 medium-sized, and 147 large lesions in our series. All patients had routine follow-up reviews at 1, 2, 6, and 12 months postoperatively, endocrinological evaluation at 1 and 6 months, and computerized tomography or, more recently, MR studies at 2 and 12 months postoperatively. The endocrinological findings are not discussed in this paper.

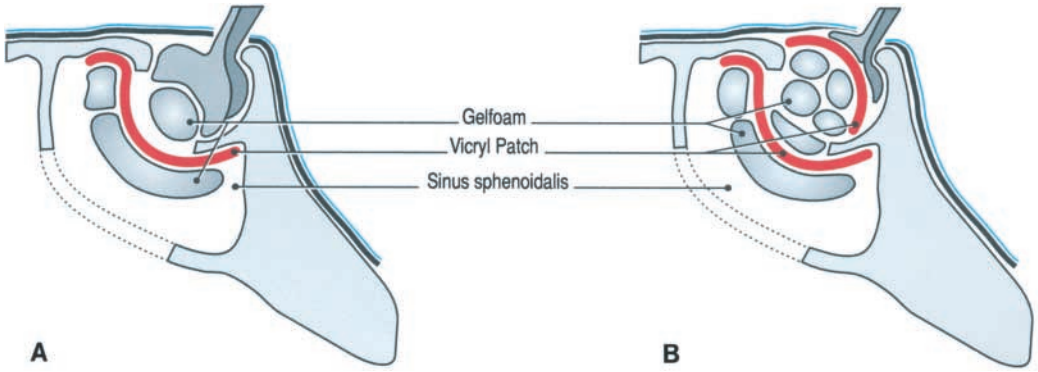

FIG. 1. Schematic representations of the sella turcica reconstruction showing the vicryl patches, gelatin foam, and fibrin glue after removal of pituitary microadenomas (A) and macroadenomas or infradiaphragmatic craniopharyngiomas (B).

Reconstructive Material

Initially, collagen-coated vicryl mesh composed of a watertight film of bovine collagen and polyglactin 910 (vicryl; Ethicon) was used. Because of the theoretical danger of transmitting bovine spongiform encephalitis with bovine collagen, this material was later changed to a fleece composed of polyglactin 910 and poly-p-dioxanone (Ethisorb; Ethicon). The patch is available in different sizes, softens when immersed for a few seconds in liquid, and can be cut to any size. It is easily handled and relatively inexpensive, and elicits a minimal inflammatory response. It is absorbed over time and replaced by fibrous tissue.[7–10] Gelatin foam is an absorbable gelatin sponge used for many years as a hemostatic agent in neurosurgery. Fibrin glue has been used routinely as a sealant for many years.

Surgical Procedure

All patients underwent surgery via a unilateral transseptal approach while in the semisitting position. After microsurgical extirpation of micro- and mesoadenomas with no suprasellar extension, the cavity is filled with gelatin foam soaked in fibrin glue, and the sellar opening is covered with a vicryl patch fixed with the same material (Fig. 1A). In mesoadenomas with suprasellar extension and macroadenomas or cysts, the vicryl patch is fixed with glue to the diaphragma, and the sella turcica is packed loosely with gelatin foam soaked in fibrin glue. A second patch is fixed to the opening in the sella and held in place with gelatin foam and glue (Fig. 1B). Cartilage or bone is not used, because the package is held in place and sealed by the fibrin glue. The duration of a routine operation is between 60 minutes and 120 minutes. Antibiotic medications are started prophylactically before the operation and administered for 24 hours. In patients with macroadenomas and large intraoperative tears of the diaphragma, a lumbar CSF drain is used postoperatively for 2 to 3 days with prophylactic adjuvant antibiotic therapy. Nasal tampons are removed on the 2nd or 3rd postoperative day, and the patients are discharged 3 to 5 days after the operation.

Results

No patient with a small lesion had an intraoperative or postoperative CSF leak. Sixteen of the 112 patients with medium-sized lesions and 52 of the 147 with large lesions developed a visible CSF leak during surgery. Eight patients with large intraoperative tears of the diaphragma were treated with lumbar drains postoperatively. Only two patients with macroadenomas had persistent CSF leaks during the 1st month after the operation. Both underwent reoperation via a transsphenoidal approach, and the leak was repaired using fascia lata and fat. These two patients comprise 0.5% of the whole series, 0.8% of the 259 patients with medium-sized and large lesions, and 2.9% of the 68 patients with an intraoperative CSF leak.

One patient with a growth hormone–producing adenoma and preexisting chronic sinusitis and polyposis of the sphenoid sinus developed meningitis on the 2nd postoperative day and was treated successfully with antibiotic drugs; he had no CSF leak. There were four patients who experienced delayed epistaxis after removal of the tampons and who needed a second nasal packing. Three patients with macroadenomas featuring marked supra- and parasellar extension, whose vision was already impaired preoperatively, experienced further visual deterioration postoperatively. No delayed visual deterioration caused by an empty sella turcica occurred. There were no other complications and no deaths in this series. The complications are summarized in Table 1.

The MR imaging studies obtained 2 months postoperatively revealed a great individual variation in the resorp-

TABLE 1

Possible and actual complications in 376 patients who underwent sellar reconstruction after transsphenoidal surgery

Complication	No. of Patients
carotid artery injury	0
hemorrhage into residual tumor bed	0
postop meningitis	1
postop visual deterioration	3
ophthalmoplegia	0
CSF leak reop	2
secondary epistaxis	4
nasal septum complication	1
delayed empty sella syndrome	0
death	0
total	11 (2.9%)

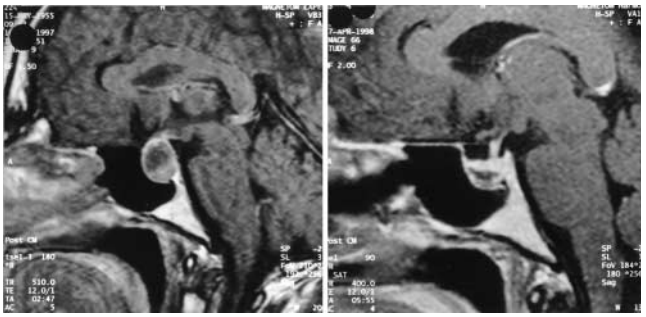

FIG. 2. Sagittal T_1-weighted MR image obtained after intravenously administered Gd-DTPA in a patient with pituitary mesoadenoma *(left)*. Sagittal MR image obtained 2 months postoperatively *(right)* demonstrating minimal contrast-enhancing scarring in the sphenoid sinus at the sellar floor, no detectable tumor, and a small intrasellar resection cavity.

tion of the substitute material, depending mainly on the amount of gelatin foam used. The intrasellar contents could generally be well visualized, whereas in most of the patients there was still some contrast enhancement in the sphenoid sinus (Figs. 2 *right*, 3 *center*, 4 *center*). The later MR studies demonstrated progressive resorption of the material, which resulted in usually minimal (Figs. 2 and 3 *right*) but sometimes significant (Fig. 4 *right*) residual scarring in the sphenoid sinus.

Discussion

The techniques of sella turcica reconstruction have been described in the literature.[2,4,11–14] Most authors use fat or muscle with or without fascia lata and/or fibrin glue. A piece of cartilage or bone, or even an alumina ceramic plate,[5] a silicone plate,[6] a stainless steel miniplate,[3] or a titanium plate[1] is used to hold the sellar packing material in place. Our series demonstrates that a support is not necessary when using fibrin glue, which is in accordance with the finding of Van Velthoven, et al., [11] that autologous tissue can be replaced by resorbable material without increasing the frequency of CSF leakage. There was also no symptomatic delayed empty sella syndrome in our series. Moreover, the application of fibrin glue and nonautologous tissue is not combined with any additional risk, such as the transmission of other diseases.

The complications associated with the current standard for transsphenoidal surgery in the United States were reviewed in a national survey in 1997.[2] The complication rate was statistically significantly higher for less experienced surgeons. Our series (Table 1) compares favorably with the results reported by the most experienced surgeons. Their incidence of CSF leakage was 1.5%, compared with 0.5% in our whole series or 0.8% if only medium-sized and large lesions are considered, because the risk of a CSF leak increases with the size and especially suprasellar extension of the lesion. Reconstruction of the sella turcica with resorbable material is also effective in patients with a visible intraoperative CSF leak, especially in combination with a postoperative drain if the tear is large. We attribute the lack of hemorrhage into the residual tumor bed to the excellent hemostatic properties of gelatin foam soaked in fibrin glue. Hemorrhage from the cavernous sinus is easily controlled, allowing loose packing of the sella turcica, which causes no compression of the diaphragma or cavernous sinus. All three patients with postoperative visual deterioration had huge suprasellar extension of their lesions, with failing vision preoperatively. This complication was most likely due to surgical manipulation and not compression by the sellar packing material.

The influence of the sellar packing material on postoperative neuroradiological studies, especially MR imaging, has to our knowledge not been reported in detail in the literature. In patients treated with our technique, the MR images obtained 2 months postoperatively revealed a great variation in the resorption of the substitute material, especially in the sphenoid sinus. The interpretation of intrasellar structures was generally not much hampered. In the studies conducted later, there was progressive resorption, allowing a more precise interpretation of the MR images obtained in most patients.

Conclusions

Closure of the sella turcica with a resorbable vicryl

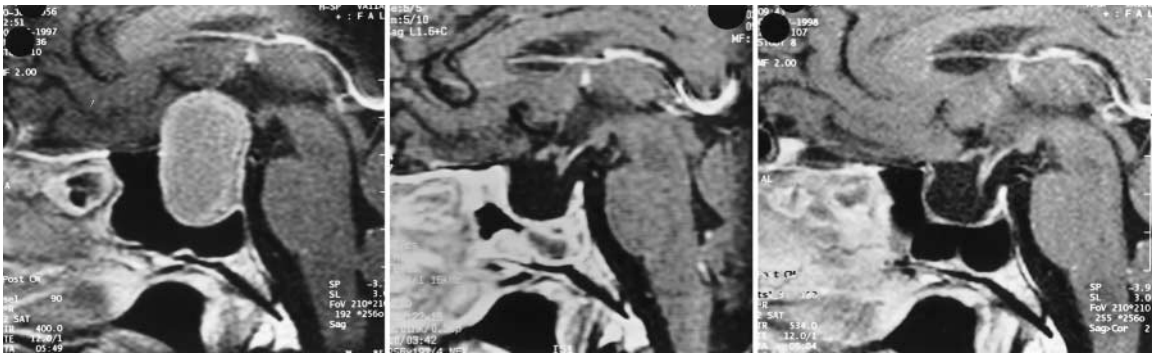

FIG. 3. Sagittal T_1-weighted MR images obtained after intravenously administered Gd-DTPA in a patient with a pituitary macroadenoma. *Left:* Preoperative study. *Center:* Postoperative MR image obtained at 6 weeks, revealing a significant contrast-enhancing reaction mainly in the sphenoid sinus. *Right:* After 1 year, all of the introduced material has been resorbed, thus allowing identification of the sellar and infrasellar contents.

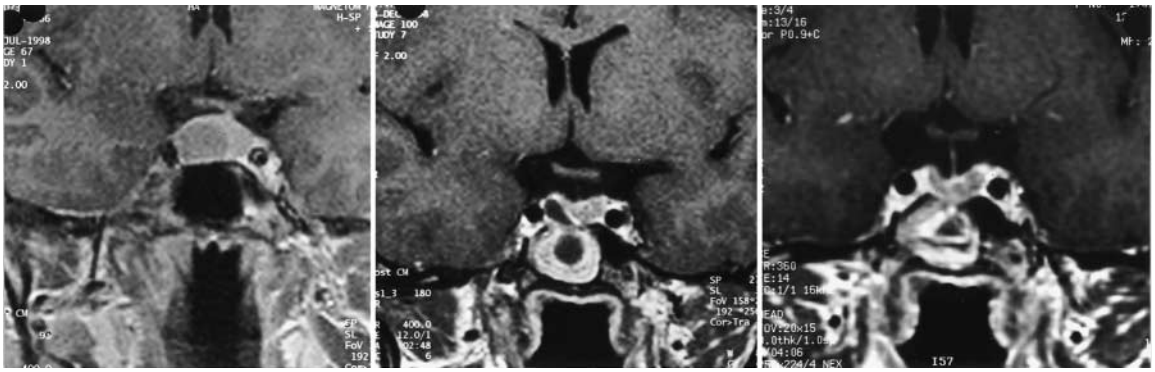

FIG. 4. Coronal T_1-weighted MR images obtained after intravenously administered Gd-DTPA in a patient with a mesoprolactinoma. *Left:* Preoperative study. *Center:* Postoperative MR image obtained at 2 months, demonstrating significant scarring. *Right:* These changes are still partially recognizable in the 1-year postoperative follow-up MR image. However, the sellar contents can be well distinguished. The patient has been cured of her prolactinoma.

patch, gelatin foam, and fibrin glue after transsphenoidal surgery is safe and very effective in preventing postoperative CSF fistulas. The use of this technique obviates the need for a second surgical incision and shortens the operating time. With progressive resorption of the substitute material, the interpretation of the postoperative MR images is not much hindered.

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