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Suturing and Closure of Diaphragma Sella to Augment Sellar Floor Repair after Endonasal Endoscopic Resection of Large Pituitary Adenoma

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Abstract

Background Large pituitary adenoma often pushes the diaphragma sella and extends to the suprasellar compartment. The thinned out diaphragma may get opened during endonasal endoscopic surgery and pose high risk for cerebrospinal fluid (CSF) leak. Such larger defects are difficult to plug with fat graft that tends to slip in to the subarachnoid space. Here, we describe a unique technique of closure of diaphragma sella that augment repair of the skull base in such cases.

Materials and Method The free edge of diaphragma sella was sutured with the anterior tuberculum sella dura in five cases of large pituitary adenoma that needed extra arachnoidal resection. Suturing was done with 6-0 prolene using endoscopic needle holder that converted a large diaphragm defect in to a smaller arachnoid rent and was easily plugged with fat graft.

Result None of these patients had postoperative CSF leak.

Conclusion Though technically difficult, direct repair of the diaphragma sella is possible. This augments the skull base reconstruct and effectively reduces the chances of postoperative CSF leak.

Keywords
- CSF leak
- diaphragma sella
- neuroendoscopy
- pituitary tumor
- sellar floor

Introduction

Sellar suprasellar lesions like pituitary adenoma often push the diaphragma sella upwards and often invade the arachnoid.[1] Endonasal endoscopic excision of such tumors may result in complete opening of the diaphragm that poses great difficulty in sellar floor repair. There are several techniques of sellar floor repair like bath plug of fat graft, overlay fascia lata graft, vascularized flap, and use of fibrin glue that have been discussed in the literature.[2,3] However, use of vascularized nasoseptal flap is not in routine practice for resection of pituitary adenoma. Here, we discuss a unique technique of suturing the diaphragm sella with the tuberculum sella dura to augment sellar floor repair in five cases of large pituitary adenoma that successfully prevented postoperative cerebrospinal fluid (CSF) leak.

Technical Details

Five patients with large sellar suprasellar pituitary tumor operated through endonasal endoscopic approach, where endoscopic direct suturing and closure of the open

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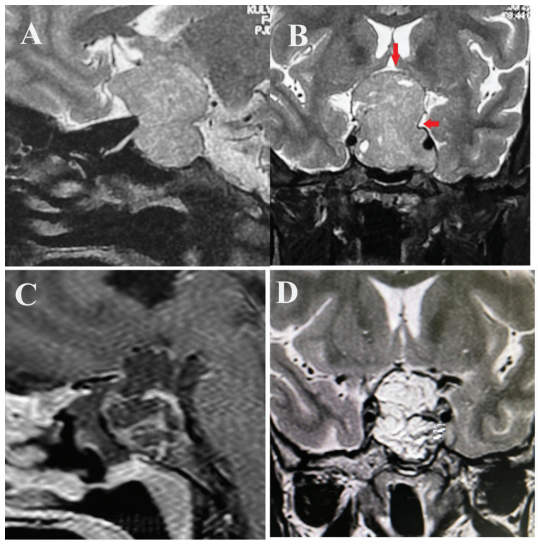

Fig. 1 (**A**, **B**) Sagittal and coronal T2-weighted (T2W) magnetic resonance imaging showing sellar suprasellar lesion with subfrontal extension. Note the elevated and stretched out diaphragm sella (red arrows) over the dome of the tumor. (**C**, **D**) Postoperative magnetic resonance image (**C**, postcontrast sagittal; **D**, T2W coronal) showing excision of tumor with fat graft in the cavity.

diaphragma sella was done, were included in this analysis. All patients had visual field deficit and two were hypocortisolic in the preoperative period. Contrast magnetic resonance imaging showed large sellar suprasellar tumor and one of them had subfrontal extension (►**Fig. 1A, B**).

Apart from standard sellar floor opening the bony drilling included the tuberculum sella anteriorly and the anterior normal dura was exposed in all cases. Tumor resection was done in standard fashion using ring curette. Extra arachnoidal dissection was done in all the cases to remove the anterosuperior extension of tumor. At the end of resection vessels of anterior circulation with the optic apparatus were visualized through the open diaphragm.

In all these cases the arachnoid opening was present at the anterior aspect and the edge of the diaphragm sella dura was intact posteriorly (►**Figs. 2A** and **3A**). The diaphragm was then sutured with the tuberculum sella dura anteriorly or the skull base dural laterally. The suturing was performed with a 6-0 prolene using endoscopic needle holder. Direct endoscopic suturing was done in four-step technique.[4] First, the needle was passed through the free edges of the diaphragm sella (►**Figs. 2B** and **3B**). Then, the needle was passed through the dura of the tuberculum sella (►**Figs. 2C, G** and **3C, D**). In

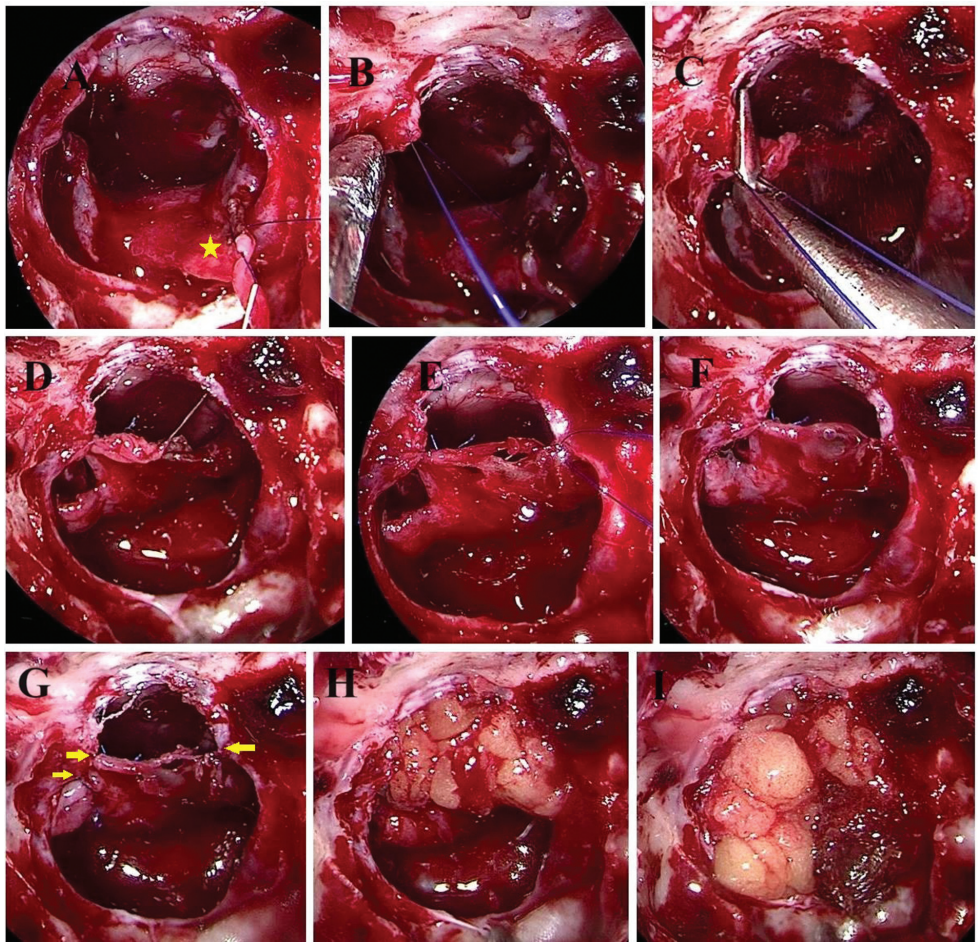

Fig. 2 Intraoperative image showing completely disrupted anterior arachnoid with free edge of diaphragm (yellow star). Note first suture passed through the free edge of diaphragm sella (**A**). (**B**–**D**) Image showing suture through the anterolateral tuberculum sella dura which was finally tightened. (**E**, **F**) Image showing suturing the diaphragm sella with the left lateral skull base dura. (**G**) Image showing multiple sutures (yellow arrows) in place holding the edges of diaphragm sella. (**H**, **I**) Image showing fat packing of the sella.

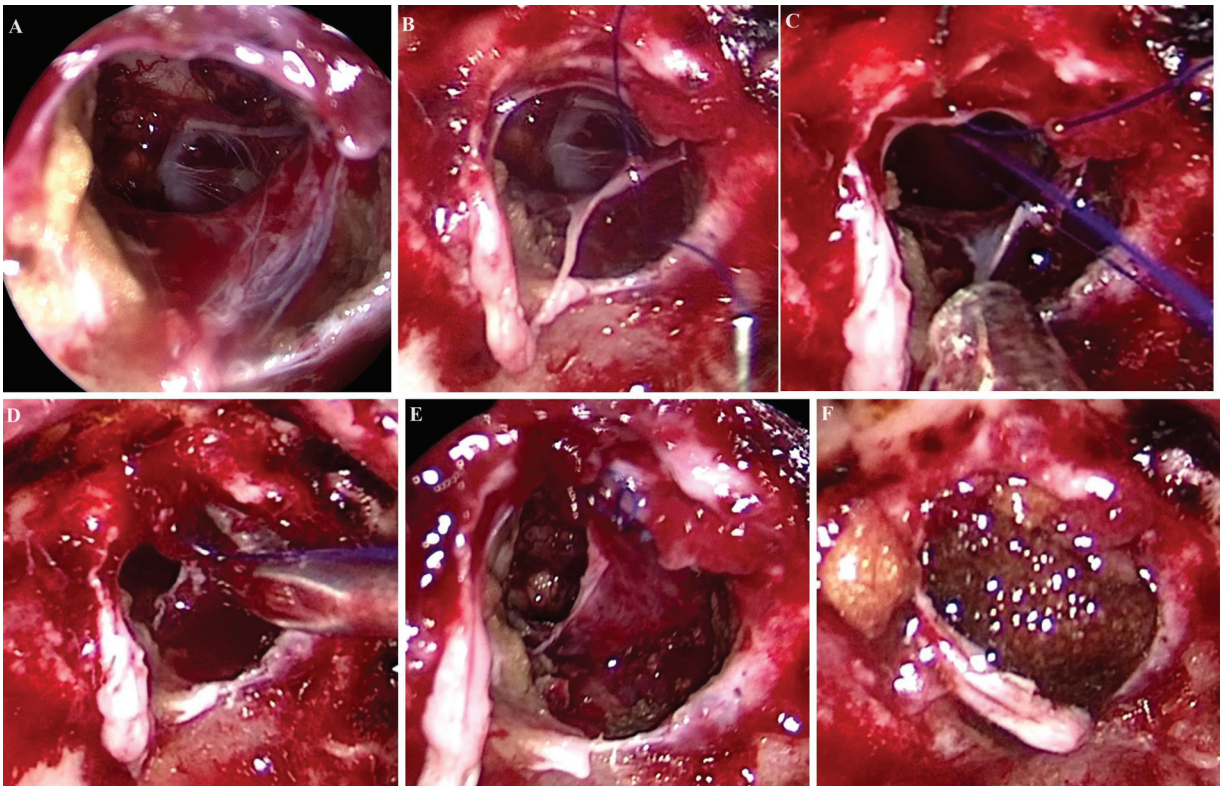

Fig. 3 Intraoperative image showing open arachnoid space after excision of pituitary adenoma (**A**). (**B**–**D**) Image showing suturing the free edge of diaphragm sella with the anterior tuberculum sella dura. Note the significant obliteration of the open arachnoid space after partial closure of the diaphragm sella (**E**). Image showing fat packing of the sella (**F**).

the third step a knot was placed outside the nostril and pushed gently in to the operative field (►**Figs. 2C** and **3D**). Finally, the suture was tightened and cut. In all our cases we could able to convert the large diaphragma defect to a small arachnoid opening (►**Figs. 2G** and **3E**). Then, the relatively smaller defect was plugged with fat graft and multilayer closure was done with overlay autologous fascia lata graft and tissel glue (►**Figs. 2H, I** and **3F**).

Postoperative radiology showed complete tumor excision in all cases [►**Fig. 1C, D**). None of the patients had CSF rhinorrhea in the postoperative period.

Discussion

Suprasellar extension of pituitary adenoma was previously considered an indication for intracranial approach. However, with the advent of better optics, angled endoscopes, and angled instruments suprasellar components are successfully operated by endonasal endoscopic approach.[5] Goel et al described the growth pattern of suprasellar pituitary adenoma in relation to the diaphragma sella. They concluded the diaphragma sella gets elevated and expanded over the dome of the suprasellar component of adenoma not necessarily invaded by the tumor.[1] Further, the diaphragma sella may be disproportionately thinned out at places and allows the lobular extension of tumor. Endonasal endoscopic excision of such large pituitary adenoma often results in the opening of the thinned out diaphragm. This may directly communicate with the subarachnoid space and often the third ventricle and poses a significant risk of postoperative CSF leak. Again, fat plugging of the sella at times becomes difficult owing to the large defect and pulsatile flow of CSF. Here, we have used the edges of diaphragma sella to close the suprasellar defect. By suturing the diaphragm with the anterior tuberculum sella dura the larger suprasellar defect converted to a relatively smaller sellar defect. The repaired diaphragm thereby reduces the pulsatile flow of CSF and further allows better plugging of the defect with fat graft. None of our patients had postoperative CSF leak which reflects the efficacy of a repaired diaphragm sella.

Conclusion

Though technically difficult, direct repair of the diaphragma sella is possible. This effectively reduces the chances of postoperative CSF leak.

Authors' Contributions

S.K.S.: Concept and design, collection of data, manuscript drafting, and reviewing; M.K.B.: Collection and collation of data, and final approval of manuscript; S.D.: Collection of data, manuscript drafting, and reviewing.

Conflict of Interest

None declared.

References

1 Goel A, Nadkarni T, Muzumdar D, Desai K, Phalke U, Sharma P. Giant pituitary tumors: a study based on surgical treatment of 118 cases. Surg Neurol 2004;61(05):436–445

2 Wormald PJ, McDonogh M. 'Bath-plug' technique for the endoscopic management of cerebrospinal fluid leaks. J Laryngol Otol 1997;111(11):1042–1046

3 Esposito F, Dusick JR, Fatemi N, Kelly DF. Graded repair of cranial base defects and cerebrospinal fluid leaks in transsphenoidal surgery. Oper Neurosurg (Hagerstown) 2007;60(4, suppl 2): 295–303

4 Sahoo SK, Dhandapani S, Gharat M. Suturing and repair of skull base dura following endonasal endoscopic transsphenoidal surgery. Neurol India 2023;71(04):671–673

5 Patil NR, Dhandapani S, Sahoo SK, et al. Differential independent impact of the intraoperative use of navigation and angled endoscopes on the surgical outcome of endonasal endoscopy for pituitary tumors: a prospective study. Neurosurg Rev 2021;44(04):2291–2298

