Our 30 Year Experience Utilizing Hydroxyapatite Cement in Cranial Surgery: Applications, Outcomes, and Considerations

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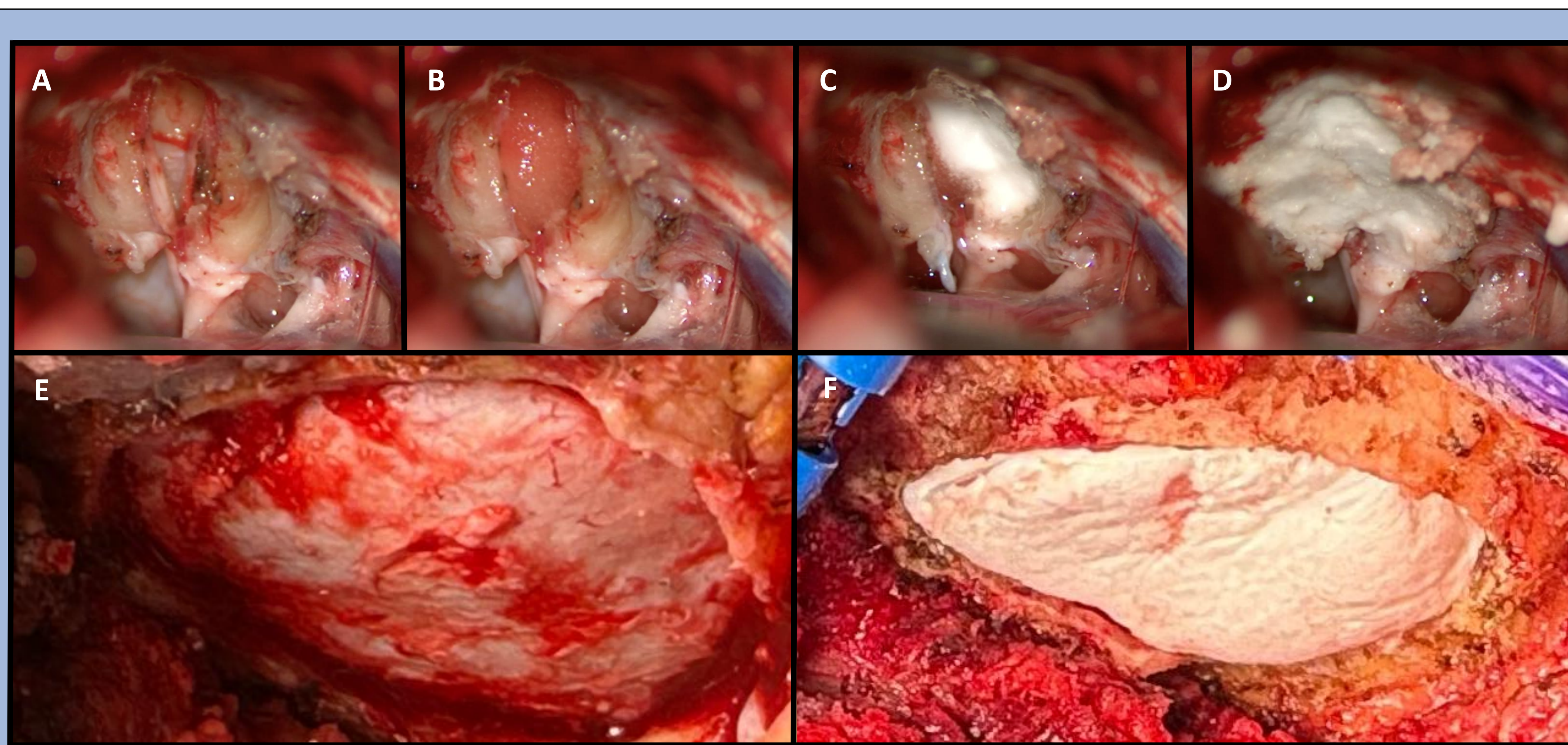

Figure 1: Steps for retrosigmoid defect repair with HAC – A: The posterior fossa is irrigated and hemostasis is achieved. B: Gelfoam is lightly placed into the IAC to protect the nerves from direct HAC application. Cottonoids are placed along the brainstem to ensure no HAC falls into the CPA during application. C/D: HAC is applied in layers utilizing a freer and cottonoid to push HAC into any communicating air cell systems which could result in CSF leak. E: The posterior fossa craniotomy site is inspected to ensure adequate hemostasis. Dura is repositioned and a layer of DuraGen is placed over the site. F: HAC is applied and shaped with a cottonoid and freer dissector to ensure the HAC approximates the bony edges to encourage osteoblast engagement. A drain is placed to prevent lateral collections, which can compromise HAC integrity.

Background

Our study center has utilized hydroxyapatite cement (HAC) for over 30 years, reporting on its use for reconstructing defects arising from lateral skull base procedures.[1–7] We provide a summary of our results, and step-by-step instructions for repairing retrosigmoid (Figure 1) and translabyrinthine (Figure 2) skull base defects.

Review

Retrosigmoid Defects: early experience demonstrated no CSF leaks or pseudomeningoceles. HAC resorption was noted before incorporation of a post-operative drain.

Translabyrinthine Defects: early experience demonstrated no pseudomeningoceles, a low rate of CSF leak (3.8%), and acceptable infection rate (5.8%).

Conclusions

HAC is a valuable tool within the neurotologic/neurosurgical armamentarium. Benefits include its ability to integrate with bone, provide watertight closure, and reduce the need for autologous grafts (and resulting scar/complications).

The described techniques achieve these goals, while encouraging osteoblast activity and protecting the cranial nerves/posterior fossa contents.

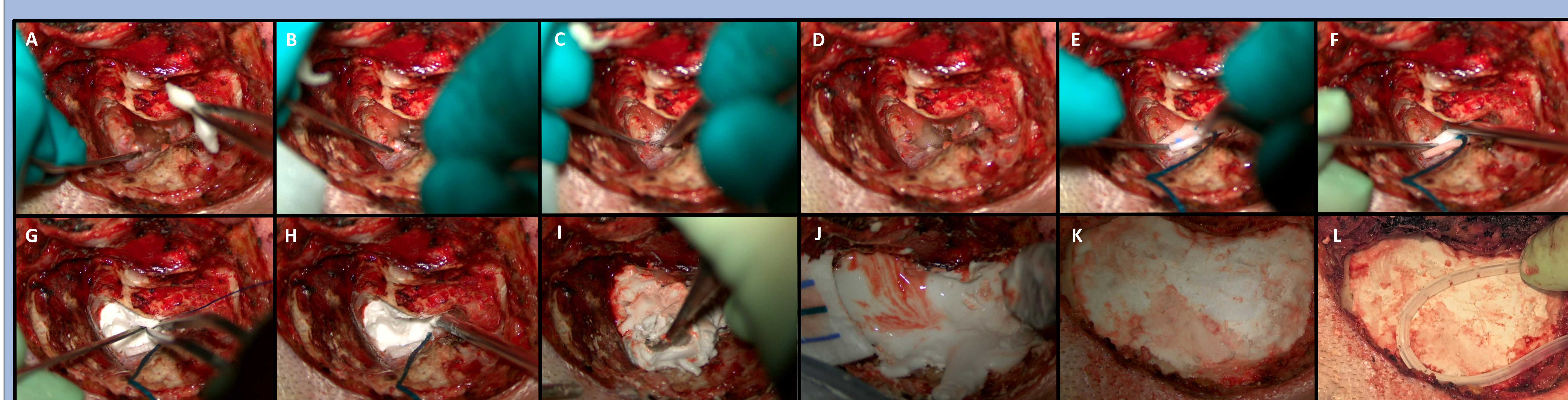

Figure 2: Steps for translabyrinthine defect repair with HAC – A: The posterior fossa is irrigated and hemostasis is achieved. B: Gelfoam is lightly placed into the IAC to protect the nerves from direct HAC application. C. Fibrillar is placed as a small plug into the dural defect entering the CPA. D. An additional gelfoam layer is placed over the fibrillar to fill the dural defect. E. A cottonoid is placed over the gelfoam as a final step to ensure HAC does not enter the CPA. F. A syringe applicator is introduced to the field, and HAC is placed in a medial-to-lateral direction until the IAC is covered. G. A second cottonoid is used to press the HAC into the petrous air cells, and any connection to the middle ear space. H. Additional HAC is applied and sealed into the communicating air cells. I: The first cottonoid protecting the CPA is removed before the HAC completely sets. J. The remaining defect is filled with HAC and shaped with a cottonoid to match the surface contour. K. A freer dissector can be used for fine sculpting, ensuring the HAC approximates the bony edges to encourage osteoblast engagement. L. Careful hemostasis is required, and a drain is placed to prevent lateral collections, which can compromise HAC integrity.

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