Watertight Robust Osteoconductive Barrier for Cranial Base Reconstruction

ALHUSAIN NAGM MD MSc; Toshihiro Ogiwara; Kazuhiro Hongo MD
1Department of Neurosurgery, Shinshu University School of Medicine, Matsumoto, Japan and 2Department of Neurosurgery, Al-Azhar University Faculty of Medicine-Nasr city, Cairo, Egypt.

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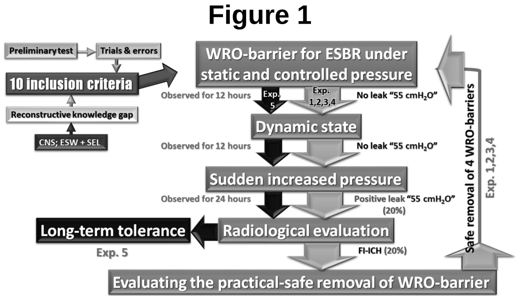
Introduction

By concluding experts' experiences along with our results, we were able to study the reconstructive knowledge gap. We introduce a watertight robust osteoconductive barrier (WRO-barrier) that possess several destinict qualities and can be considered as a good endoscopic reconstructive alternative.

Methods

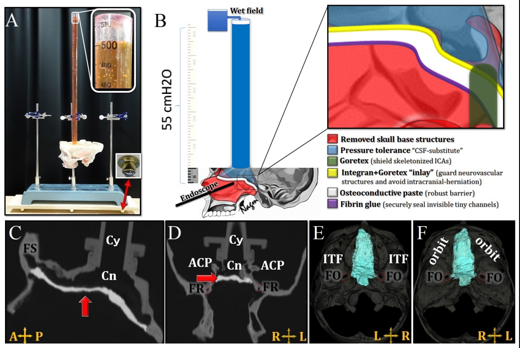
As a novel, we focused on ten clinical conditions. A 3D-skull base-water system model was innovated for practicing ESBR under realistic/stressful conditions. A large-irregular defect (31x89 mm) extending from the anterior-to-posterior fossae was achieved. Then, WRO-barrier was fashioned and its tolerance was evaluated under specific settings, including an exceedingly high (55 cmH2O) pressure, with radiological assessment. Afterward, the whole WRO-barrier was drilled to examine its practical-safe removal (simulating redo-EEA) and the whole experiment was repeated. Lastly, WRO-barrier was kept into place to value its 10-month long-term high-tolerance.

Figure 1



Methodology

Figure 2



Watertight robust osteoconductive (WRO) barrier for endoscopic skull base reconstruction. A,B: WRO-barrier tolerates an exceedingly high pressure of 55 cmH2O (50 cmH2O in cylinder "upper inset"+5 cmH2O in conduit "B") without evidence of leak even under stressful settings (double-head arrow indicates the wheels "lower inset" that used in dynamic settings). Magnified view of WRO-barrier (B) that used to reconstruct a large skull base defect (red) via EEA through a deep-narrow-critical wet (blue) endoscopic field. Goretex sheet shielded skeletonized paraclival-carotids (green), Integran+Goretex "inlay" guard neurovascular structures and avoid intracranial-herniation (yellow), osteoconductive paste as a robust barrier (white) and fibrin glue securely seal invisible tiny channels (violet).

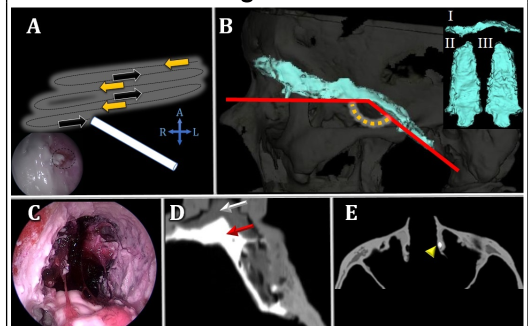
Results

WRO-barriers were satisfactorily fashioned (80%) to conform the geometry of the created defect under realistic circumstances via EEA, tolerated an exceedingly high pressure without evidence of leak even under stressful settings, resisted sudden-elevated pressure (80%), remained in its position to maintain long-term watertight seal, efficiently evaluated with neuroimaging and simply removed-and-reconstructed when redo-EEA is needed. Nevertheless, risk of intracranial fashioning-induced herniation might occur.

Conclusions

WRO-barriers were successfully fashioned (80%) to conform the geometry of the created defect under realistic circumstances via EEA, tolerated an exceedingly high pressure without evidence of leak even under stressful settings, resisted sudden-elevated pressure (80%), remained in its position to maintain long-term watertight seal, efficiently evaluated with neuroimaging and simply removed-and-reconstructed when redo-EEA is needed. Nevertheless, risk of intracranial fashioning-induced herniation might occur.

Figure 3



How to avoid complications: risk of fashioning-induced intracranial herniation or migration. A: Injecting the osteoconductive paste in an S-shaped manner (yellow-and-black arrows). An endoscopic view (inset) showing the homogenously-fashioned WRO-barrier with a special care to include all leaking points (black circle). B: Ideal WRO-barrier's configuration (blue) from different prospective. The transition angle (yellow dotted-curved line) where an easy-but-dangerous manipulative force is more likely to occur. C-E: Experiment 1. C: Removal of WRO-barrier: endoscopic view showing fashioning-induced intracranial herniation at the transition angle. D: CT sagittal view showing dangerous WRO-barrier's configuration. Intracranial herniation of the paste (red arrow) and the inlay materials=Spongcel (white arrow). E: CT axial view showing the escape of the paste along the left lacrimal duct (yellow arrow-head).

Contact

Alhusain Nagm, M.D., M.Sc.
nagm@shinshu-u.ac.jp