

Introduction

- Anterior skull base defects are heterogeneous in nature due to their local, size, and risk of cerebrospinal fluid leak.
- Goals of reconstruction remain the same which involve filling the intracranial dead space and establishing a barrier between the sinonasal cavity and intracranial space.¹
- These defects are primarily iatrogenic due to tumor resections which have transitioned nearly universally to endoscopic assisted transnasal approaches.
- There are many repair methodologies to reconstruct anterior skull base defects including endoscopic endonasal techniques, extranasal locoregional flaps, and free flap reconstruction.
- It is our hope to review and help categorize these techniques in addition to demonstrating the times and situations in which to utilize them despite there being no formal consensus on the matter.

Methods

- Our team performed a literature review of published data on reconstruction methods for anterior skull base defects using PubMed using terms including “endoscopic”, “regional and free grafts and flaps”, and “free flap reconstruction”.
- The reconstruction materials and surgical techniques used for anterior skull base reconstruction are reviewed.

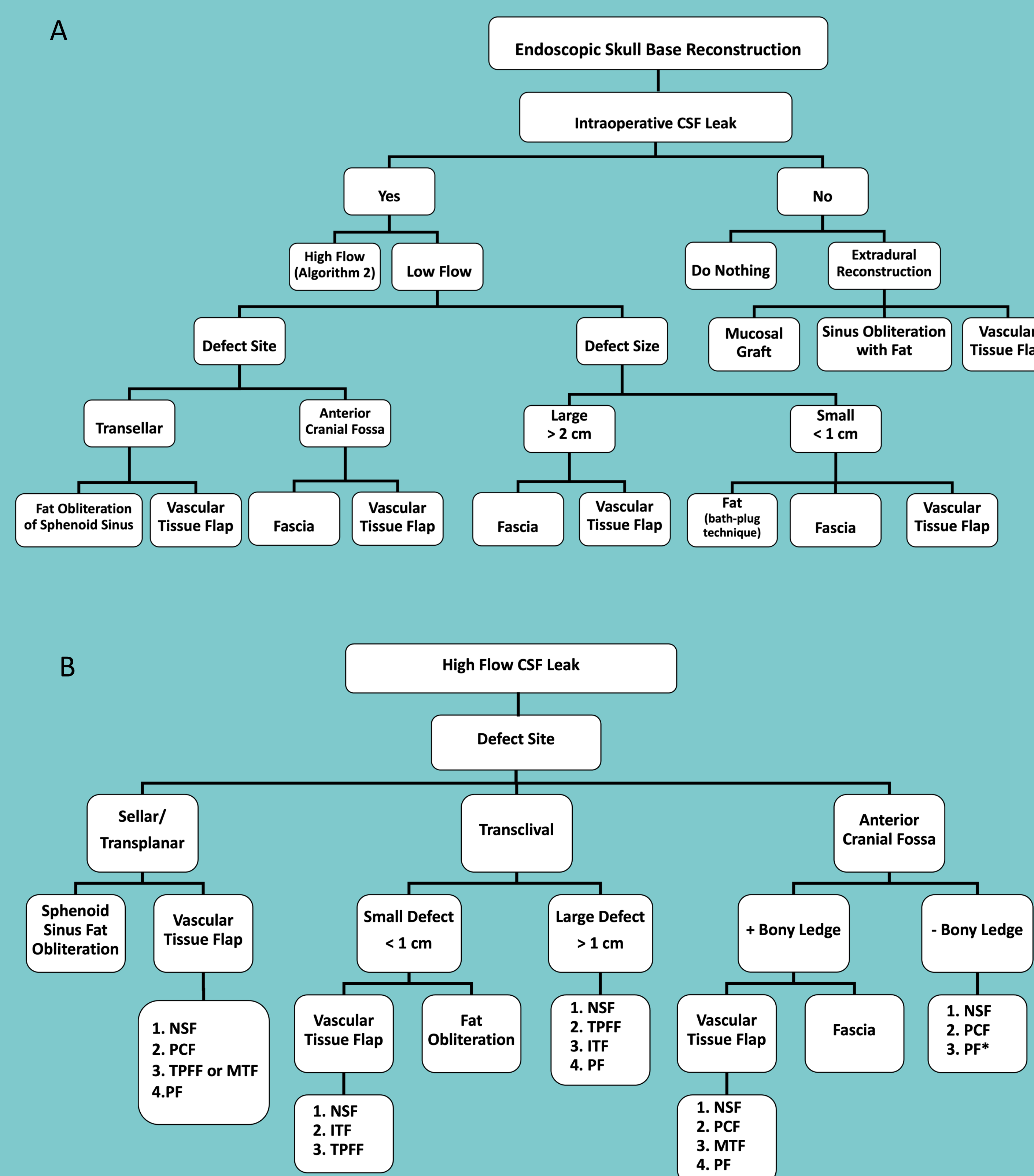
Choice of Reconstruction

- Factors imperative in choosing reconstruction include location, size, bony ledges present upon inset of reconstruction material, future treatment including radiation and CSF leak potential.
- Patel et al. discuss within their series of 166 skull base dural defects repaired with endonasal vascular flap an algorithms that can assist in the decision of reconstruction methodology.³

Endonasal Reconstruction

- Over the last 2 decades, several new options have been introduced for endoscopic reconstruction of skull base defects including larger dural defects with high flow CSF leaks and avascular grafts for small CSF leak.³
- Patel demonstrated that nasoseptal flap reconstruction is a reliable option for low and high flow CSF leaks.³
- Cases with thin diaphragma or dural stress are amenable to repair with a nasoseptal flap.³
- In a study by Patel, 150 patients with intra-operative CSF leaks, 59 of which were high flow and 91 of which were low flow.³
- High flow leaks were described as opening of the ventricle or from entering the arachnoid cistern.³
 - Both patient populations were managed with nasoseptal flaps.³
 - There were 4 failures in the high flow CSF leak category managed with fat grafting and a lumbar drain.³
- A meta-analysis by Harvey et al. showed CSF leak rates with vascularized reconstruction (6.7%) was lower than free graft reconstruction (15.6%).⁶
- Endoscopic repair CSF leak rates are similar to open repair CSF leak rate.⁶

Endoscopic Reconstruction Algorithm



* Last-line options include AlloDerm, fascia latta, and/or free flap via open approach

Figure 1A and 1B. Reconstruction algorithm for intraoperative CSF leaks by Patel et al.

Patel M R, Stadler M E, Snyderman C H et al. How to choose? Endoscopic skull base reconstructive options and limitations. *Skull Base*. 2010;20(06):397-404.

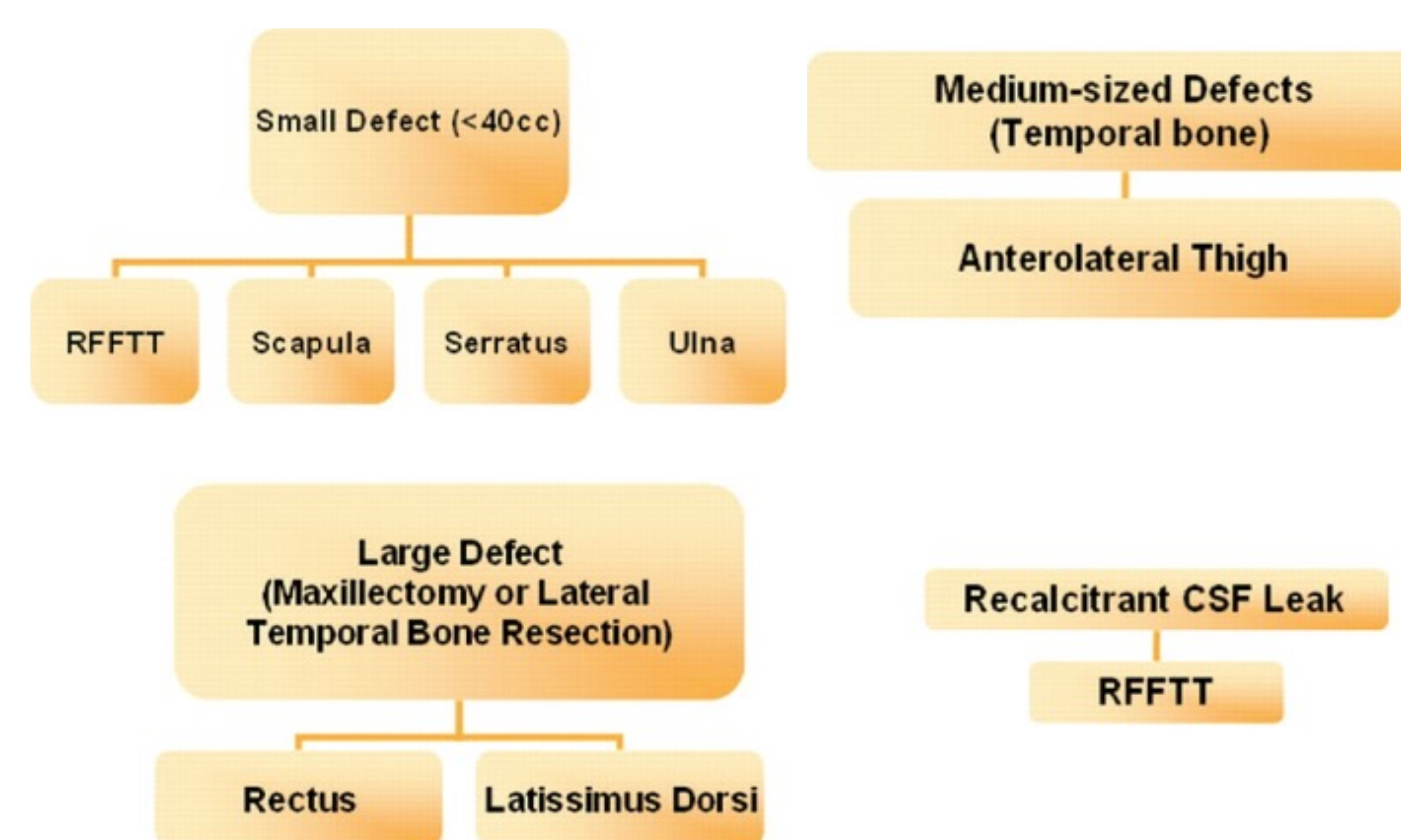


Figure 2. When free flap reconstruction is required for anterior skull base reconstruction an algorithm by Weber et al. has been proposed.

Weber SM, Kim JH, Wax MK. Role of free tissue transfer in skull base reconstruction. *Otolaryngol Head Neck Surg*. Jun 2007;136(6):914-9. doi:10.1016/j.otohns.2006.12.030

Free Tissue Transfer To The Skull Base

- A study by Weber et al. demonstrated large skull base defects from tumor extirpation are best reconstructed with free tissue transfer.⁷
 - 38 patients underwent free flap reconstruction over 10 years for a total of 45 free flaps for skull base reconstruction.
 - 12/38 (31.5%) experienced CSF leak after index surgery without free flap reconstruction.
 - 26/38 (68.4%) underwent primary closure of iatrogenic surgical defects with exposed or opened dura.⁷
 - 33/38 (87%) defects were anterior skull base.
 - 3/45 (6.7%) donor sites with free flap reconstruction experienced CSF leaks. 2/45 (4.4%) underwent flap revision and 1/45 (2.2%) underwent lumbar drain.⁷
 - Reconstructions were done using RFFF (25/45; 55.6%), rectus abdominis (12/45; 26.7%), latissimus dorsi (4/45; 8.9%), ALT (1/45; 2.2%), scapula (1/45; 2.2%), serratus anterior (1/45; 2.2%), and ulnar flaps (1/45; 2.2%).⁷
 - Following flap re-vascularization, the flap was anchored to the surrounding bone with a drill and suture.⁷
 - 5/45 (11.1%) flaps were compromised and replaced by new free tissue transfer.⁷
- A meta-analysis by Lim et al. demonstrated the RFFF and ALT were most commonly used for skull base reconstruction.⁸
 - Mortality with or without local flap reconstruction was 0-7%.
 - Free flap complications were 0-14%: partial flap failure, total flap failure, osteoradionecrosis, fistula, and flap necrosis.
 - Local flap complications were 0-35%: osteomyelitis, major wound infection, meningitis, CSF leak, hematoma, pneumocephalus/ hydrocephalous and delayed resumption of neurological status.⁸
 - Total flap loss was 7.7%. Partial flap loss was 4.1%. These occurred in pedicled flaps, local flaps, and free flaps.⁸

Conclusion

- Anterior skull base defects are primarily iatrogenic and necessitate reconstruction to separate the sinonasal cavity and intracranial space.
- Endoscopic reconstruction has similar rates of CSF leak compared to open repair. These techniques generally provide less morbidity to the patient.
- Free flap reconstruction of large anterior skull base defects may decrease post-operative CSF leaks.

References

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