







**Table 3: Free tissue transfer alternatives for reconstruction of anterior skull base defects**

	Benefits	Disadvantages
Radial forearm free flap	Versatile, reliable donor site anatomy, long pedicle length, size is appropriate for most anterior skull base defects	Visible donor site scar. Cannot cover very large skull base defects. Shorter hospital stays compared to other free tissue transfers
Latissimus dorsi muscle free flap	Consistent vascular pedicle and its large muscle	Larger donor site defect, greater risk of seroma, may result in redundant bulky tissue in an anterior skull base defect
Vertical rectus abdominis muscle free flap	Consistent vascular pedicle and its large muscle	Larger donor site defect, may result in redundant bulky tissue in an anterior skull base defect
Serratus anterior muscle free flap	Longer pedicle, versatile size	Can only reliably cover small skull defects
Temporoparietal fascial flaps	Thin and pliable, can be tailored to fit many defect sizes	May not provide long-term durable coverage. Less able to obliterate dead space. Limited rotation, can only provide coverage for anterior defects
Omental free flap	Minimal donor site scar, can be tailored to fit many defect sizes	Can thin over time and may not provide long-term durable coverage
Pedicled trapezius flap	Less complex operation without risk of vascular anastomoses	Only appropriate for low or inferior defects; pedicle length is limited
Pedicled latissimus dorsi	Less complex operation without risk of vascular anastomoses	Only appropriate for low or inferior defects; pedicle length is limited

meningitis, persistent CSF leak, herniation of brain tissue, pneumocephalus, encephalitis, and brain abscess.<sup>[2,3]</sup> Patients with malignant tumors of the anterior skull base are prone to even higher rates of complication post-resection.<sup>[17]</sup> As described by Bentz *et al.*,<sup>[4]</sup> even in patients without confounding complications, the 5-year disease specific survival rate for patients undergoing anterior skull base resection for malignancy is 57%. Those patients with anterior skull base defects whose courses are complicated by prior surgical intervention, radiation, chronic infection, or fistula formation are at even greater risk for death and complications, and often suffer extended hospitalization and repetitive attempts at surgical correction.<sup>[2]</sup>

The impact of prior treatment on overall survival of these complicated patients is significant. As noted by Jackson *et al.*<sup>[18]</sup> in a series of 155 patients with tumors affecting the anterior skull base (malignant and non-malignant), survival was 85% for patients with no prior treatments, but only 48% for patients with prior intervention. Dos Santos *et al.*<sup>[19]</sup> reported in a review of 81 patients who underwent skull base surgery that prior surgical treatment was a pre-operative factor that affected survival significantly. As reported by Teknos *et al.*,<sup>[1]</sup> patients with skull base defects who have received prior radiation have a significant increase in hospital stay, with an average stay of 17.7 days versus 12.4 days in un-irradiated patients. It is therefore important to choose the treatment with the highest chance of success, whether it is the initial repair or a revision of previous failed operations. With this goal, the reliable and well-vascularized RFFF is a reasonable treatment for correction of anterior skull base defects in complex wound beds, especially those weakened by prior interventions.<sup>[20]</sup>

The RFFF is robust, predictable, and well-vascularized, yet lacks the bulkiness of muscle or myocutaneous flaps and is able to fill dimensionally intricate spaces. Compared to other pedicled or free tissue transfers, the radial forearm free flap's reliability and predictability make it an excellent option for infected, irradiated buried anterior skull base reconstruction in complex patients who have received previous treatment [Table 3]. Our patients presented with prior surgical

intervention ( $n = 4$ ), recurrent infection ( $n = 3$ ), radiation ( $n = 2$ ), persistent CSF leak ( $n = 1$ ), or a combination of these. In our experience with these complex patients with prior therapeutic interventions, we demonstrate improved outcomes compared to previously published results, including 100% flap survival. For example, we noted an average post operative hospital stay of 16 days (range 4-37), compared to an average hospital stay of 26.4 days reported previously in the literature for cranial base reconstruction with free tissue transfer.<sup>[17]</sup> To maximize the quality of life of patients with anterior skull base defects, it is essential to minimize their time spent in the hospital and minimize or eliminate the need for any further operations. To this end, we feel that anterior skull base reconstruction with the well-vascularized and highly reliable RFFF is an excellent option for the ill or complex patient who has received prior anterior skull base radiation or surgical intervention.

This case series demonstrates in four patients the successful reconstruction of anterior skull base with radial forearm free tissue transfer. Our flaps were successful in damaged, inhospitable wound beds and the authors are confident that this should be considered as an early reconstructive option in this patient population. Debridement of infected tissue is of utmost importance in these patients, Weber *et al.*<sup>[11]</sup> described flap loss secondary to purulent material found at the time of initial free tissue transfer which persisted and occluded the pedicle after one week, despite aggressive antibiotic usage. Califano *et al.*<sup>[2]</sup> reported a lower complication rate with free tissue transfer when compared to local flaps, even with more complex resections occurring in the free tissue transfer group. He further reported major complications with 35% of local tissue transfer and only 31% with free tissue transfer.<sup>[2]</sup> This data combined with our experience with the RFFF suggests that free tissue transfer is a reasonable first choice reconstructive option in anterior skull base defects. Due to the moderate success of local flaps, it is reasonable to utilize these flaps before resorting to a RFFF, since they also do not prevent later anastomosing the radial artery to the superficial temporal artery. For secondary reconstruction or salvage operations, the RFFF should be considered after local flaps or other interventions have failed.

