

# Use of the Omental Free Flap for Treatment of Chronic Anterior Skull Base Infections

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**Summary:** Chronic complications following anterior cranial fossa tumor extirpation, such as cerebrospinal fluid leak, meningitis, mucocele, pneumocephalus, and abscess, negatively impact patient quality of life. Robust vascularized tissue is generally required to adequately reconstruct and obliterate this complex geometric space. The aim of this study was to describe outcomes and advantages of the omental flap for these defects. Following institutional review board approval, a prospective, reconstructive database was reviewed from 2011 to 2020. Four patients with chronic anterior skull base complications treated with omental flap reconstruction were identified, with chart reviews performed. Median time from the index operation until the complication ultimately required a free omental transfer was 7.3 years. All patients underwent adjuvant radiation with the indications for surgery, including cerebral abscess, recurrent meningitis, osteomyelitis, and pneumocephalus. All free flaps survived without any need for revision. There were no donor site complications. One patient had delayed healing at an adjacent nasal wound that healed secondarily. At a median follow-up of 19.4 months, none of the patients had recurrent infections. The omental free flap has a number of properties, which make it ideally suitable for anterior skull base defects. Its malleable nature combined with the presence of multiple vascular arcades enable flexibility in flap design to contour to the crevices of 3-dimensional skull base defects. Although other free flaps are available to the plastic surgeon, the versatility and reliability of the omentum make it a first-line consideration for anterior skull base reconstruction. (*Plast Reconstr Surg Glob Open* 2020;8:e2988; doi: 10.1097/GOX.0000000000002988; Published online 11 August 2020.)

## INTRODUCTION

Open craniofacial tumor resection followed by postoperative radiation therapy can result in significant complications. Communication with the nasal cavity, paranasal sinus, or external skin predisposes patients to chronic infection. Once skull base infections occur, they result in repeated episodes of meningitis, subdural or intradural abscess, and can even be associated with seizures.<sup>1,2</sup>

Whether by the endoscopic or open approach, the primary treatment option for skull base defects is the

interposition of vascularized tissue separating the contaminated nasal cavity from the sterile, central nervous system. The first line of treatment for open craniofacial surgery tumor resection includes local tissue, such as the pericranial, the nasal septal, temporal parietal fascial, and temporalis muscle flaps.<sup>3-7</sup> However, for larger defects or those affected by radiation, chronic infection, or recurrent tumor, local tissues are either no longer available or insufficient, necessitating free tissue transfer. A case series of chronic anterior skull base complications illustrating the advantages of the omental free flap for reconstruction is described.

## METHODS

Following institutional review board approval, a search was performed of a prospective database to identify all open skull base reconstructions performed at Memorial Sloan Kettering Cancer Center between March 2011 and June 2019. Demographics, surgical characteristics, and outcomes such as infection, recurrence, wound healing complications, and flap failure were considered when evaluating the effectiveness of omental flaps.

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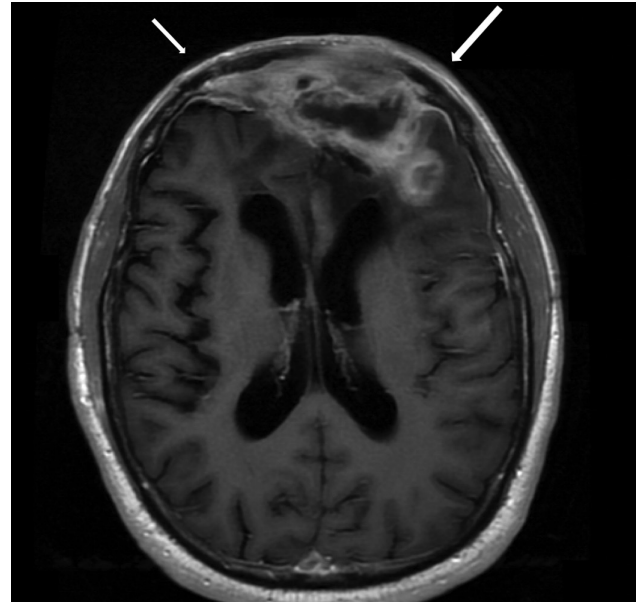
**RESULTS**

Four patients were identified during the study period (Table 1). All 4 patients had adjuvant radiation treatment after resection. The nature of the chronic complication included osteomyelitis, pneumocephalus, chronic wound, meningitis, and brain abscess. Median time from the index operation until the complication ultimately requiring a free omental transfer was 7.3 years. The median follow-up was 19.4 months. All flaps were harvested through a laparotomy by the 2 plastic surgeons (B.M. and E.M.) who are fully trained in general surgery. The omentum was anastomosed to the superficial temporal vessels and healed well. One patient had an area of delayed healing at an adjacent nasal wound that ultimately healed. No revisionary procedures were necessary. No patient had recurrent infection following omental transfer. One patient subsequently required an ipsilateral neck dissection and adjuvant chemotherapy and radiation therapy for recurrent esthesioneuroblastoma 5 years after the omental transfer (and 13 years after the index oncologic operation). Additionally, there were no complications recorded related to the abdominal donor site.

**CASE REPORT**

A 76-year-old man with a history of esthesioneuroblastoma underwent craniofacial resection and dural graft placement in 2006. His early postoperative course was complicated by left frontal lobe hemorrhagic stroke, seizures, and surgical site infection with methicillin-resistant *Staphylococcus aureus*. Following multiple operative debridement and long-term antibiotic treatment, he ultimately required hardware removal almost a year later. His course was further complicated by recurrent brain abscesses (Fig. 1) and pneumocephalus, requiring transnasal debridement twice in 2013 and 2014 with multiple courses of antibiotics.

In June 2015, he ultimately underwent a debridement of the frontal lobe abscess, and autologous cranioplasty by



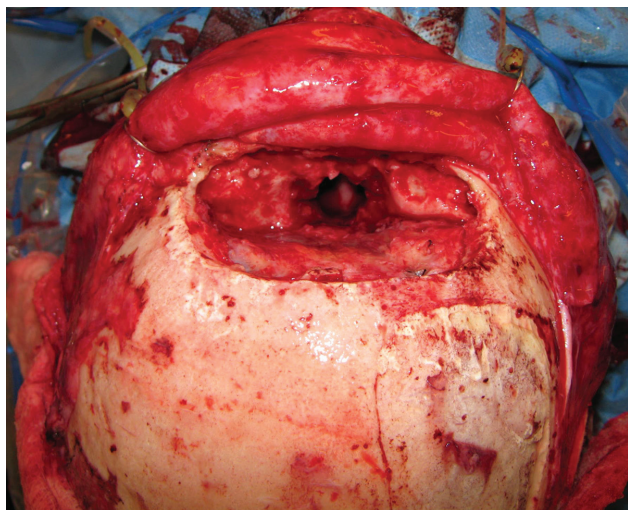
**Fig. 1.** MRI of the brain showing a peripherally enhancing multiloculated collection involving the left (long arrow) more than right frontal lobes (small arrow) and parasinuses, consistent with an abscess. MRI indicates magnetic resonance imaging.

the neurosurgery team followed by a free omental transfer. The defect encountered at the end of the debridement by the neurosurgical team was a large dead space anterior to the frontal lobe, occupying the site of the former frontal sinus (Fig. 2). The defect was a long narrow tunnel communicating directly with the nasal cavity. The right gastroepiploic vessels of the omentum were anastomosed to the left superficial temporal vessels. The flap was used to fill the abscess cavity and obliterate the dead space into the nasal cavity (Fig. 3A). Finally, a cranioplasty was performed over the omentum (Fig. 3B). The patient recovered well and was sent home on postoperative day 12. His last follow-up was 11.5 months postoperatively, at

**Table 1. Demographics, Complication Characteristics, and Outcomes following Free Omental Transfer**

	Patient Number			
	1	2	3	4
Sex	Woman	Woman	Man	Woman
Age at diagnosis (y)	77	46	62	27
Date of surgery	March 2011	June 2003	August 2006	June 1974
Type of approach	Endoscopic, followed by craniofacial resection	Craniofacial resection	Craniofacial resection	Unknown, followed by craniofacial resection
Pathology	Sinonasal salivary adenocarcinoma	Esthesioneuroblastoma	Esthesioneuroblastoma	Giant cell tumor of maxillary sinus
Adjuvant radiation (yes/no)	Yes	Yes	Yes	Yes
Type of complication	Chronic infection of nasal cavity and base of skull	Intermittent CSF leak, pneumocephalus	Infected bone plate and frontal lobe abscess, forehead wound	Recurrent sinus infections, osteomyelitis of left frontal bone skull base, meningitis, intracranial abscess
Intervention before free omentum	Serial debridements, antibiotics (2017)	Lumbar-peritoneal shunt (2003), forehead flap (2009)	Washout, plate replacement, local closure (2006)	Cranioectomy, frontal sinus cranialization (2018)
Date of free omentum	May 2018	March 2011	June 2011	March 2019
Defect type	Lateral rhinotomy to skull base	Frontal sinus to skull base defect	Frontal sinus and nasofrontal duct	Frontal sinus to skull base, nasofrontal duct
Status at follow-up	NED, no infection	NED, no CSF leak	NED, no infection	NED
Operative time (min)	533	550	514	445

CSF, cerebrospinal fluid; NED, no evidence of disease.



**Fig. 2.** Intraoperative photograph after debridement showing the anterior cranial fossa defect requiring coverage.

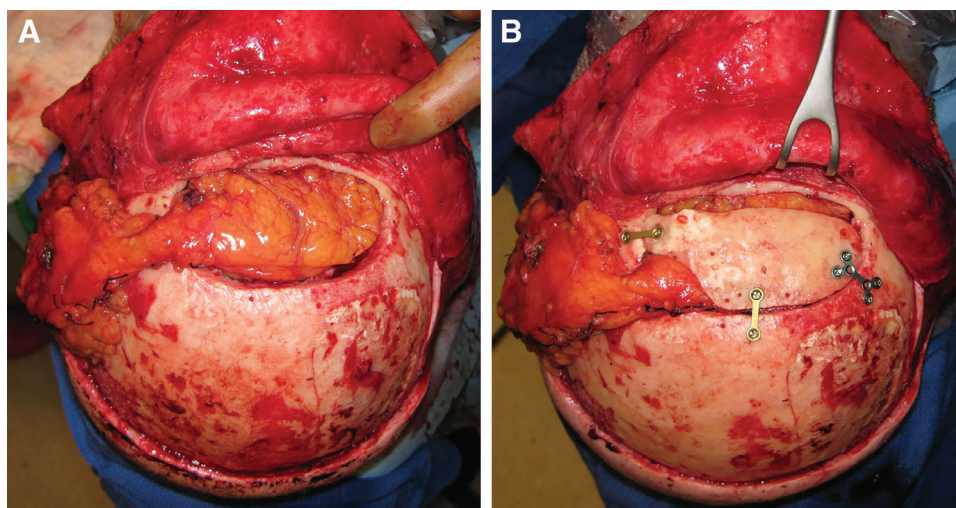
which point, his examination was unremarkable and interval imaging revealed no evidence of infection or disease recurrence.

### DISCUSSION

Initial efforts at anterior skull base reconstruction are typically performed using local flaps; however, larger defects of the skull base, especially including the frontal sinus and nasofrontal duct, are challenging to manage and are prone to chronic complications. When these occur, more robust vascularized tissue in the form of a free flap is usually required.<sup>6-8</sup> The omental free flap was first described for scalp defect coverage.<sup>9</sup> It has since being widely used in head and neck reconstruction because it has a variety of properties that make it suitable for reconstruction of such defects.<sup>10,11</sup> Previously referred to as “vascular putty,” its moldable, pliable nature helps it contour to

crevices and obliterate complex 3-dimensional skull base defects; this is in contrast to other fasciocutaneous or myocutaneous flaps that are not as malleable and therefore difficult to fabricate. Other advantages include its robust vascular supply, long vascular pedicle, large surface area with ability to cover defects of various sizes, minimal donor site morbidity, and immunogenic properties.<sup>12,13</sup> Finally, the large number of vascular arcades enable the flap to be tailored and trimmed to appropriately match the skull base defect. For example, the flap can be divided between the vascular arcades, allowing a portion of the flap to lie within the skull base defect and another portion outside the cranial vault beneath the skin, which is often radiated. Perhaps, the principle limitation to omental flap use is the need for laparotomy, which can uncommonly lead to complications, including abdominal hernia or injury to intra-abdominal organs.<sup>14</sup> This can be optimized by a minimally invasive harvest of the omentum.<sup>11,12</sup>

As an alternative to the omentum, several other free flaps have been described for anterior cranial base reconstruction. The rectus abdominis flap is perhaps the most common free flap used for reconstruction.<sup>2</sup> Disadvantages of this flap include a large abdominal scar and risk of hernia development.<sup>2</sup> Thigh-based flaps (including the anterolateral thigh [ALT], vastus lateralis, and tensor fascia lata) are also effective for obliteration of anterior cranial fossa defects.<sup>15,16</sup> One of the major disadvantages of the ALT is the unpredictable pedicle length and perforator distribution, but this may be somewhat minimized by preoperative imaging. The lateral arm is a relatively thin, pliable flap that does not sacrifice a major artery, but has a short pedicle.<sup>2,17</sup> In contrast, the radial forearm is also thin, pliable free flap but has a much longer pedicle length. However, it is associated with disadvantages such as donor site cosmesis with necessity for a skin graft and potential numbness of the donor hand in the radial nerve distribution.<sup>18</sup> Finally, the latissimus dorsi is a large myocutaneous flap with a long, reliable, vascular pedicle that



**Fig. 3.** The omentum was transferred to the calvaria and was used to occupy the dead space in the anterior cranial fossa following the debridement (A). Immediate result after inset of the omentum and completion of a cranioplasty (B).

can be used to reconstruct particularly large defects with minimal donor site morbidity.<sup>19</sup> Perhaps the principal drawback with any of the aforementioned options relative to the omentum is the lack of pliability of any fasciocutaneous or muscle flap with inability to contour to the thin narrow and 3-dimensional geometry of anterior skull base defects.

Herein 4 complex reconstructive cases are used to illustrate the merits and low complication rate of the omentum flap to obliterate dead space and deliver vascularized tissue to reconstruct anterior cranial fossa defects.

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