Scarless Abdominal Fat Graft Harvest for Neurosurgical Procedures: Technical Note

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Abstract

Background Abdominal fat grafts are often harvested for use in skull base reconstruction and cerebrospinal fluid (CSF) leak repairs, and for operations traversing the nasal sinuses or mastoid bone. Although the endoscopic transnasal surgery has gained significant popularity, in part because it is considered “scarless,” a common adjunct, the abdominal fat graft, can result in a disfiguring scar across the abdomen.

Objective This is the first report of a scarless abdominal fat graft technique for skull base reconstruction.

Methods Ten patients with a median age of 56.5 years (range: 45–73 years) underwent endoscopic transsphenoidal tumor resection with intraumbilical fat graft harvest. Careful circumferential fat dissection at the umbilicus, with progressive retraction of the graft, was crucial to ensure maximal visualization and to prevent injury to the subcutaneous vessels and rectus fascia.

Results Following reconstruction of the sellar skull base, all patients did well postoperatively with no evidence of CSF leak. At 12-week follow-up for all patients, there was no evidence of scar, intracavity hematoma, or wound infection.

Conclusions Fat graft harvest through an intraumbilical incision results in a scar-free abdominal harvest, and is a useful procedural adjunct to complement “scarless” brain surgery.

Keywords

- abdominal fat graft harvest
- skull base reconstruction
- scarless neurosurgery
- minimal access

Introduction

Abdominal fat grafts are often harvested for use in skull base reconstruction during cerebrospinal fluid (CSF) leak repairs, operations traversing the nasal sinuses or mastoid bone, and for cosmesis in plastic procedures. Main indications include translabrynthine and other transpetrosal approaches, and transsphenoidal approaches to the sella and the anterior skull base.^{1–3} A fat graft is often used in combination with other native tissues and prosthetic inserts to reduce the risk of CSF leaks.^{4,5} Traditionally, an abdominal fat graft is harvested either through a small transverse skin crease incision (if necessary below the bikini line in women) or through a paramedian abdominal incision of variable length. There is

inevitably visible scar formation with this approach. We present a technical note describing a scarless intraumbilical incision for abdominal fat graft harvest.

Illustrative Case

A 69-year-old man presenting with visual loss was found to have a large nonsecreting pituitary mass, and he underwent an expanded endoscopic transsphenoidal/transplanum resection. The suprasellar component of the large adenoma required the diaphragma sella be opened to resect the whole tumor. After tumor removal, the skull base was reconstructed as guided by reports in the literature.^{4,5} We harvested abdominal fat via an intraumbilicus incision (–**Figs. 1** and **2**). Care was taken not to

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Fig. 1 Umbilicus; donor site preoperatively.

damage the anterior abdominal skin when making the incision. Constant retraction on the fat as circumferential scissor dissection was undertaken ensured maximal visualization of what was being dissected (►**Fig. 3**). Once the fat graft was removed (►**Fig. 4**), closure was performed with two to three inverted deep dermal Vicryl sutures (Ethicon, Somerville, NJ) and Steri-Strips (Nexcare, Brighton, MI) (►**Fig. 5**). Gauze packing provided hemostatic tamponade (►**Fig. 6**). An inlay graft of Durepair (Medtronic, Minneapolis, MN) was placed over a 2 × 2 cm piece of harvested abdominal fat. The incised dura was laid over that, followed by another piece of Durepair as an onlay graft. A Porex (Porex Surgical, Fairburn, GA) graft was placed on top followed by a septal mucosal flap and then DuraSeal (Confluent Surgical, Waltham, MA). Nasal packing was left in place to buttress the repair and provide tamponade to the nasal mucosa. The patient did very well postoperatively, with 3 days of lumbar drainage and subsequently no evidence of CSF leak.

Results

Ten patients underwent a scarless abdominal fat graft harvest for skull base reconstruction following endoscopic endonasal

Fig. 2 Vertical incision through superior wall of the umbilicus, ~ 2 cm, with care not to extend out onto the surface of the abdomen.

Fig. 3 Use of curved scissors for careful circumferential fat dissection, creating spherical fat graft of a size to suit repair needs. The graft is retracted progressively further out of the small incision as the dissection proceeds.

tumor resection (►**Table 1**). Final histopathologic diagnosis was pituitary adenoma in eight patients, meningioma in one patient, and glomus jugulare in one patient. Transient postoperative diabetes insipidus was encountered in two patients. All patients did well postoperatively with no evidence of graft site hematoma, wound dehiscence, or CSF leak. With our technique we generally obtained ~ 3 cm³ of fat, but more could be harvested as suited the situation. The small size of the umbilical incision and postresection tamponade with sponge packing resulted in excellent hemostasis. At

Fig. 4 Harvested en bloc fat graft.

Fig. 5 Wound after closure with two inverted dermal sutures and Steri-Strips.

12-week follow-up, there was no evidence of a scar, intra-cavity hematoma, or wound infection.

Discussion

Advances in surgical techniques and instrumentation have facilitated enhanced exposure and resection of intradural lesions via an expanded endoscopic endonasal approach. One remaining challenge of endonasal skull base surgery is the repair of large bony and dural defects of the ventral skull

Fig. 6 Packing of umbilicus with 2 × 2 gauze and sterile dressing.

base. Several authors report the use of a multilayer cranial reconstruction with use of abdominal fat graft.¹⁻³ Yet there is no consensus on the ideal methodology for harvesting and handling of graft fat in the neurosurgical literature, and surgeons may select their method of grafting based on anecdotal evidence.⁶

The fat graft is a crucial component of cranial base reconstruction; it reinforces inlay and onlay grafts, provides a biological dressing, and promotes vascularized granulation tissue formation.⁵ The graft also has a tamponade effect on CSF. However, fat graft augmentation requires an incision at the donor site, and it has the potential for visible scars.² Although practice patterns vary widely, often a paramedian or midline abdominal incision is performed and can result in a disfiguring scar at the harvest site.

Our scarless fat graft technique was developed as a less traumatic, and more cosmetic, method for en bloc harvesting of abdominal fat. The incision is limited entirely by the borders of the umbilicus, without disturbing the anterior abdominal skin. The anatomical grooves of the umbilicus, whether concave or convex, make healing incisions less discernible and the eventual scar essentially invisible. Careful circumferential dissection allows retention of maximal volume from a small incision.

This technique enables the harvesting and transplantation of fat as an intact unit, rather than in piecemeal fashion. Studies from the plastic surgery field demonstrate that traumatic handling of grafts during harvest can be detrimental to long-term survival of the graft, resulting in destruction of adipocyte cellular membranes and microcirculation.² This may have implications for the integrity of the graft and potential for CSF leak. Kassam et al⁵ noted the findings most common to CSF leaks: failure of the graft to heal and migration away from the bony margin of the defect. A graft with greater integrity and vascularity may adhere more robustly to residual tissues, minimizing graft migration and formation of CSF fistulas. Our technique may therefore maximize the potential for preservation of graft survival and vascularity, increasing the probability for early healing with surrounding structures and subsequent formation of granulation tissue. Because of the technique's smaller incision, there may be less potential for infection, and postprocedure recovery of the incision is short. No infections or graft site hematomas occurred in our series.

One concern that has been raised regarding our technique is the quantity of fat that may be acquired from an intraumbilical incision. We were able to routinely obtain ~ 3 cm³ of fat graft, which was sufficient for reconstruction of the anterior and lateral skull base defects in our series. Lateral skull base reconstruction may often require larger grafts to accommodate the three-dimensional defects often commensurate with mastoidectomy and other transtemporal approaches.⁷ We have used this approach for repair of these defects and believe that our graft harvesting technique is more than adequate for this purpose. Dissection is performed subcutaneously through the small opening and extends significantly further than the limited surface anatomy of the umbilicus, allowing large volumes of adipose tissue to be obtained.

Table 1 Clinical characteristics and operative details of 10 patients undergoing scarless abdominal fat graft procedure

Patient	Age /Sex	Pathology	Repair	Postoperative CSF leak	Graft site complications
1	54/M	Pituitary macroadenoma	Inlay/Onlay/DuraSeal	No	None
2	73/M	Pituitary macroadenoma	Inlay/Onlay/DuraSeal	No	None
3	56/F	Pituitary macroadenoma	Inlay/Onlay/Nasal Septal Flap/DuraSeal	No	None
4	69/M	Pituitary macroadenoma	Inlay/Nasal septal flap/DuraSeal/ Lumbar drain	No	None
5	57/M	Tuberculum meningioma	Inlay/Nasal septal flap/DuraSeal	No	None
6	45/M	Pituitary macroadenoma	Inlay/Nasal septal flap/DuraSeal	No	None
7	65/M	Pituitary adenoma/apoplexy	Inlay/Nasal septal flap/DuraSeal	No	None
8	53/M	Pituitary macroadenoma causing obstructive hydrocephalus	Inlay/Nasal septal flap/DuraSeal	No	None
9	57/M	Pituitary adenoma/apoplexy	Inlay/Onlay/DuraSeal/lumbar drain	No	None
10	51/F	Glomus jugulare	Dura repair/Fat/DuraSeal	No	None

Abbreviation: CSF, cerebrospinal fluid.

Conclusions

The intraumbilical scarless fat graft harvest presented here is a useful adjunctive technique to skull base reconstruction that has clear cosmetic advantages by minimizing scar formation, and it may have additional benefits such as enhanced granulation tissue formation and decreased infection from a smaller exposure.

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