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ORIGINAL CONTRIBUTION

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Protective Silastic® sheet in combined transorbital and transnasal resection of sinonasal lesions*

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Abstract

Background: Combined transorbital and transnasal endoscopic surgery for access to the skull base has contributed to the gradual expansion of the remit of the endoscopic skull base surgeon.

Method: We present our technique of Silastic® sheet aided combined transorbital and transnasal endoscopic resection of anterior skull base malignancies, with a description of surgical technique and our method of safeguarding the orbital contents with appropriate suggested indications.

Results: Patient underwent resection of non-intestinal type adenocarcinoma. There were no immediate or delayed postoperative complications related to transorbital access.

Conclusion: In cases where tumour infiltrates medial orbital wall and there is an indication to remove the lamina papyracea and/or periorbita, we find the initial transorbital approach advantageous to find a dissection plane in healthy tissue and to achieve partial devascularisation of tumour by cauterisation of anterior and posterior ethmoidal artery. Moreover, this approach can be combined with intraorbital placement of Silastick sheet to prevent a prolapse of orbital contents into the nasal cavity during transnasal resection which may lead to its damage.

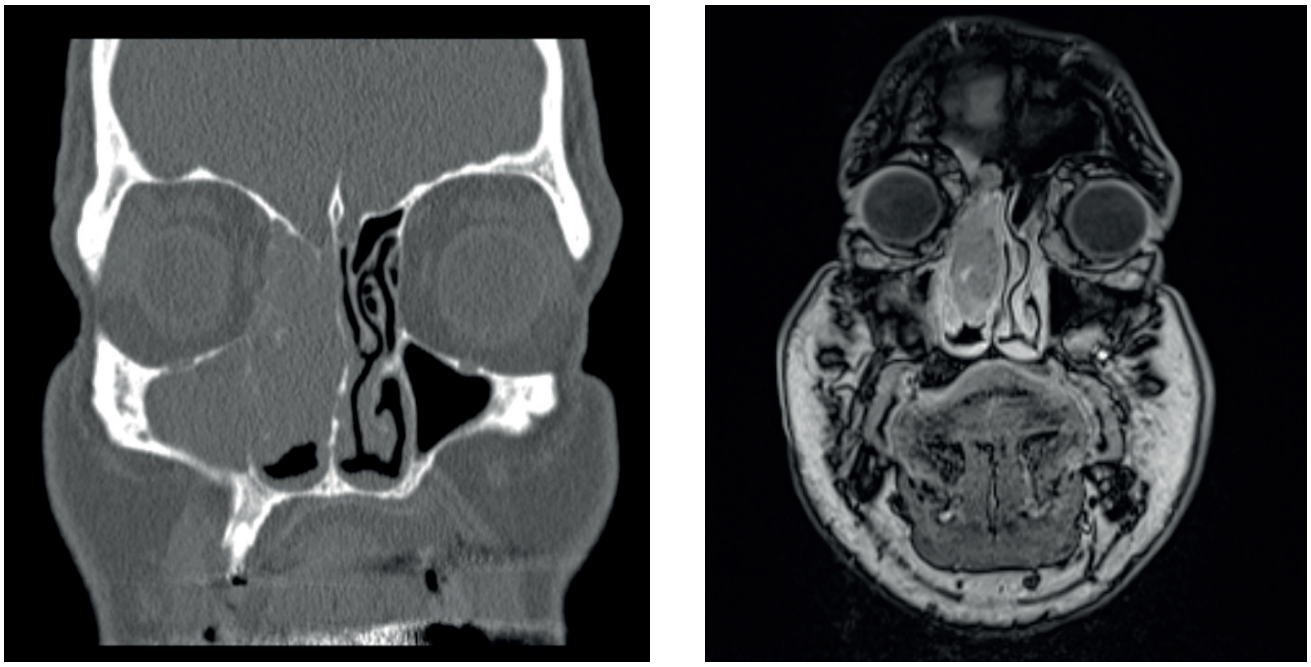
Key words: transorbital, endoscopic, skull base, tumour, CSF leak

Introduction

Endoscopic transnasal techniques have revolutionised the surgical management of diseases of the central skull base. They provide a route for comprehensive dissection without the morbidity of open craniofacial approaches but are anatomically constrained by the presence of the orbits laterally. The more recent emergence of the transorbital portal for endoscopic access to the skull base, utilised alone or in conjunction with the transnasal corridor, has contributed to the gradual expansion of the remit of the endoscopic skull base surgeon [1,2].

Four principal transorbital approaches allow access to all four quadrants of the orbit, and therefore on four different trajectories: the superior eyelid crease (blepharoplasty), transconjunctival lower eyelid, medial precaruncular and lateral retrocanthal approaches [3]. These surgical techniques are well described in a review by Gassner et al. [1]. In our study, we describe a modified retrocaruncular approach which falls naturally in the indentation between the caruncle and the plica semilunaris and does not require suturing [4].

This article aims to outline and illustrate modification of combined transorbital and transnasal approaches in skull base surgery, with details of surgical technique and our method of safeguarding the orbital contents. We provide clear suggested criteria for use of this technique.



CT (left) and post-contrast T1 MR (right) of sinuses showing a large right intranasal mass widening the olfactory recess with thinning and remodelling of the ethmoid trabeculae and lamina papyracea. There are no signs of dural invasion and the anterior skull base is intact.

Materials and Methods

Ethical considerations

Informed consent was provided by the patient for use of images in publication.

Case report

A 58-year old gentleman presented with a history of recurrent right sided epistaxis and a large right sided intranasal polypoidal mass. A CT and MR sinuses demonstrated a large right intranasal mass widening the olfactory recess with thinning and remodelling of the ethmoid trabeculae and lamina papyracea, which was laterally bowed. There were no signs of dural invasion and the anterior skull base was intact (Figure 1).

An endoscopic biopsy confirmed a diagnosis of a T2N0M0 non-intestinal type intermediate grade sinonasal adenocarcinoma. The patient was discussed at the Head and Neck MDT meeting and complete surgical excision followed by adjuvant radiotherapy was recommended.

The patient underwent a combined retrocaruncular, using a protective Silastic® sheet, and transnasal resection of the tumour including complete ipsilateral ethmoidectomy, middle and superior turbinate removal. The periorbita, lamina papyracea and anterior skull base were removed along with the superior septum leaving contralateral mucosa and dura intact. A fascia lata graft was harvested from the left thigh, placed as an underlay to reinforce the bony defect in the anterior skull base and covered with contralateral inferior turbinate mucosal free graft.

There were no post-operative complications with good healing of orbital incision.

Anatomical Study

One fresh frozen cadaver was dissected to define anatomy associated with our surgical procedure. We present a combination of intraoperative and cadaveric dissection figures for better understanding of anatomy and surgical technique.

Results

How we do it?

Preoperative:

The patient is placed under general anaesthesia. Moffett's solution is applied to the nasal cavity in the anaesthetic bay and the patient is given tranexamic acid 1g and one dose of co-amoxiclav 1.2g (if no allergy to penicillin) intravenously on induction. Sterile half-strength betadine solution is applied to the face and a head drape is applied, leaving both eyes, forehead and nose exposed.

Retrocaruncular approach:

The conjunctiva in the area of the semilunar fold is infiltrated with 1-2 mL 2% lidocaine and 1:80,000 adrenaline. The upper and lower eyelids next to the medial angle are retracted with traction sutures. The caruncle is retracted medially with atraumatic fine forceps. The incision is placed immediately lateral to

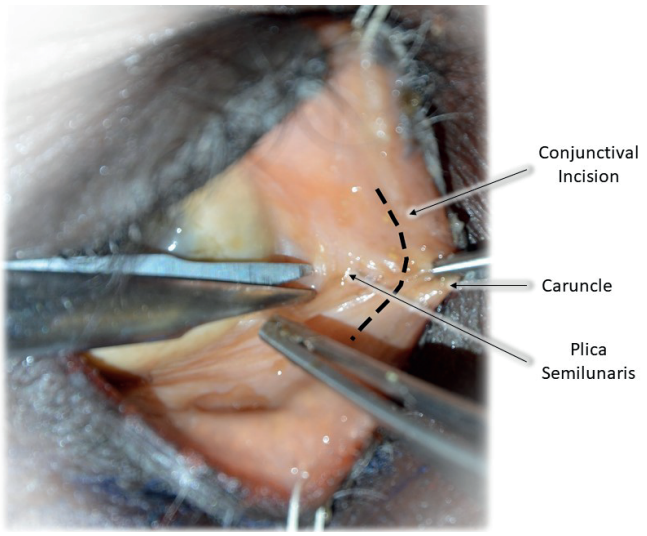


Figure 2. Relationship of conjunctival incision to caruncle (cadaver).

the caruncle through the conjunctiva of the plica semilunaris (Figure 2). Care must be taken to avoid traumatising the lacrimal punctum and canaliculi. The condensed fibrous layer just deep in the caruncle are dissected in the direction of the posterior lacrimal crest using Iris scissors until Horner's muscle is encountered and followed medially to the posterior lacrimal crest. A malleable retractor is inserted to retract the globe laterally (Figure 3). The periosteum is then incised and elevated, identifying the anterior and posterior ethmoidal arteries, located at approximately 12 and 24 mm from the anterior lacrimal crest. These are cauterised to aid haemostasis (bipolar 10W) (Figure 4).

Silastic® sheet insertion

An inert silicon elastomer (Silastic®, Dow Corning Corporation, USA) sheet is then cut to an appropriate size and shape. This is sized through measurement of the anticipated defect using a malleable ruler. We have found a U-shaped piece allows for easy rolling into a cone for insertion. The Silastic® implant is then placed medial or lateral to the periorbita depending on whether the lamina papyracea and the periorbita are to be removed or the lamina papyracea alone (Figure 5). The clear sheet allows for visualization during the transnasal endoscopic portion of the tumour removal especially when landmarks are difficult to identify and can help identify the lateral margin of the tumour excision. This also allows the periorbita to be removed, while preventing orbital fat from prolapsing into the nasal cavity.

Transnasal approach

A transnasal endoscopic approach using 0o and 30o rigid Hopkins endoscope is then performed. If accessible, a sphenopalatine artery ligation is performed with bipolar cauterisation which is followed by debulking of lesion. The Silastic® implant is easily identified within the nasal cavity, demarcating to the surgeon the lateral limit of dissection while preventing orbital fat prolapse. Care should be taken to ensure the Silastic® implant has not slipped, although if appropriately sized the sheet should be supported by surrounding fixed bony margins.

Closure

After completion of the intranasal dissection, the Silastic® implant can be removed endonasally or transorbitally depending on the size of lamina papyracea defect (Figure 6).

Post-operative

Patients are admitted overnight with eye observations (eye movement, acuity and colour vision) performed in recovery on wakening and then at four-hourly intervals. Patients are advised to report any acute change in vision. Discharge medications include saline nasal douches and chloramphenicol eye ointment one application TDS for two weeks, and patients are advised to avoid straining, bending down or Valsalva for two weeks. Patients are reviewed at two weeks in an outpatient clinic.

Discussion

Transorbital approaches to sinonasal and skull base pathology is increasingly common. It is an important adjunct to the more traditional transnasal approaches of the endoscopic skull base surgeon. A varied range of cutaneous and transconjunctival incisions allows for multiple angles of approach and increased manoeuvrability for pathologies that are not easily accessible by the transnasal route 1.

The indications for this approach are evolving; published case series describe the drainage and decompression of orbital and extradural complications of sinusitis, repair of CSF leak, repair of orbital fractures and sinonasal tumour resection [3,5,6].

Oncological resection of sinonasal tumours are challenging through purely transnasal endoscopic approaches. The vascularity of tumours often leads to a challenging operative field putting surrounding structures at increased risk. Assessment of the lateral extent of the tumour and the normal tissue planes are often difficult to assess after dissecting through the tumour to reach its lateral margin.

The combined transorbital & transnasal approach allows for identification and control of the anterior and posterior ethmoidal arteries, reducing tumour vascularity prior to resection. This technique allows early identification of the lateral extent of the tumour and clear demarcation of uninvolved tissue planes at the orbital interface, allowing for a more controlled operative field. The placement of the customisable protective Silastic® sheet ensures that this tissue plane is not lost once approaching the tumour transnasally. It also allows a clear protective barrier of the orbital contents from the transnasal endoscopic approach,

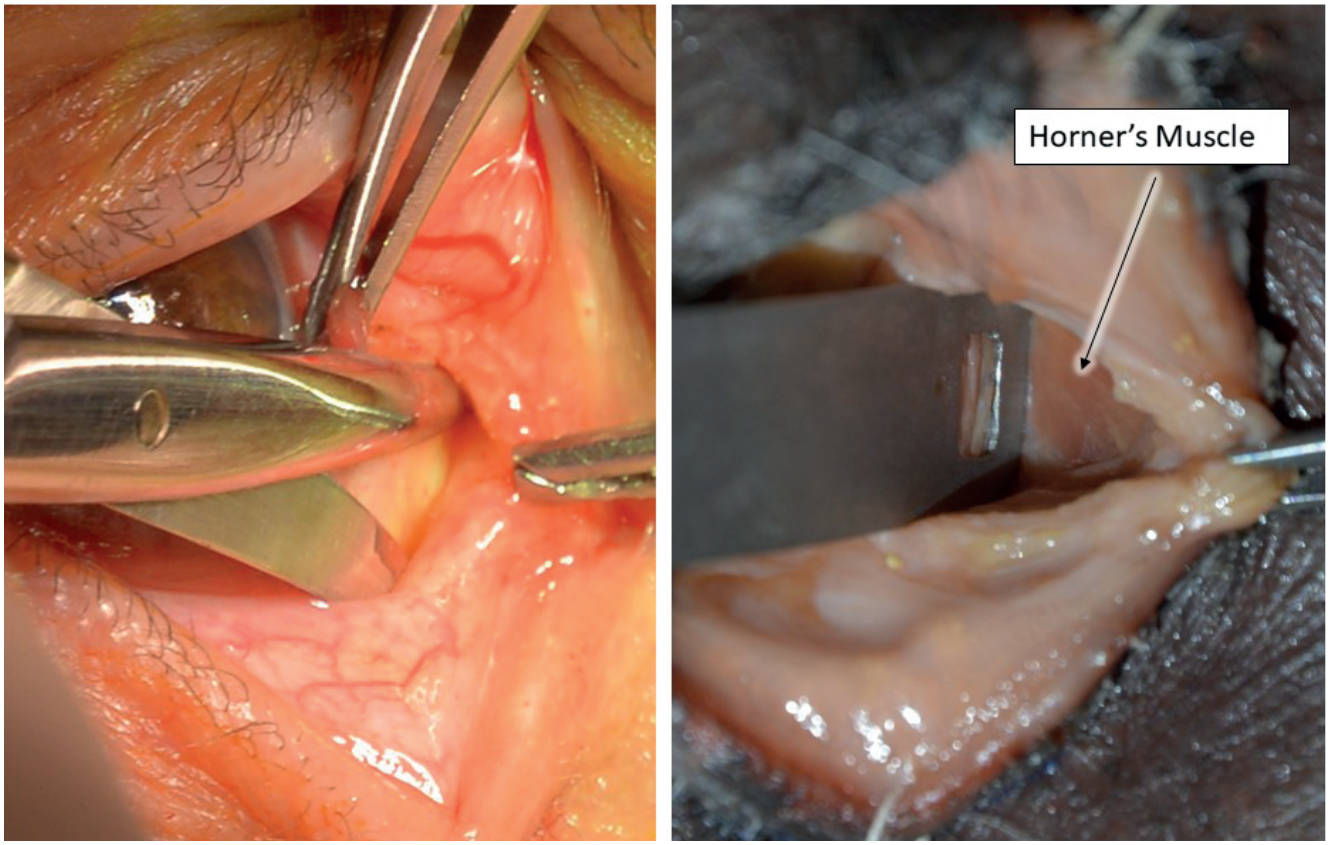


Figure 3. Dissection of fibrous layer (patient, left) down to Horner's muscle (cadaver, right).

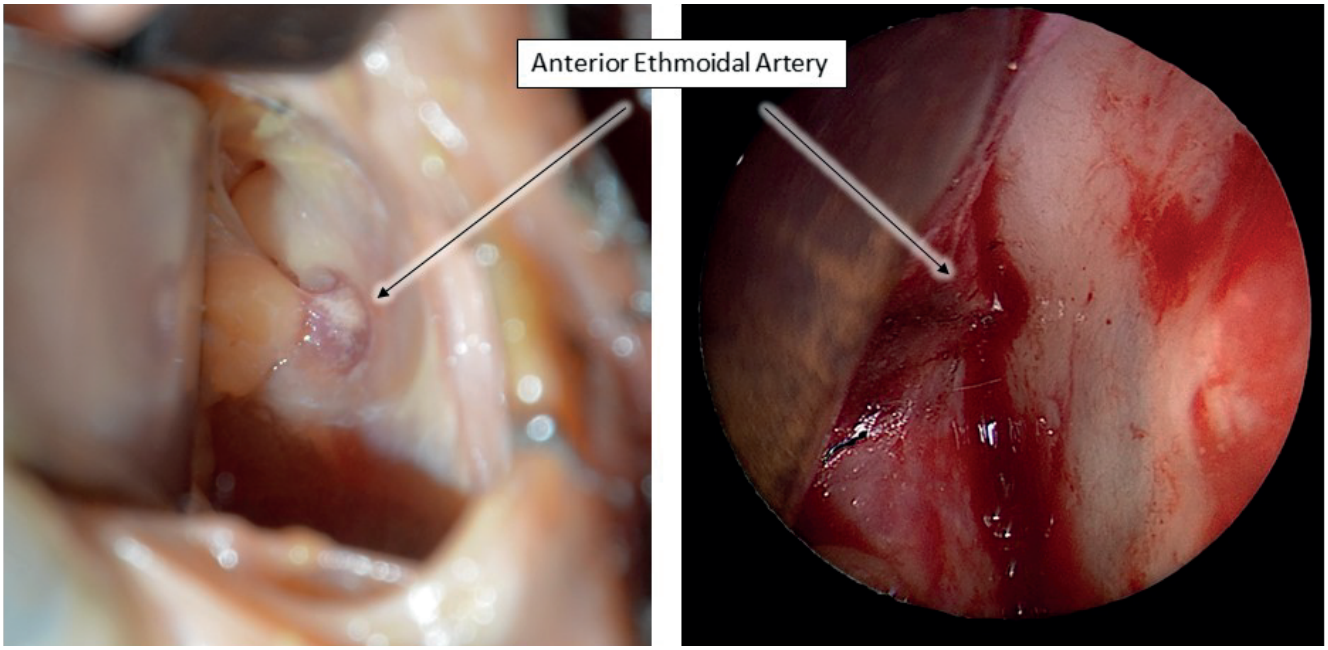


Figure 4. Identification of the anterior ethmoidal arteries with cadaveric (cadaver, left) and operative (patient, right) demonstration.

which often includes use of powered microdebriders.

A large case series looking at endoscopic sinonasal tumour surgery noted that in up to 46% of cases 45.8% with malignant pathologies required resection of periorbita [7]. In cases where tumours do not invade extraocular muscle, the ocular globe or orbital apex, there is an increased drive for orbital preservation surgery [8].

With orbital preservation surgery, eye-related functional impairment is not infrequent with large case series documenting a 42% rate, including diplopia and blindness [8].

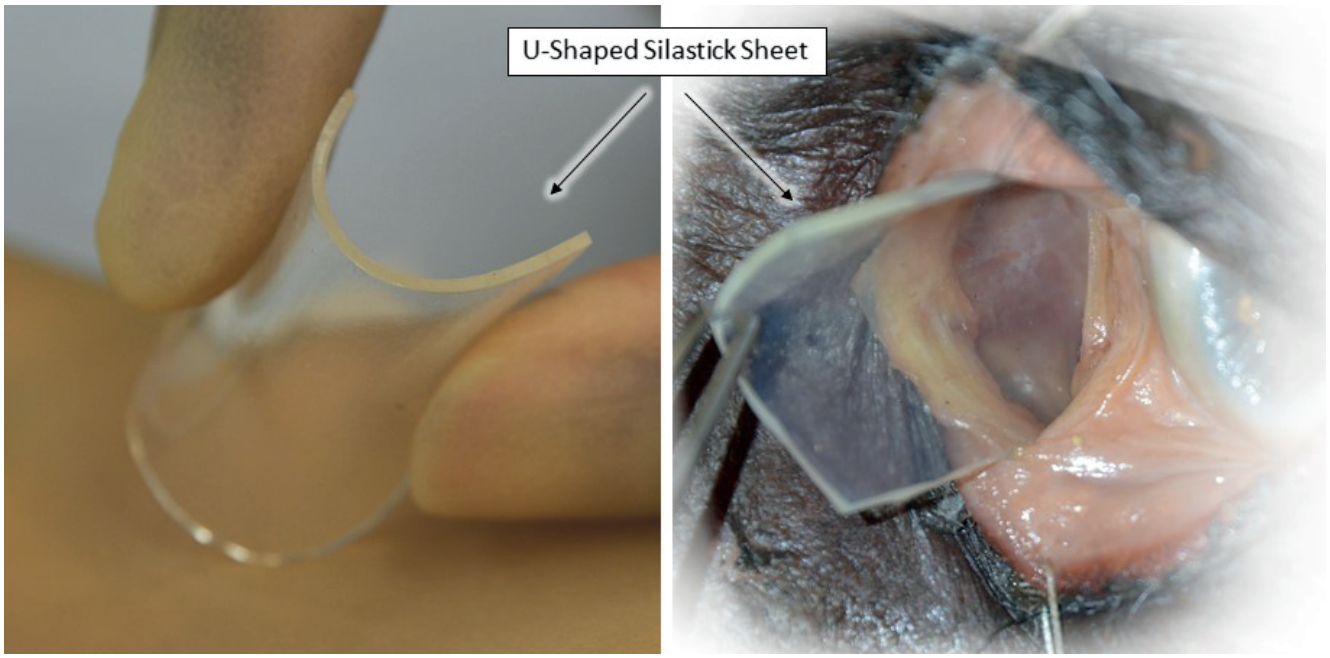


Figure 5. Sizing and placement of the protective Silastic® sheet (cadaveric dissection).

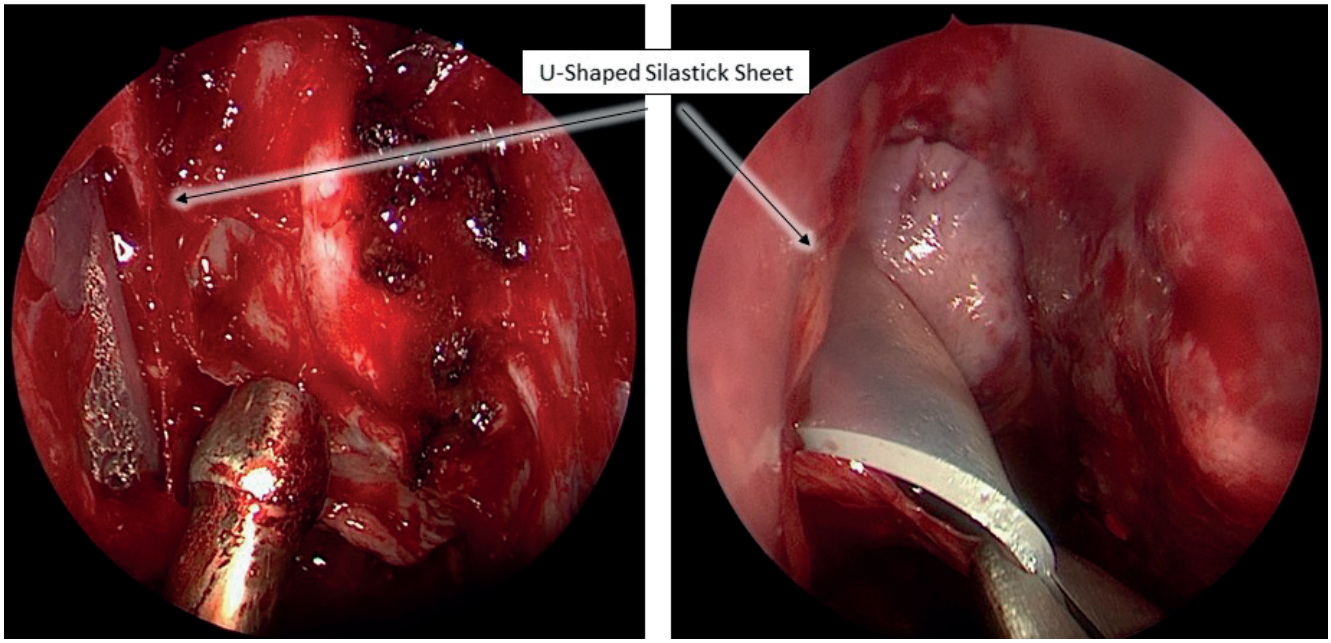


Figure 6. Intraoperative view of protective Silastic® sheet during transnasal tumour dissection (left) and transnasal removal of protective Silastic® sheet after completion of dissection (right).

The protective Silastic® sheet allows for complete protection laterally placed univonvleved orbital contents and ensures prevention of periorbital fat prolapse in cases where periorbita is removed due to disease infiltration.

We do not recommend the use of malleable orbital retractors as it is very difficult to avoid at least partial prolapse of fat due to the fixed dimensions and shape of the retractors. In cases where there is a challenging operative field, partial prolapse may lead to inadvertent damage of periorbital contents.

The literature addresses the potential risks and pitfalls of the transorbital approach, due to the incision and subsequent intraoperative compression, manipulation or heating effects. Scarring from this surgical approach is near invisible. Other reported complications include self-limiting diplopia, epiphora, ptosis, infraorbital hypoaesthesia and enophthalmos, and our experience and that of other authors is that the burden of morbidity is very low [9].

There is a significant learning curve for most skull base surgeons

and working alongside an orbital surgeon is advocated in the early stages [10].

Suggested criteria for use of described technique:

1. In cases of orbital preservation surgery with an indication to remove lamina papyracea with/without periorbita due to tumour invasion.
2. To determine the exact extent of tumour penetration into the orbital tissues prior to endonasal resection when orbital invasion was not possible to rule out based on radiological findings.

Conclusion

In cases where tumour infiltrates medial orbital wall and there is an indication to remove the lamina papyracea and/or periorbita, we find the initial retrocaruncular approach advantageous to find a dissection plane in healthy tissue and to achieve partial devascularisation of tumour by cauterisation of anterior and posterior ethmoidal artery. Moreover, this approach can be combined with intraorbital placement of protective Silastic® sheet to prevent a prolapse of orbital contents into the nasal cavity during transnasal resection which may lead to its damage.

Authorship contribution

NA: paper writing; TJ: obtaining photographs, paper writing; FT: cadaveric dissection, obtaining photographs, paper writing; CH: senior supervision, paper writing; PS: senior supervision, paper writing, cadaveric dissection, picture editing.

Conflict of interest

The authors declare no funding or conflict of interest.

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