

Endoscopic modified Lothrop procedure: an alternative for frontal osteoma excision*

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SUMMARY

Purpose: To describe three cases of frontal osteoma which were safely removed with a stereotactic-assisted, endoscopic modified Lothrop approach (EMLP).

Method: Retrospective case review

Results: Three patients presented with extensive frontal sinus osteomas. Two underwent an EMLP and one patient with osteoma extending significantly into the orbit had an EMLP for removal of the medial frontal sinus component combined with an anterior orbitotomy to remove the orbital extension. In all cases stereotactic localization was utilized to ensure preservation of the skull base. Post-operatively, one patient required debridement of oedema at the junction of a lateral mucocele and the frontal sinus. The other two patients remained well post-operatively with no complications. At follow-up, there was no tumour recurrence.

Conclusion: A stereotactic-assisted, EMLP with or without an orbital approach may be considered for the removal of large frontal osteomas and may provide a less invasive alternative to traditional external approaches.

Key words: image-guidance, endoscopic modified Lothrop procedure (EMLP), frontal sinus, external approach, drill.

INTRODUCTION

Osteoma of the para-nasal sinuses is a rare and benign tumour with an incidence of 0.1 to 3% (Fu and Perzin, 1974; Selva et al., 2000). The frontal sinus is the most common location, accounting for 75% of para-nasal sinus osteomas (Fu and Perzin, 1974). Patients with frontal sinus osteomas are usually asymptomatic and require no treatment. Symptomatic osteomas, on the other hand, should be treated by excision and the traditional external approaches include a frontoethmoidectomy approach or an osteoplastic flap procedure. The advent of endoscopic sinus surgery, however, has provided an alternative in the management of some of these lesions. The endoscopic modified Lothrop procedure (EMLP) has been recently described and gives wide access to the frontal sinuses. The aim of EMLP is to create a wide median frontal sinus drainage by removing the entire floor of both frontal sinuses, the upper nasal septum and frontal sinus intersinus septum under endoscopic visualization. This wide access has enabled the resection of selected benign frontal sinus tumours (Gross et al., 1995). Stereotactic localization may also be used to ensure accurate localization and tumour removal with preservation of the skull

base. We describe three cases of frontal sinus osteomas, one with an orbital extension, that were safely removed using a stereotactic-assisted EMLP.

CASE REPORT 1

A 30-year-old man presented to the Orbital clinic at the Royal Adelaide Hospital with a two-day history of right retro-orbital pain against a background history of progressive right ptosis for five years. He had no significant past medical history or symptoms of sinus disease. On examination he had visual acuities of 6/6 bilaterally and a tender fullness of the right medial upper lid. He had a 2mm right non-axial proptosis and inferior globe displacement. Extraocular movements were restricted in upgaze and there was marked tenderness over the right frontal sinus. No nasal abnormalities were detected. Computerised tomography (CT) showed an extensive osteoma which obliterated the medial portion of both frontal sinuses (Figure 1). There was an associated right mucocele which had eroded through the orbital roof into the orbit, displacing the globe infero-laterally. Magnetic resonance imaging (MRI) confirmed the extent of the mucocele which measured 3.0 by 1.5 cm with



Figure 1. Coronal bone window CT scan demonstrating an extensive bilateral frontal sinus osteoma completely obliterating the medial portion of both frontal sinuses.

no intracranial extension. Surgical options of an osteoplastic flap versus EMLP were extensively discussed with the patient; the patient did not wish to undergo an open procedure. An EMLP was performed and following removal of the majority of the osteoma with a powered drill, the lateral mucocele was opened into the space created by removal of the osteoma. An eyebrow frontal trephine was placed to allow the mucocele and newly created frontal sinus to be irrigated at regular intervals after the surgery. As the newly created frontal sinus was surrounded by raw bone, the right middle turbinate was harvested and a free mucosal graft was placed to ensure continuity between the lateral mucocele and nasal cavity was maintained. A large ostium measuring 22 by 16 mm was formed which had a good connection to the mucocele. A diamond burr was used on the skull base under image-guidance to minimize the risk to the skull base. The patient had a second look procedure at 6 weeks and this showed that the free mucosal graft had taken well but was oedematous and some debridement was necessary to ensure continuity of the lateral mucocele and frontal sinus. The frontal sinus was well visualized through the ostium showing no recurrence.

CASE REPORT 2

A 28-year-old woman presented to the Orbital Clinic at the Royal Adelaide Hospital with right proptosis. She had no significant past medical history or symptoms of sinus disease. Examination revealed visual acuities of 6/6 bilaterally and 3 mm of non-axial right proptosis. The globe was displaced 6 mm inferiorly and 4 mm laterally. There was a hard mass



Figure 2. An intraoperative photograph showing the supraorbital nerve (arrow) running over the orbital portion of the osteoma.

palpable in the superior-medial anterior orbit and mild limitation of right upgaze. Perusal of old photographs indicated the globe displacement had been present for at least 7 years. A CT scan showed an extensive fronto-ethmoidal osteoma with a significant intraorbital component. Three-dimensional CT reconstruction was obtained preoperatively and although the ethmoidal and medial frontal sinus component was accessible endoscopically, the lateral frontal sinus and orbital component necessitated an orbital approach. Intraoperatively, the ethmoidal and medial frontal components of the tumour were initially drilled out via an EMLP. A diamond burr and stereotactic localization were used when the osteoma attached to the skull base on the posterior wall of the frontal sinus was removed. The remaining frontal and orbital osteoma was then approached via a superior skin crease incision. The tumour was found to have breached the periosteum and the supraorbital nerve could be seen coursing over its surface (Figure 2). The nerve was distracted laterally and a 4 mm cutting drill was used to core out the central portion of the osteoma. The rem-



Figure 3. Post-operative coronal CT scan post EMLP and combined orbital approach showing no residual frontal osteoma.

nants of the osteoma at the junction of the floor of the frontal sinus and skull base were drilled away with a 2 mm diamond burr. Stereotactic localisation was again used to ensure protection of the dura. The patient made a good recovery in the immediate post-operative period and at 6-month follow-up she was asymptomatic. She later developed an infection and CT was performed to exclude any collections in the frontal sinus; there were no residual tumour demonstrated (Figure 3).

CASE REPORT 3

A 68-year-old man presented with a two-month history of watery discharge from his right nostril. He had no significant past medical history or symptoms of sinus disease. On examination no nasal abnormalities were detected and the patient did not have any neck stiffness. The watery discharge was tested for beta-2-transferrin to ensure that it was not cerebrospinal fluid (CSF) and the result was negative. Computerised tomography (CT) of the paranasal sinuses showed an extensive right frontal sinus osteoma with obstruction of the outflow tract and retention of secretions in the frontal sinus. On sagittal reconstruction, there was a defect observed at the postero-inferior margin of the bony wall of the right frontal sinus, probably related to the osteoma with apparent communication between the sinus and the subarachnoid space. The remaining bony margins of the paranasal sinuses appeared intact (Figure 4). An EMLP was performed and the osteoma removed. No CSF leak was identified so the apparent loss of anterior skull bone seen on the CT scan did not represent a CSF leak. The rhinorrhoea was thought to be caused by obstruction of the outflow tract of the right frontal sinus. A diamond burr was used on the postero-inferior region of the posterior wall of the frontal sinus to minimize the risk to the skull base. Two frontal sinus cannulas (metal cannula Medtronic Xomed Jacksonville, FL, USA) was placed through the anterior table of the frontal sinus, not through the frontal sinus ostium, and were left in place for 5 days post-operatively to ensure post-operative patency. He has

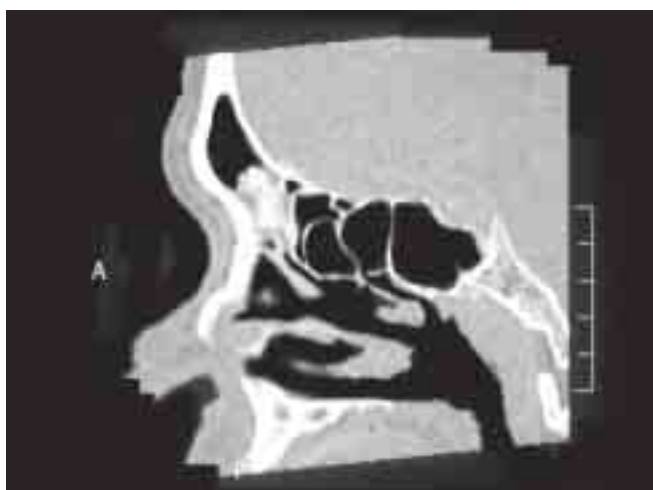


Figure 4. Sagittal view of reconstruction CT scan showing right frontal sinus osteoma extending postero-inferiorly.

been asymptomatic for 3 years with a patent frontal ostium which allowed visualization of the frontal sinuses, hence no post-operative CT were performed.

DISCUSSION

Osteomas are benign proliferations of bony tissue that most commonly occur in the sinuses, skull and facial bones. Although most sinus osteomas are asymptomatic, obstruction of the sinus ostia may lead to sinusitis or mucoceles. Orbital encroachment results in gradual proptosis and/or globe displacement (Selva et al., 2000). On CT scan, osteomas appear as sharply circumscribed osteoblastic masses that can be either sessile or pedunculated. They characteristically arise within a sinus, conform to the internal contour of the sinus margin and may have a bosselated surface (Fu and Perzin, 1974; Selva et al., 2000). They have been classified histologically into three groups depending on the predominant tissue present: compact (cortical, ivory), cancellous (trabecular, spongiosum) and fibrous (Al-Sebeih and Desrosiers, 1998). In our series, on the basis of radiological and intraoperative appearances, cases 1 and 2 had predominantly a cancellous type, and case 3 a compact type tumour.

Traditional resection of symptomatic osteoma has been performed via a variety of open approaches. Frontal or fronto-ethmoid osteomas are often excised via a frontoethmoidectomy approach (Lynch procedure) or an osteoplastic flap (Gross et al., 1995, Schick et al., 2001). The Lynch procedure has a high failure rate because of subsequent stenosis of the nasofrontal duct; hence the osteoplastic approach is the most widely used technique for frontal sinus osteoma which has a good success rate (Gross et al., 1995). The advantage of these open approaches is good visualization and open access to the frontal sinus that also allows easy obliteration of the sinus if the nasofrontal duct is compromised. The osteoplastic frontal sinus operation after coronal incision is reported to have reduced likelihood when compared to the brow incision of injuring the supraorbital nerve (Schick et al., 2001). The disadvantages include an incidence of CSF leak, post-operative frontal pain, paraesthesia or anaesthesia from supraorbital nerve damage (Gross et al., 1995; Seiden and El Hefny, 1995; Al-Sebeih and Desrosiers, 1998). Frontal bossing (Gross et al., 1995) and fracture of the bone flaps (Weber et al., 2000) have also been reported as post-operative complications. As an alternative to frontal sinus obliteration, endoscopic procedures have been performed in selected cases since the early 1990s (Gross et al., 1995, Schick et al., 2001). Schick et al. (2001) recommended that the endonasal approach can be considered for selected cases of frontal osteoma if sufficient frontal sinus access can be achieved endonasally and the osteoma is placed medially or is the tumour base is at the inferior part of the posterior frontal sinus wall.

We believe an EMLP, combined with an orbital approach if necessary, is associated with less morbidity and enables a quicker recovery. The EMLP gives a wide frontal sinus opening through which the osteoma and walls of the frontal sinus can be visualized and the osteoma resected. The Lothrop procedure was first described in 1914 with the aim to create a wide median frontal sinus drainage. The technique was limited at the time due to inadequate visualization (Gross et al., 1995). Type III Draf technique described in 1991 is similar to the EMLP in that the aim is to create a wide frontal sinus drainage. This procedure is performed utilizing a microscope and endoscopy for visualization. The creation of the largest possible communal frontal sinus drainage is identical to that achieved by the EMLP as both procedures remove the frontal sinus floor on both sides and resect the superior part of adjacent nasal septum and inferior area of interfrontal septum (Schick et al., 2001). The term EMLP regained attention in 1993 with improvements in endoscopic techniques, computerised tomography and endoscopic drill development and allowed the procedure to be performed entirely endoscopically (Gross and Schlosser, 2001). Gross et al. (1995) reported no complications and no failure to maintain patency of frontal sinus drainage in 10 patients at 7 months follow-up.

With regard to frontal osteomas, a significant risk of the endoscopic approach is the problem of visualization of the posterior or deep segment during drilling, particularly if this has a significant attachment to the posterior wall of the frontal sinus (Ohye et al., 2000; Gross et al., 2001). One of the indications for an endonasal approach is when the osteoma based on the inferior part of the posterior frontal sinus wall (Schick et al., 2001). In our experience, computerized tomography (CT) images in combination with a navigation device enables three-dimensional localization and minimizes the risk to the skull base. As is seen in Case 2, a postero-inferiorly based osteoma attached to the posterior frontal sinus wall, can be safely removed. Computers may be used to reformat imaging databases for surgical planning and simulation, in addition to frameless stereotactic intraoperative guidance (Grunert et al., 1998; Kelly, 2000)

A possible criticism of the EMLP approach is the possibility of incomplete resection, especially the very large tumours, as seen in Case 1. However, recurrence of even partially resected osteoma is exceedingly rare. There is a single report of recurrence following an external frontoethmoidal approach which subsequently required a craniofacial approach for excision (Chang et al., 1997). Schick et al. (2001) reported 23 cases of fronto-ethmoidal osteoma which were resected endonasally where 3 were incomplete; two of these 3 cases had an endonasal revision surgery and one was observed. Similarly, EMLP does not preclude a second approach via an endonasal revision surgery or an external approach at a later date.

Therefore, the authors suggest EMLP as a reasonable option for patients with large frontal osteoma mainly confined to the frontal sinus. A combined EMLP and orbital approach can be considered for large osteoma encroaching on the orbit where the intraorbital component may be accessed via either a suprabrow or superior skin crease incision as in Case 2. Protection of the supraorbital nerve can generally be achieved by adequate mobilization and traction, with equal preservation of the supraorbital nerve as in osteoplastic opening. The most important factor in determining whether a patient is suitable for an EMLP for osteoma removal is the skill of the operating surgeon. The EMLP is a technically demanding operation which in untrained hands can be dangerous for the patient. Therefore the surgeon should have significant exposure to the EMLP before tackling a patient with a frontal sinus osteoma. Use of image guidance during the surgery is also advisable as it allows the tumour attached to the posterior wall of the frontal sinus (the skull base) to be safely removed leaving a layer of bone over the skull base and decreasing the risk of a CSF leak.

The EMLP with or without an additional orbital approach can be successfully used to remove symptomatic osteomas of the frontal sinus. As this approach does not preclude a later external approach and has minimal morbidity, it may be considered as an option in the management of these patients with what can be a difficult clinical problem. Image guidance during the surgery is recommended to minimize the risk to the skull base during the procedure.

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