Endoscopic and External Surgical Approach to Paranasal Sinus Mucocele

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INTRODUCTION

A mucocele is an epithelial-lined mucous containing sac completely filling a paranasal sinus and capable of expansion by virtue of a dynamic process of bone resorption and new bone formation.[1] Mucoceles are also defined as chronic, cystic, benign lesions, which may originate from any of the paranasal sinuses. They result from obstruction of the ostia of the sinuses and lead to enlarged fluid-filled sinuses, which will eventually erode through the bony wall and then protrude to the surrounding structures.[2-4] Lund et al. implicated various cytokines and inflammatory mediators as being responsible for the remodelling of and erosion of the bone.[5] The frontoethmoidal sinuses are the most common sinuses involved, with the frontal sinus accounting for over 80%.[2,3] Other sinuses such as the maxillary and sphenoid sinuses are less commonly involved.[2,3]

Langenbeck has been credited with the first detailed description of mucoceles in the early nineteenth century, while Berthon was the first to discuss the treatment of the condition.[6-9] Mucoceles occur in all ages and do not have gender bias. Although the role of sinusitis in the development of sinus mucoceles is uncertain, 25% of mucoceles result from sinus infection or its surgical treatment, while 75% are accounted for by facial trauma, allergies, inflammatory disease, and polyposis or tumor.[1,4] In some cases no specific etiological factor may be found.

Although conventional radiographs may give clues to the diagnosis of mucoceles, computerized tomographic (CT) scan and Magnetic Resonance imaging (MRI) are radiologically superior in giving additional information of the presence, site, and extent of all paranasal sinus mucoceles.[2-4,10,11] This, in addition to the clinical presentation, will aid in surgical management. The external surgical approach is commonly performed through the Lynch-Howarth incision, but sometimes also through transverse eyebrow incision, bifrontal incision, modified lateral rhinotomy, and bicoronal osteoplastic flap approach, otherwise called Macbeth procedure, which have been very popular for years, until the popularization of endoscopic sinus surgery.[12,13] The current trend is the endoscopic approach, while the external approach is reserved for a difficult or failed endoscopic approach, in which case a combined external and endoscopic approach is employed.[13]

The endoscopic approach is not yet routinely carried out in Nigeria, mainly because most centers do not carry out routine endoscopic sinus surgery. The endoscopic and external approaches in surgical management of mucoceles of the paranasal sinuses are described in this article, with caution that one should be able to revert to the external approach when there are difficulties with the endoscopic approach. Generally the endoscopic approach is faster...
and may even be carried out as an outpatient procedure in experienced hands, with adequate supporting facilities.

**ENDOSCOPIC APPROACH**

**Preoperative preparation in endoscopic approach**

A complete otorhinolaryngologic and ophthalmologic examination is usually carried out before the surgery, along with routine biochemical and hematological laboratory investigations. The CT scan of the paranasal sinuses is mandatory [Figure 1].

Informed consent must be obtained before any surgery and the site of surgery, including the radiological findings, which must be adequately documented and marked or labeled. The endoscopic approach is explained to the patient with the intent that should any difficulty arise during the procedure, the external surgical approach would be carried out. The nose is usually prepared by packing it with gauze soaked in xylocaine with adrenaline 1:100,000 dilution. The CT scan is placed in the operating room for study and guidance. A zero degree 4 mm telescope is used in all cases to examine the nasal cavities and to carry out the endoscopic surgery, but a 30° or 70° telescope may be required, particularly if there are problems trying to gain access to the frontal sinus. A functional high pressure suctioning machine to have a clear operative field is very vital. Maintaining a bloodless operative field or minimal bleeding should be achieved through adequate nasal preparation and adequate anesthesia. High blood pressure must be avoided during general anesthesia as this will cause excessive bleeding, which will make it difficult to visualize the operative field clearly.

**Endoscopic surgical technique**

**Anesthesia**

General anesthesia is employed with endotracheal intubation and packing of the pharynx with wet gauze to further strengthen positions against aspiration, even if a cuffed endotracheal tube is used. However, in experienced hands and where the facilities exist, some simple mucoceles can be handled under local anesthesia as an outpatient procedure.

**Surgical procedure [Figure 2]**

The patient is placed in the supine position with the head up, 30 – 45 degrees, over a head rim and properly draped. Using a zero degree 4 mm telescope, both nasal cavities are examined before concentrating on the side with the pathology, starting on the floor, from the anterior nares to the posterior nares. Then the inferior meatus and the middle meatus are examined. The middle turbinate is identified and displaced medially and uncinectomy is carried out to gain access to the ethmoidal bullae. Exenteration of the cells leads to the access of the frontal sinus mucocele where the sac or the covering of the mucocele is seen. For the ethmoidal mucocele and large frontal sinus mucoceles, the sac may be bulging into the nasal cavity. A punch forceps is used to make an opening into the mucocele sac and the contents immediately drain. This is sucked out aggressively, and samples are taken for cytology, microscopy, culture, and sensitivity. After draining of the mucocele contents, the mucocele sac is opened wide with a punch forceps to achieve wide marsupialization and to keep the drainage pathway patent and forestall early closure and recurrence of the lesion. The nasal cavities are packed with gauze lubricated with antibiotic-steroid preparations or sufratulle for 24 – 48 hours and then removed.

![Figure 1: CT scan of the left ethmoidal mucocele approached endoscopically](image1)

![Figure 2: Endoscopic approach to the left ethmoidal mucocele](image2)
Caution
The endoscopic nasal approach could be used to tackle mucoceles of any size and at any site, but one must be conversant with the anatomy of the nose and the paranasal sinuses to avoid complications to the orbit, the anterior ethmoidal artery, the anterior cranial fossa (for frontoethmoidal mucoceles), and the internal carotid and optic nerve (for sphenoidal mucoceles). The original deformity caused by the mucocele may not have a dramatic restoration to the normal facial contour, but gradually over weeks or months due to the remodeling process, and patients should be warned of this.

Postoperative care
Nasal toileting is routinely carried out to take away crusts and to avoid adhesions. Broad spectrum antibiotics and nasal decongestants are used for five days. However, the patient can be discharged on the second postoperative day to be reviewed after one week at the outpatient clinic. Thereafter, depending on the findings, the patient may be reviewed after one month. Further appointments will depend on the findings of the outpatient examination.

Complications of endoscopic approach
Complications may arise if the surgeon is not conversant with the anatomy of the region, with possible aberrations from the normal, if he does not have the necessary experience or skill or has poor visibility of the operative field due to hemorrhage. The orbit may be traumatized and the early warning sign for this may be the exposure or herniation of the orbital pad of fat. The optic nerve and the internal carotid artery may be injured, particularly in surgeries of the sphenoid. The anterior skull base may be injured with evidence of cerebrospinal fluid (CSF) rhinorrhea. The pituitary fossa may also be accidentally entered and injured.

In case of evidence of any of these calls for suspension of the endoscopic approach, one needs to call for assistance from an experienced colleague, reverse to the external surgical approach or treat the complications before any further consideration for surgery.

External surgical approach
Preoperative preparation
This is as per the endoscopic approach. There should be no shaving of the eyebrow.

Anesthesia
General anesthesia is given with precautions as for the endoscopic approach.

Surgical technique: Figures 3-10
Approach to each mucocele depends on the site, size, and extent of the mucocele. Any mucocele with a discharging sinus requires the external approach along with the presence of co-morbid pathologies that may not be amendable to the endoscopic approach alone, such as fractured bones, or neoplasia. It may be tempting to approach some giant mucoceles externally. Various approaches are available as shown in Figures 3 and 4. The incisions could be Lynch-Howarth along the supero-medial quadrant or region of the orbit, transverse eyebrow, bifrontal, bicoronal, for frontal sinus mucoceles, modified lateral rhinotomy for ethmoidal and huge maxillary mucoceles or Caldwell-luc for certain maxillary sinus mucoceles. Local infiltration is carried out with xylocaine adrenaline 1:100,000 dilution. Skin incision is taken down to the sac or covering of the mucocele if it is very obvious, which is opened and the contents drained,
Figure 5: Preoperative right maxillary mucocele

Figure 6: Incision — modified lateral rhinotomy

Figure 7: Identification of the sac

Figure 8: Cavity after extirpation of the sac

Figure 9: Immediate postoperative picture

Figure 10: Patient, three months after mucocele excision
with samples taken for cytology, microscopy, culture, and sensitivity. However, if there is a thin piece of bone over the mucocele sac, this is removed with special care to preserve the lateral support of the frontal recess. In huge or giant mucoceles this support may be absent. The mucocele sac may or may not be stripped from the surrounding tissues. The drainage of the sinus is established by widening the bone at the most dependent part in communication with the nasal cavity. If this is wide enough, there will be no need for the insertion of stents. The wound is closed with a two-layer stitch. The first layer is done with absorbable 3/0 or 4/0 sutures, while the skin is closed with non-absorbable 3/0, 4/0, or 5/0 sutures. Alternatively a one layered non-absorbable stitch may be used. The nose is packed with gauze lubricated with antibiotic–steroid preparation or sufratulle, which can be removed within 24 – 48 hours.

Postoperative care

Nasal toileting is routinely carried out to take away crusts and avoid adhesions. Broad spectrum antibiotics and nasal decongestants are used for five days. Stitches are removed on the sixth postoperative day. However, the patient can be discharged on the second postoperative day to be reviewed after one week at the outpatient clinic. Thereafter, depending on the findings, the patient may be reviewed after one month.

Complications of external surgical approach

Facial paraesthesia along the site of incision, especially at the supratrochlear nerve region may occur. Over stretching of the infra-orbital nerve during the Caldwell luc operation may also lead to paraesthesia over the cheek as well as facial scarring along the incision sites. Other complications as stated in the endoscopic approach may occur.

Outcome

The total number of patients who were operated for mucoceles of the paranasal sinuses was 18 (nine males and nine females). Nine were at frontal sinus, six were ethmoidal, two were at the maxillary sinus, and one at the sphenoid. Fourteen (77.8%) were operated externally, while four (22.2%) were operated through the endoscopic route [Figure 1]. For the endoscopic route, all were females, two cases being frontal sinus mucoceles, while two were ethmoidal mucoceles. There were no bilateral cases of mucoceles. The endoscopic cases were followed up for six months with no recurrence and are still being followed up. The longest follow up of the external approach cases has been 10 years with no recurrence (minimum for all is six months). The operation time was shorter (15 – 30 minutes) compared to the external approach (1 – 2 hours).

Facial deformity took a longer time to be restored to normal (2 – 3 months) in the endoscopic group when compared to the external approach, where time taken for the deformity to return to normal was immediate [Figure 7]. In the case of large mucoceles, a desire for the facial deformity to be restored to normal immediately could make a surgeon and patient incline toward the external approach. Younger, unmarried, enlightened female patients, worried about facial scars, may prefer the endoscopic approach. However, there was no scarring that needed attention in any of the cases approached externally. There was no need for stenting in the endoscopic group when compared to the external group, where stents were used for seven to nine days, except where there was sufficient widening of the drainage pathway; in which case no stent was used.

No complications or recurrences have been recorded so far in any group, since surgery.

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