ABSTRACT

Presence of high or lateral frontal cells pose unique challenges when using endoscopic approaches. We describe utilization of a balloon dilation system as an aid for functional endoscopic sinus surgery (FESS) to access the frontal sinus in cases that would traditionally require open approaches.

We present a case series of 3 patients with chronic rhinosinusitis refractive to medical management who underwent FESS with the aid of a balloon dilation system at a tertiary referral center. All patients had variant forms of frontal sinus anatomy. Surgical techniques will be described and use of the balloon system will be reviewed.

All patients (ages 13-68 years) successfully underwent frontal sinusotomies with the assistance of a balloon dilation system, which was employed in a variety of ways: to dilate the narrow infundibulum of a high inter sinus septal cell, to obliterate an anteriorly located Type III frontal sinus cell, and to find the natural frontal ostium in presence of excessive Agger Nasi pneumatization. All patients were spared an osteoplastic flap or trephination, and there were no intraoperative complications. No postoperative bleeding, infection, or CSF leak were reported.

Balloon dilation in combination with standard frontal sinus dissection techniques may be beneficial for select groups of patients with complex frontal anatomy. In this series of patients, the balloon was used successfully as a tool during FESS thereby eliminating the need for open approaches.

INTRODUCTION

The three-dimensional anatomy of the frontal recess is complex, with a high degree of anatomic variability between individuals. Conflated between the anterior skull base and the orbits, the clefted location of the frontal sinus makes endonasal access into it technically quite challenging. 1 The frontal sinus outflow tract represents one of most common sites of obstruction leading to chronic rhinosinusitis. 2 With a high risk of stenosis and mucocle formation if techniques of mucosal preservation are not employed. 3

Frontothmoid air cells, present in approximately 20% of patients, contribute to the pathogenesis of frontal rhinosinusitis by obstructing outflow at the level of the frontal recess. These cells can impede endoscopic visualization and access into frontal sinus.

Recently, the balloon dilation system has been recognized for its minimally invasive nature as well as its ability to preserve mucosa while dilating the maxillary sinus ostium. In the operating room, used either by itself, or in combination with endoscopic sinus surgery, its use has resulted in reduced bleeding and operative time. 6

We propose that in the appropriate setting, when combined with standard functional endoscopic sinus surgery (FESS), the balloon dilation system may have utility in accessing aberrant frontal anatomic obstruction. The balloon can be threaded into narrow sinus passageways and gently dilated, to both open up the outflow tract, as well as create space for insertion of traditional endoscopic instruments. By considering the balloon technology as a tool to be used within the spectrum of frontal instruments, we have identified a selected cohort of patients whose obstructions could not be instrumented without a balloon combined with standard frontal FESS.

In the present study, we describe several different methods in utilizing the balloon catheter as an aid within standard functional endoscopic sinus surgery to treat complex frontal sinus disease.

METHODS

The balloon sinuplasty system (Acclarent, Inc., Menlo Park, CA) was used on three patients with chronic frontal rhinosinusitis refractive to maximal medical management who were undergoing FESS. Fully standard wide frontal sinusotomies (Draf IIb or III) were performed however either the height of the disease process or the narrow space between the cell and the skull base did not allow for standard frontal instrument dissection.

Briefly, a sinus guide catheter was inserted under direct visualization with a rigid endoscope. A lighted flexible guide wire was then passed through the catheter and threaded up into the region of stenosis. The position of the wire was confirmed by positive transillumination of the frontal sinus and direct endoscopic examination. A sinus balloon catheter was passed over the guide wire into the frontal sinus outflow tract and ostium, then the balloon was inflated in the targeted space. The balloon was then deflated and removed, and endoscopic inspection confirmed successful dilation.

RESULTS

All patients (ages 13-68 years old) successfully underwent frontal sinusotomies with the assistance of an Acclarent balloon dilation system. The balloon was useful in a variety of ways: to dilate the narrow infundibulum of a high inter sinus septal cell, to obliterate an anteriorly located Type III frontal sinus cell, and to find the natural frontal ostium in presence of challenging anatomy. All patients were spared undergoing a trephination or osteoplastic flap, and there were no intraoperative complications. Patients were discharged on the same day with no postoperative bleeding, infection, or CSF leak. All patients had symptom relief and the patient in figure 1 had post operative 6 month CT that showed cell ostia patency.

CONCLUSION

Balloon dilation in combination with standard frontal sinus dissection techniques may be beneficial for select groups of patients with complex disease and anatomy. The balloon system has the advantage of preserving mucosa while simultaneously enlarging narrow passageways to allow for access with endoscopic instruments. They are also flexible and can be threaded into areas not accessible with standard frontal instruments. When paired with FESS, the hybrid procedure allowed for dilation and definitive removal of diseased, osteitic bone with standard instruments.

In this series of patients, the balloon system was used successfully as a tool, in conjunction with FESS, to relieve frontal sinus outflow tract obstruction that was a direct result of complex aberrant frontal anatomy. Our study demonstrates that a hybrid-FESS balloon dilation procedure is effective in both adult and pediatric patients with frontal CRS who have anatomic frontal sinus outflow tract obstruction. Furthermore, it provides the surgeon access into the frontal sinus that is less invasive than trephination or osteoplastic flap in these selected cases.

It should be noted that the balloon as shown in the author’s opinions is a tool to be selectively deployed in these types of cases. For routine frontal sinus disease and frontal sinus surgery, standard FESS is considered the gold standard and is the standard within our practice.

REFERENCES

5. Age Radiography Finding Indications for Balloon Dilation
   1 31 High inter sinus septal cell with narrow infundibulum Dilate inter sinus septal cell infundibulum
   2 13 Type III frontal sinus cell Obliterate cell to dilate the frontal sinus outflow tract (FSOT)
   3 68 Bilateral extensively pneumatized agger nasi cells Locate the natural frontal ostium

CONTACT

Gita M. Fleischman, MD: gita@med.unc.edu  
Adam M. Zonathan, MD: adam_zonathan@med.unc.edu  
Charles S. Ebert, MD: charles_ebert@med.unc.edu  
Department of Otolaryngology and Head and Neck Surgery  
University of North Carolina at Chapel Hill, Chapel Hill, NC  
919-966-3342

Figure 1: High inter sinus septal cell measuring 15 mm x 44 mm, with narrow infundibulum, seen in sagittal (A) and coronal (B) sections. The patient underwent a Draf IIb sinusotomy, which included removal of the ipsilateral frontal sinus floor from the lamina paprylacea to the nasal septum. The high inter sinus septal cell was identified by endoscopic visualization. The cell ostia was then identified, and a 6x24 balloon was used to dilate the infundibulum. Once the ostium could be accessed endoscopically, a ball probe was used to luxate the anterior walls of the intersepal sinus cell. The balloon was then re-inserted through the anterior wall of inter sinus septal cell, and again dilated, effectively creating a communication between the frontal sinus, the inter sinus septal cell.

Figure 2: Right-sided Type II frontal sinus cell extending through the ostium into the true frontal sinus, causing obstruction of the frontal recess, seen in sagittal (A) and coronal (B) sections. The frontal recess was then identified endoscopically and was widened with a curette. The narrow passageway limited further endoscopic instrumentation. A lighted sinus guidewire was placed into the frontal recess to confirm position, then advanced into the frontal ostus until it spanned the region of stenosis. The balloon catheter was advanced over the wire, then inflated until the cell was crushed anteriorly, dilating the tract (C). Further removal of bone and mucosa was then able to be performed with standard endoscopic instruments.

Figure 3: Extensively pneumatized Agger Nasi cell seen in sagittal (A) and coronal (B) sections. Endoscopically, frontal recess could not be visualized past the large agger nasi cell. The lighted sinus guide catheter was used to help identify the area of frontal recess. A 6x24 mm balloon was threaded over the guide wire into the frontal recess, and advanced into the ostium of the sinus, until it was felt to juxtapase the agger nasi cell. The balloon was inflated twice to fracture the posterior wall agger nasi cell and deiate the frontal ostium. This allowed for passage of endoscopic instruments into the frontal sinus, and the ostum (C) was further enlarged using the Hosemann, front to back, and Giraffe side and front to back forces.

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