

Balloon sinuplasty in acute frontal sinusitis*

Claire Hopkins, Edward Noon, David Roberts

Department of ENT, Guy's Hospital, Great Maze Pond, London, United Kingdom

SUMMARY

Balloon sinuplasty has been licensed for the treatment of chronic rhinosinusitis since 2006. Balloon dilation enlarges the sinus ostium by effecting tiny fractures of the surrounding bone and compressing soft tissue such that no mucosa is removed. We believe this to be the ideal technique for achieving drainage of an acutely infected frontal sinus when surgical intervention is required.

We report the application of this new technique in a 32-year-old female with acute frontal sinusitis. The frontal sinus was successfully cannulated and drained. Post-operative irrigation was achieved using a modified Vortex catheter.

Key words: balloon catheter, dilation, frontal sinus, acute sinusitis, drainage

INTRODUCTION

Acute frontal sinusitis (AFS) is characterised by headache, nasal purulence and pain over the frontal bone. The true incidence is unknown; each year in Europe 1–5% of adults are diagnosed with acute sinusitis by their general practitioners⁽¹⁾, accounting for 6 million restricted working days a year⁽²⁾, but AFS accounts for a small proportion of cases. There were 86 hospital admissions with AFS to NHS hospitals in England reported to Hospital Episode Statistics in the year 2005 – 2006⁽³⁾. When conservative medical management fails, or when associated with complications (the frontal sinus is the most likely sinus to give rise to intracranial complications), surgical management is required.

Trephination of the frontal sinus, a procedure performed as early as prehistoric times, has remained the standard procedure to effect drainage of an acutely obstructed and inflamed frontal sinus. However, such an external approach necessitates a scar, risks intracranial penetration and cosmetic deformity, and does not address any frontal sinus outflow obstruction.

We describe the novel application of balloon sinuplasty in acute frontal sinusitis. We believe this to be a safe and effective method of treatment for this condition.

MATERIALS AND METHODS

Patient

A 32-year-old female barrister presented to the ENT department with severe acute frontal sinus pain and headache. She gave a 3-week history of antecedent upper respiratory tract infection, associated with disabling frontal sinus pain, which partially responded to a 5-day course of amoxicillin. The pain recurred 72 hours prior to admission and had been treated with co-amoxiclav, topical oxymetazoline drops and systemic

decongestants. On admission she was pyrexial and distressed. There was no prior history suggestive of chronic rhinosinusitis.

CT scans demonstrate opacification of the left frontal sinus while the remaining sinuses are patent (Figure 1). She was treated with IV antibiotics for 24 hours with no resolution of symptoms; consequently, the decision was made to drain the frontal sinus.



Figure 1. Axial and sagittal CT scan demonstrating opacification of the left frontal sinus, and a large agger nasi cell pushing up into the floor of the frontal sinus.

Surgical technique

Balloon dilation of the sinus ostia was first described for the treatment of chronic rhinosinusitis in 2006⁽⁵⁾. The principle is similar to that used effectively for many years in cardiology and uses a Seldinger technique⁽⁶⁾. A catheter (introducer) tailored to each sinus is delivered into the nose endoscopically. A guidewire is advanced into the sinus through the catheter

(Figure 2), and its position confirmed by trans-illumination of the sinus, visible externally. Following this, the balloon is delivered over the guidewire to span the ostium. The balloon is dilated with the balloon inflation device (a screw-handle pump) that gently enlarges the ostium by effecting tiny fractures of the surrounding bone and compressing soft tissue such that no mucosa is removed⁽⁶⁾. The balloon is then deflated and removed.

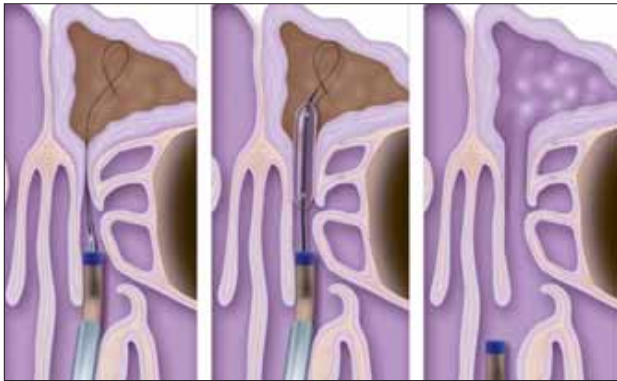


Figure 2. Relieva frontal sinus catheter is used to direct the guidewire into the frontal sinus. The balloon is placed over the guidewire and advanced into the frontal recess before inflating the balloon. The balloon is then deflated and removed.

Trans-sinus illumination is a recent modification to the original balloon sinuplasty system. Previously the position of the balloon was confirmed fluoroscopically, using radio-opaque iodine to fill the balloon. This led to concerns regarding the potential dosage of ionizing radiation used, particularly regarding exposure to the lens of the eye⁽⁷⁾ although this is said to be well within safe limits. The Relieva Luma guidewire is a thin, flexible wire, housing an optical fibre that enables a high-powered light to be emitted from the tip. The guidewire is advanced into the sinus through the catheter in the same way, but its position is confirmed by trans-illumination of the sinus, visible externally. Clearly, the Relieva Luma system solves the controversy of radiation exposure to the patient and surgeon, and reduces time (and costs) by eliminating the need for a radiographer. Furthermore, it is more demanding to determine the position of the balloon fluoroscopically, whereas trans-illumination of the sinus could only come about by the guidewire entering the antrum via its ostium, thus reducing the risk of placement errors.

RESULTS

In this case, the nose was prepared with a modified Moffet's solution (1ml 1/1000 adrenaline, 2ml 5% cocaine, 2ml NaHCO₃ and 5ml saline). The patient was placed in a reverse Trendelenberg position. Using the Relieva™ frontal sinus catheter (F70, Acclarent, Inc. Menlo Park, CA, USA), a standard Relieva Sinus Guidewire was advanced into the frontal sinus (Figure 3A), with position verified by trans-sinus illumina-

tion (Figure 3B). A 7mm x 24mm balloon was advanced over the guidewire. The position of the balloon was confirmed endoscopically. The pressure was increased in the balloon gradually, with increments of 2 atms up to 12 atms and the balloon was then deflated and removed. Pus was seen to discharge from the frontal sinus (Figure 3C). The Relieva Vortex irrigation device was delivered to the sinus over the guidewire and used to flush the frontal sinus until secretions were clear. The Relieva Vortex is a uniquely designed catheter which uses a combination of side- and distal-tip jets that powerfully deliver fluid to bring about sinus content expulsion.



Figure 3. A) Using the Relieva™ sinus catheter (F70), a standard Relieva Sinus Guidewire was advanced into the frontal sinus. B) Trans-illumination of the frontal sinus confirms correct placement of the guidewire. C) Pus discharging from the frontal sinus after removal of the balloon following dilatation.

A shortened Vortex catheter was used as a drain and for post-operative irrigation for 24 hours (Figure 4). It was placed in the frontal sinus using the guide-wire, and secured with a roman garter tie to the drain and a trans-septal suture (Figure 5A and B). The patient was discharged pain-free 24 hours post-operatively, and remains well, with no recurrence of symptoms.



Figure 4. Vortex positioned in the frontal sinus

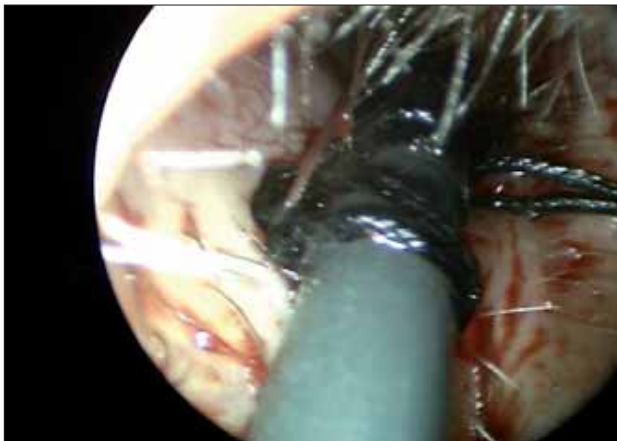


Figure 5A. Fixation of the Vortex using a trans septal suture.

DISCUSSION

We have described the use of balloon sinus dilation in acute frontal sinusitis, with a modified vortex irrigation catheter used as a frontal sinus drain

Currently, the results of balloon sinuplasty have only been reported for *chronic* rhinosinusitis. As this is a new technique that has only been in use since 2006, there is a limited evidence base. However, there are a number of case series' and one non-randomized controlled trial. Friedman et al.⁽⁸⁾ treated patients with either balloon sinuplasty or conventional FESS and measured symptoms using the Sinonasal Outcome Test-20 (SNOT-20) at baseline, and at 3 months. Patients in each group had similar symptom scores initially (2.7-2.8) but the scores in the balloon sinuplasty group (0.78) were significantly better than those in the FESS group (1.29) after 3 months ($p < 0.006$). Levine et al.⁽⁹⁾ report a case series of this procedure involving 1036 patients. Sixty-three percent of patients received ethmoidectomy as well as balloon sinuplasty. Ninety-six percent of patients reported an improvement in symptoms, and 73% of patients reported they were free from symptoms during the mean follow-up period of 40 weeks. No "major adverse events" occurred as a result of the balloon catheter, in this series, nor did there in the series reported by Bolger et al.⁽¹⁰⁾ Overall, revision treatment was required in 2-3% of patients.

Despite the lack of fully randomized trials currently, the acceptance of balloon sinuplasty as a technique does appear to be progressing. The National Institute for Health and Clinical Excellence (NICE, 2008) have acknowledged that there are no "major safety concerns" and has therefore permitted its use in the UK.

We believe this to be the first reported case of balloon sinuplasty in acute frontal sinus infection. The fact that many patients with acute infections are responsive to medical therapy, and that they have often recovered before consultation with an Otorhinolaryngologist trained in this technique, may explain this. Nevertheless the frontal sinus anatomy, and the



Figure 5B. External view with the drain in situ.

presence of acute sinus outflow obstruction lend themselves to the principles of balloon dilation.

The anatomy of the frontal recess and frontal sinus is complex and highly variable. Agger nasi cells are commonly found, but vary in size, and may coexist with any number of frontoethmoidal cells, forming the posterior boundary of the frontal cells. Frontal bullae may narrow the recess posteriorly. Leunig et al.⁽¹¹⁾ elegantly describe how multiplanar imaging can demonstrate the frontal drainage pathway, and thus facilitate surgical dissection. However, in the presence of acute inflammation with complete opacification of the frontal sinus and its drainage pathway, the CT images may be difficult to interpret. In addition, the associated oedema, increased vascular and purulent secretions found intraoperatively may prevent identification of the relevant anatomy.

The aim of surgical management of acute frontal sinusitis is to achieve drainage of the frontal sinus, whilst minimizing instrumentation and mucosal damage in the inflamed frontal recess that might lead to stenosis and subsequent chronic obstruction. For this reason, endoscopic drainage has not gained widespread popularity, and trephination has remained the mainstay of surgical management.

Trephination of the frontal sinus involves an incision in the medial eyebrow and entry through the anterior wall of frontal sinus using a drill or chisel. Catheters may be inserted to allow continued irrigation through the frontal recess. However, the scar is undesirable, in hypoplastic frontal sinuses there is a risk of inadvertent intracranial penetration, and the procedure itself does not address any underlying obstruction to the frontal drainage pathways. In contrast, balloon dilation of the frontal recess could achieve long-term patency of the outflow tract by minimizing mucosal trauma, and allow effective clearance of purulent secretions and post-operative irrigation. The risks of operative complications are smaller than either external approaches or more conventional endoscopic sinus surgery.

Long-term outcome data on a large group of patients is required to confirm the efficacy of this procedure in acute sinusitis. However, we believe in this clinical setting, balloon sinuplasty has clear advantages over more traditional techniques, and should be considered when surgical intervention is required.

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Claire Hopkins
Carmay, Chelsfield Lane
Orpington, Kent BR6 7RR
United Kingdom

E-mail: clairehopkins@yahoo.com