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Nasoantral window assessment by acoustic rhinometry

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Abstract
Twenty-five patients who had each had inferior meatal antrostomies performed were endoscopically examined and assessed with acoustic rhinometry six weeks and six months after surgery. No significant increase in nasal cross-sectional area could be demonstrated at the site of the antrostomy in the post-operative cases, although the nasoantral window was found to be patent in 44 of the 50 nasal cavities.

Key words: Airway resistance; Nose; Maxillary antrum

Introduction

Inferior meatal antrostomies have been extensively performed in the past for chronic maxillary sinusitis. They are still used as routine treatment for this by many surgeons but are known to stenose down in many cases, particularly if the initial opening is less than 1 × 1 cm (Lund, 1988). Irrigation or endoscopic inspection of the antra is easily carried out in cases where the nasoantral window is still patent when it is felt to be necessary, but requires repuncture if closure has occurred. Acoustic rhinometry (AR) has become a widely used diagnostic tool in many departments since its introduction in 1989 and gives accurate, repeatable measurements of nasal cross-sectional areas at known distances from the nares. It is conceivable, therefore, that in the vicinity of a nasoantral window, the cross-sectional area (CSA) of the nasal cavity will be altered accordingly (Figure 1). Furthermore it was envisaged that progressive closure of such a window could be demonstrated to the point where complete closure resulted and the AR trace returned to its pre-operative form.

Patients and methods

Twenty-five patients due to undergo bilateral inferior meatal antrostomy alone were studied. Each patient underwent bilateral baseline AR followed by decongestion with xylometazoline nose drops and repeat AR. None of them had undergone any previous nasal surgery and all were then examined endoscopically to exclude pre-existing nasal polyps, septal perforations and any other nasal pathology. Twenty patients had bilateral antrostomies for chronic facial pain over the cheeks despite normal CT scans and protracted intranasal medical therapy (14 females and six males), whilst five (four males and one female) underwent surgery for cheek pain associated with maxillary sinus mucosal thickening on scanning. This group had antroscopy carried out via the nasoantral windows bilaterally. The average age was 32 years, ranging from 21 to 45 years and all were fit, healthy non-smokers.

After the surgery, which was carried out by several different middle-grade training staff, the patients were all discharged on the first or second post-operative day. They were all followed up at outpatients in two weeks for nasal toilet. Four weeks later they each underwent AR after decongestion and endoscopic nasal examination. Six months later the same routine was carried out. The diameter of each nasoantral window was noted on endoscopy using a graduated probe, along with the distance from its

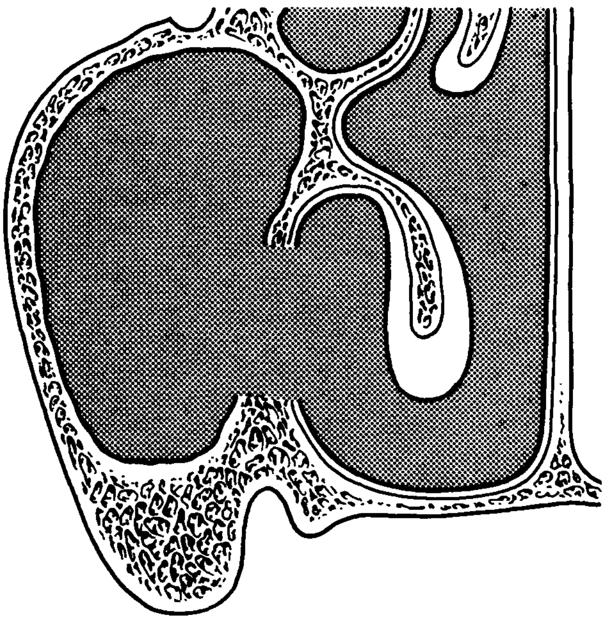

FIG. 1
Cross-sectional representation of nasal cavity and antrum at the level of antrostomy. (By kind permission from Butterworths Publishers: *Rob and Smith's Operative Surgery*, Fourth Edition).

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centre to the nasal aperture. The CSA at this point was obtained from the AR readings.

Results

At the six-month examination, 16 of the 20 patients in the first group were subjectively improved subsequent to surgery; two felt there was no difference and two felt they were getting worse. Of the second group, three felt improved while two felt no improvement.

At the same examination, 44 of the 50 antrostomies were found to be patent on endoscopy aperture.

The average pre-operative CSA were 1.66 cm^2 and 1.61 cm^2 in the left and right nasal cavities respectively at the future sites of the antrostomies (SDs = 0.28 and 0.28 respectively). The post-operative means were 1.61 cm^2 for the left and 1.67 cm^2 for the right (SDs = 0.11 and 0.23 respectively). The average endoscopically measured antrostomy size was 10.91 mm^2 on the left and 13.27 mm^2 on the right (SDs = 4.64 and 6.00 respectively).

In 14 cases on the left side there was a decrease in CSA post-operatively, averaging 0.2 cm^2 whilst there was an increase in CSA in nine left sides averaging 0.19 cm^2 and in two cases no change was found. A mean increase of 0.25 cm^2 was demonstrated in 13 of the right nasal cavities, with a decrease of 0.18 cm^2 in 11 and no change in one.

No correlations existed between the change in cross-sectional area and the measured size of the antral window.

Discussion

Intranasal antrostomies, although less often used nowadays since the advent of endoscopic sinus surgery, are still performed and are frequently found in patients who have undergone previous intranasal surgery. They are readily apparent on both endoscopic examination and on computed tomography (CT) and may be used as a route to inspect or irrigate the antra. The acoustic rhinometer has become a familiar instrument in most rhinology laboratories and in many outpatient situations, but nothing is known about how nasoantral windows are likely to affect the readings obtained from patients in whom they are present.

As is well known from many excellent papers dealing with the physical principles involved in acoustic rhinometry (Brooks *et al.*, 1984; Hilberg *et al.*, 1989) the propogated waveforms enter the nasal cavity and travel in a straight line until reflected off its walls, turbinates and other intranasal structures. After data acquisition from these reflected waves, intranasal cross-sectional areas at points known distances from the nosepiece can be plotted.

The data presented in this paper suggests that nasoantral windows are not 'detected' by reflected acoustic waves. This is explained by the fact that in none of the cases was the inferior turbinate removed and hence this structure effectively provides an 'umbrella-like' protective effect over the antrostomy, and incident waves are reflected off the turbinate and do not actually penetrate the antrostomy at all to produce a CSA including the area of the antrum at that site, as orginally suspected.

Summary

Acoustic rhinometry is an established tool in rhinological practice and is helpful in the assessment of nasal obstructive disorders. It has been shown that reflectometry cannot reliably direct the presence of inferior meatal antrostomies whilst they are covered by the turbinate itself, and these are best assessed by direct inspection endoscopically or by computed tomography.

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