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Main Article

Benefit from the minimally invasive sinus technique

N Salama, R J Oakley*, C J Skilbeck†, N Choudhury†, A Jacob

Abstract

Introduction: Sinus drainage is impeded by the transition spaces that the anterior paranasal sinuses drain into, not the ostia themselves. Addressing the transition spaces and leaving the ostia intact, using the minimally invasive sinus technique, should reverse chronic rhinosinusitis.

Aim: To assess patient benefit following use of the minimally invasive sinus technique for chronic rhinosinusitis.

Method: One hundred and forty-three consecutive patients underwent the minimally invasive sinus technique for chronic rhinosinusitis. Symptoms (i.e. blocked nose, poor sense of smell, rhinorrhoea, post-nasal drip, facial pain and sneezing) were recorded using a visual analogue scale, pre-operatively and at six and 12 weeks post-operatively. Patients were also surveyed using the Glasgow benefit inventory, one and three years post-operatively.

Results: We found a significant reduction in all nasal symptom scores at six and 12 weeks post-operatively, and increased total quality of life scores at one and three years post-operatively (25.2 and 14.8, respectively).

Conclusion: The patient benefits of treatment with the minimally invasive sinus technique compare with the published patient benefits for functional endoscopic sinus surgery.

Key words: Paranasal Sinuses; Endoscopy; Otorhinolaryngological Surgical Procedures

Introduction

Although the results of functional endoscopic sinus surgery (FESS) are reported regularly in the literature, these probably encompass a variety of surgical techniques. The vast majority of these studies would probably have used a middle meatus antrostomy as the surgical approach, and possibly some reduction of the inferior and/or middle turbinates.

In 1996, Dr R Setliff published his article on the minimally invasive surgery technique for sinus disease.[1,2] This technique developed from the rationale that drainage of the anterior group of paranasal sinuses is impeded by the transition spaces that the anterior sinuses drain into and not by the ostia themselves.[3] Addressing the transition spaces and leaving the natural ostia intact would therefore be sufficient to reverse the pathology.[4] This would explain the relative infrequency of involvement of the posterior ethmoid and the sphenoid sinuses, as they drain directly into the nasal cavity and not into transition spaces.

We present a study of a cohort of 143 consecutively recruited patients who underwent endoscopic sinus surgery for chronic rhinosinusitis, using the minimally invasive sinus technique, in our unit.

The surgery performed on all patients in this study adhered strictly to the surgical principles advocated by Setliff and further expanded by Catalano and Roffman.[5]

Method and materials

Patients

We included in the study all patients presenting to our department with chronic rhinosinusitis, with or without polyp disease, who had failed medical treatment. Medical therapy was deemed to have failed if patients were still symptomatic after a minimum of three months' treatment with topical nasal steroids and an extended course of antibiotics. Patients were recruited sequentially to the study as they presented for surgery. Patients with unilateral polyps or tumours were excluded, as the pathology was deemed to be different from chronic rhinosinusitis. Data on all patients were collected prospectively using a patient booklet which followed the patient's clinical course. Symptom scores were recorded on a visual analogue scale (ranging from zero to 10). Scores were recorded pre- and post-operatively. Assessment of long term quality of life was undertaken by circulating Glasgow benefit inventory questionnaires[6] to all patients, one year and three years post-operatively.

From the Consultant ENT Surgeon at University Hospital Lewisham, *Spr in ENT in South Thames and †Sprs in ENT in North Thames, London, UK.
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Pre-operative preparation

All patients underwent a pre-operative computed tomography (CT) scan of the paranasal sinuses, according to a standardised protocol agreed with the radiology department. These CTs were then scored using the Lund–Mackay system,[7,8] scoring each sinus using a range from zero to two, and score for the ostio-meatal complex of either zero or two. A peri-operative medical protocol was used, comprising oral antibiotics for two weeks (clarithromycin 500 mg twice daily or co-amoxiclav 375 mg thrice daily) and 0.1 per cent betamethasone/0.5 per cent drops twice daily for two weeks. Patients with polyps also received oral prednisolone 30 mg daily for one week. All medications were commenced one week pre-operatively and continued as per protocol for a week after surgery.

After induction of anaesthetic, a Moffatt solution (1 ml 1:1000 adrenaline, 1 ml 4 per cent cocaine, 1 ml 8.4 per cent sodium bicarbonate and 7 ml normal saline) was instilled in the nose. All patients received a general anaesthetic, with hypotension where appropriate. Surgery was performed by the senior author (NS) in most cases, or by a senior trainee under his supervision.

Procedure

Surgery consisted of a retrograde uncinectomy initiated by a paediatric back-biter, with the uncinate then removed by a micro-debrider to open the infundibulum and expose the maxillary ostium. The ostium was merely exposed and not instrumented, even if found to be diseased. We did not approach the maxillary sinus cavity itself through the ostium, but any secretions were aspirated by an angulated sucker, being as gentle as possible with the mucosa.

The agger nasi was then exposed, and, if indicated, reduced medially and posteriorly to open the frontal recess. Next, the medial wall of the ethmoid bulla was removed, incorporating its ostium postero-medially. This was more of a marsupialisation than an exenteration.

The posterior ethmoids were not routinely exposed, but, where indicated by pathology, the basal lamella was approached inferiorly and the posterior ethmoids cleared of any polyps. Finally, any polyps in the medial corridor between the middle turbinate and the septum were removed, up to the spheno-ethmoidal recess, exposing the sphenoid ostium.

We relied on a powered micro-debrider for most of the above steps,[9] removing loose bony spicules with forceps but never stripping the mucosa. Polyps were thoroughly removed at various stages of the procedure, the timing dependent on their size and interference with access. An histological sample was always obtained for analysis. No reduction of the middle or superior turbinates was attempted; we removed only the polypoid fringes and the lateral aspect of a middle turbinate concha bullosa if large enough to interfere with middle meatus drainage. None of the patients in this cohort received inferior turbinate reduction surgery.

Following the above steps, we were able to avoid leaving any exposed bone. Bleeding was generally minimal, with good visibility throughout the procedure. If bleeding was more than a trickle, we used Surgicel® (Johnson and Johnson Gateway, Piscataway, NJ, USA) to cover the source of bleeding. No packs were used. A small absorbable dressing (Gelfilm®, Pfizer, Inc, New York, NY, USA) was placed in the middle meatus to minimise the risk of adhesions.

No post-operative debridement was performed. Patients were instructed to perform alkaline nasal douching for two weeks post-operatively.

Results

A cohort of 143 consecutive patients undergoing minimally invasive sinus surgery was scored using a visual analogue scale (zero to 10), in order to assess the severity of their nasal symptoms pre-operatively and at two post-operative visits (six and 12 weeks post-operatively) (Table I). The symptoms analysed were: blocked nose, reduced sense of smell, rhinorrhoea, post-nasal drip, facial pain and sneezing. A visual analogue scale score of 10 would indicate the worst possible symptoms, whilst a score of zero would indicate no symptoms.

A statistically significant reduction in all nasal symptom scores was demonstrated when pre- and post-operative mean symptom scores were compared using a two-tailed Student *t*-test (Table II).

Further stratification of this cohort of 143 chronic rhinosinusitis patients into those with polyps ($n = 85$) and without polyps ($n = 56$) revealed a statistically insignificant reduction in symptom scores for sense of smell and sneezing in the subset of patients without nasal polyps (Table III). However, a statistically significant reduction in all nasal symptoms was seen in all patients with nasal polyps (Table IV).

We further analysed our results using CT scores. Patients' CT scores were allocated into four groups for statistical analysis (Table V). No significant difference in symptom score reduction was demonstrated when the cohort was stratified by pre-operative CT findings, using the Lund–Mackay scoring system.

To assess long term patient satisfaction following surgery, the Glasgow benefit inventory questionnaire

TABLE I

MIST PATIENTS'* NASAL SYMPTOM SEVERITY VAS SCORES: PRE- AND 2 WEEKS POST-OPERATIVE

Symptom	Pre-operative score			Post-operative score		
	Mean	SD	SEM	Mean	SD	SEM
Nasal blockage	6.4	2.43	0.203	1.72	2.04	0.170
Sense of smell	5.11	3.96	0.331	3.35	3.64	0.304
Rhinorrhoea	3.82	3.47	0.290	1.56	2.15	0.180
Post-nasal drip	5.72	3.11	0.260	2.97	2.88	0.241
Facial pain	2.94	3.50	0.293	0.83	2.03	0.170
Sneezing	2.95	3.11	0.260	1.38	2.08	0.174

*$n = 143$. MIST = minimally invasive sinus technique; VAS = visual analogue scale; SD = standard deviation; SEM = standard error of the mean

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TABLE II

COMPARISON OF PRE- AND POST-OPERATIVE NASAL SYMPTOM SEVERITY VAS SCORES; TWO-TAILED STUDENT *T*-TEST

Symptom	Mean score reduction*	SD	SEM	*t*	DF	*p*
Nasal blockage	4.67	2.92	0.244	19.13	142	<0.001
Sense of smell	1.76	3.24	0.271	6.48	142	<0.001
Rhinorrhoea	2.27	3.22	0.270	8.40	142	<0.001
Post-nasal drip	2.76	3.18	0.266	10.38	142	<0.001
Facial pain	2.12	3.13	0.262	8.07	142	<0.001
Sneezing	1.57	3.07	0.257	6.11	142	<0.001

*Pre- *vs* post-operative. VAS = visual analogue scale; SD = standard deviation; SEM = standard error of the mean; DF = degrees of freedom

TABLE III

COMPARISON* OF PRE- AND POST-OPERATIVE NASAL SYMPTOM SEVERITY VAS SCORES: PATIENTS WITHOUT POLYPS

Symptom	Mean score reduction†	SD	SEM	*t*	DF	*p*
Nasal blockage	3.44	3.25	0.43	8.00	56	<0.001
Sense of smell	0.93	3.08	0.41	2.28	56	0.02
Rhinorrhoea	1.62	3.25	0.43	3.77	56	<0.001
Post-nasal drip	2.96	3.03	0.40	7.40	56	<0.001
Facial pain	2.91	3.33	0.44	6.60	56	<0.001
Sneezing	0.48	3.14	0.42	1.16	56	0.25

*Two-tailed Student *t*-test. †Pre- *vs* post-operative. VAS = visual analogue scale; SD = standard deviation; SEM = standard error of the mean; DF = degrees of freedom

was sent to all 143 patients in the original cohort, 12 months after surgery and then again three years after surgery. The Glasgow benefit inventory is a retrospective, 18-part, validated quality of life assessment tool which measures three components of quality of life: general health, social support and physical health, in addition to deriving an overall score. Possible scores range between −100 and +100, where zero indicates no change in health, a negative score suggests deterioration and a positive score suggests improvement.

In the first survey (12 months after surgery), 107 questionnaires were returned (75 per cent response rate). Analysis of these 107 returned questionnaires demonstrated an overall improvement in each component of the Glasgow benefit inventory (Table VI).

At the time of the second survey (approximately three years after surgery; mean 34.7 months), only 131 patients of the original cohort were still available for follow up. Of these, 70 responded, giving an overall response rate of 53 per cent. Analysis of these returned questionnaires demonstrated

TABLE IV

COMPARISON* OF PRE- AND POST-OPERATIVE NASAL SYMPTOM SEVERITY VAS SCORES: PATIENTS WITH POLYPS

Symptom	Mean score reduction†	SD	SEM	*t*	DF	*p*
Nasal blockage	5.49	2.37	0.255	21.50	85	<0.001
Sense of smell	2.31	3.25	0.350	6.59	85	<0.001
Rhinorrhoea	2.69	3.16	0.340	7.91	85	<0.001
Post-nasal drip	2.62	3.28	0.354	7.41	85	<0.001
Facial pain	1.59	2.89	0.312	5.09	85	<0.001
Sneezing	2.29	2.82	0.304	7.54	85	<0.001

*Two-tailed Student *t*-test. †Pre- *vs* post-operative. VAS = visual analogue scale; SD = standard deviation; SEM = standard error of the mean; DF = degrees of freedom

TABLE V

REDUCTION IN NASAL SYMPTOM SEVERITY VAS SCORES BY CT APPEARANCE, LUND−MACKAY SCORING

Lund–Mackay CT score	Pts (*n*)	Mean score reduction (SD)					
		Blocked nose	Smell	Rhinorrhoea	PND	Facial pain	Sneezing
0–6	37	3.81 (3.37)	0.97 (3.26)	1.46 (3.17)	3.0 (2.94)	2.76 (3.02)	0.76 (3.13)
7–12	49	4.32 (2.70)	2.08 (3.16)	2.44 (3.17)	3.07 (3.27)	2.87 (3.50)	2.10 (3.40)
13–18	36	5.07 (2.76)	2.28 (2.97)	2.01 (3.40)	2.17 (3.64)	1.04 (2.87)	1.04 (2.04)
19–24	20	6.25 (2.17)	1.58 (3.84)	3.93 (2.73)	2.75 (2.51)	1.13 (2.07)	2.55 (3.31)

VAS = visual analogue scale; CT = computed tomography; Pts = patients; SD = standard deviation; PND = post-nasal drip

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TABLE VI

PATIENTS' GLASGOW BENEFIT INVENTORY SCORES

Parameter	12 mth post-op	3 yr post-op*		
		No polyps†	Polyps‡	Total
Questionnaires (*n*)				
Posted	143			131
Returned	107	27	43	70
GBI score				
General health	30.1	16.2	17.6	17.06
Social support	4.64	1.23	5.7	3.98
Physical health	32.82	19.75	18.7	19.1
Overall	25.26	14.3	15.24	14.8

Means = *34.7, †33.6 and ‡35.4 months. Mth = months; post-op = post-operative; yr = years; GBI = Glasgow benefit inventory

a reduced but sustained improvement in each component of the Glasgow benefit inventory (Table VI).

We encountered no serious complications in our cohort, and only one case of clinically insignificant adhesions.

Discussion

Endoscopic sinus surgery does not address a single disease. Much is still to be explained about the pathogenesis of chronic rhinosinusitis and nasal polyposis. When chronic rhinosinusitis is refractory to medical treatment, it comes as no surprise that there is a great deal of debate regarding the type of surgery performed and its efficacy.[10–12] However, the aims are the same, that is, to produce the maximum benefit for the patient with the safest and least intrusive intervention.

We routinely prepare patients for surgery by giving them antibiotics and topical steroid drops for seven days pre-operatively. Polyp disease patients are given additional daily oral prednisolone. This is to reduce the inflammation of the nasal mucosa and thus enhance the chance of a clear surgical field with a minimum of bleeding.

There is no doubt that polyp disease patients have more impressive results in the shorter term. However, as the disease is by its nature progressive, improvement fades in the long term. By contrast, patients without polyp disease tend to have better long term benefits but less dramatic early results. An improvement in the symptom of post-nasal drip is noted, often a difficult problem to address. Our results point to an encouraging response to surgery; however, we would not advocate surgery for monosymptomatic post-nasal drip.

In the experience of the senior author, not only does the minimally invasive sinus technique provide good patient outcomes, it is also easily taught sequentially to trainees, with only minimal complications. There were no serious complications in our series. There was one case of middle meatus adhesions which were clinically silent.

The main surgical difference between the minimally invasive sinus technique and the more widely practiced FESS with middle meatal antrostomy technique is that the former does not widen the maxillary ostia. In addition, we rarely needed to reduce the inferior turbinates. The middle turbinate was left intact unless a concha bullosa was present and deemed to be interfering with drainage of the middle meatus, in which case a reduction of its lateral wall was performed. At all stages, meticulous care was taken to minimise trauma to the mucosa, relying heavily on the micro-debrider to avoid any accidental stripping.

- **The minimally invasive sinus technique for sinus disease surgery developed from the rationale that drainage of the anterior group of paranasal sinuses is impeded by the transition spaces that the anterior sinuses drain into, and not by the ostia themselves**
- **Addressing the transition spaces and leaving the ostia intact, using the minimally invasive sinus technique, should therefore reverse chronic rhinosinusitis**
- **Functional endoscopic sinus surgery for chronic rhinosinusitis resistant to medical management is the current 'gold standard' treatment; this study reports further evidence to suggest that the minimally invasive sinus technique should be considered as the initial surgical intervention**

If the results of the minimally invasive sinus technique[13] compare favourably with other studies involving more extensive surgery, then it would seem sensible to adopt the more conservative technique, at least as a first step. Mehanna *et al.*[14] published their results for 101 cases of FESS, all of which included middle meatal antrostomies, using the Glasgow benefit inventory. Their results after one year of follow up showed a Glasgow benefit inventory score of 23, which is very similar to our own results at the same time point (i.e. 25.2). At three years, our results tended to taper off (to 14.8), which is to be expected given the large number of polyp patients in our cohort.

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Sinusitis remains a condition which is primarily treated medically. Surgery is reserved for cases that fail to respond to medication, and should ideally be minimally invasive and produce maximum benefit. In the UK, the percentage of patients undergoing day case endoscopic sinus surgery is still below 10 per cent. Since adopting the minimally invasive sinus technique, over 80 per cent of our patients have been able to be discharged home on the same day as surgery. This has significant cost implications for our already stretched National Health Service.

Conclusion

Functional endoscopic sinus surgery for chronic rhinosinusitis resistant to medical management is the current 'gold standard' treatment. However, we report further evidence to suggest that the minimally invasive sinus technique should be considered as the initial surgical intervention.

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Address for correspondence:
Mr N Salama,
Department of Otolaryngology,
University Hospital Lewisham,
Lewisham High Street,
London SE13 6LH, UK.

E-mail: NYSALAMA@aol.com

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