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# An Audit of Endoscopic Sinus Surgery

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## ABSTRACT

**Aim of Study: A prospective study was carried out to evaluate the results of endoscopic sinus surgery based on symptom score and endoscopic findings and to evaluate the prognostic factors using an audit form designed by IS Mackay of London.**

**Methods: Consecutive cases undergoing endoscopic sinus surgery were entered into the study. Pre-operative symptom, computer tomographic and endoscopic scores were recorded. Operations were also evaluated objectively; post-operative symptom and endoscopic scores were recorded at 3, 6 and 12 months. Cases lost to follow-up were interviewed over the telephone and offered free endoscopic assessments. Those who required revision surgery were considered failures and re-entered into the study.**

**Results: The study comprised 113 cases (108 patients, 60 males and 48 females) with ages ranging from 14 to 80 years (mean 40.4). There were 52 with chronic rhinosinusitis, 46 with nasal polyps, 7 with tumours/inverted papillomata, 5 with acute complicated sinusitis and 3 with fungal sinusitis. Of these, 81.9% of patients with chronic rhinosinusitis or polyps showed an overall improvement of symptoms. Nasal obstruction showed the greatest improvement, followed by rhinorrhoea, loss of smell and headaches and facial pain. Endoscopic improvement was greatest in polyps (83.3%) and oedema (87.0%) but less for discharge (59.4%).**

**Conclusions: Our results compared well with international series. Computer tomography scoring and the number of revision operations emerged as potential prognostic indicators requiring further evaluation.**


**Keywords: audit, rhinosinusitis, nasal polyposis, computer tomography, endoscopic sinus surgery**

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## INTRODUCTION

Endoscopic sinus surgery was first popularised by Stammberger using techniques based on the pathophysiological principles described by Messerklinger[1] in 1978. Many international papers have reported high success rates of between 80% – 98% clinical improvement based on symptoms[2-9]. This has been substantiated by objective assessments of the results of endoscopic sinus surgery by Lund and Scadding[10,11] in 1991 and 1994.

In Singapore, there has been escalating interest in endoscopic sinus surgery since its introduction in the late 1980's. Older conventional operations such as inferior meatal antrostomy, Caldwell-Luc antrostomy and external ethmoidectomy are uncommon on current day operating lists. The aim of this study was to audit our results, complication rates, and compare them with international series. This study represents the first local audit of endoscopic sinus surgery, and will enable local surgeons to offer advice to their patients based on local patient data. Our results are presented after a one year follow-up period but we acknowledge that longer term follow-up is necessary.

## MATERIALS AND METHODS

A prospective study was conducted using an audit form designed by IS Mackay of London which is based on a staging system described by Lund and Mackay[12] in 1993. Although several other staging systems have been proposed[7,13], we chose this system for its simplicity and reproducibility since our data collection involved several surgeons. This system was accepted with modifications at a consensus meeting on rhinosinusitis by an international and multidisciplinary group of clinicians in Princeton, USA in July 1993.

Consecutive cases undergoing endoscopic sinus surgery were entered into the study from 1 January 1994 to 31 December 1994.

### Pre-operative scoring

a. *Symptom score*
The patients' top 3 symptoms were recorded. Visual analogue scores on a scale of 0 – 10 were also recorded for the following 4 groups of symptoms: nasal obstruction/congestion, anterior/posterior nasal discharge, disorders of smell/taste and facial pain/headaches.

b. *Endoscopic score*
Endoscopic appearances were quantified on a 0 – 2 point basis for the presence of polyps (0 = none; 1 = confined to middle meatus; 2 = beyond middle meatus), discharge (0 = none; 1 = clear and thin; 2 = thick and purulent), oedema (0 = none; 1 = mild oedema, 2 = gross oedema), scarring/adhesions (0 = none; 1 = adhesion bands; 2 = closed cavity) and crusting (0 = none; 1 = mild crusting; 2 = gross crusting).

c. *Computer tomographic score*
Staging of disease relied predominantly on

computer tomographic (CT) scan assessment. Each sinus group (frontal, anterior ethmoids, posterior ethmoids, maxillary and sphenoid) was graded between 0 – 2 (0 = no abnormality; 1 = partial opacification; 2 = total opacification). The ostiomeatal complex was scored as '0' (not obstructed) or '2' (obstructed). This gave a possible score of between 0 – 12 on each side and an overall total score of between 0 – 24. The presence of anatomic variants – absent frontal sinus, concha bullosa, paradoxically bent middle turbinate and Haller cell – was noted but did not alter the score.

### Operative scoring

Scores were recorded as '0' (not done) and '1' (done) for the following procedures: uncinectomy, middle meatal antrostomy, anterior ethmoidectomy, posterior ethmoidectomy, sphenoidectomy, clearance of frontal recess and reduction of middle turbinate. This produced a possible total score of between 0 – 14 (0 – 7 for each side).

### Post-operative scoring

Assessments were carried out at 3, 6 and 12 months following surgery. The top 3 symptoms were followed up and recorded as A (absent), B (better), S (same) and W (worse). The visual analogue scores (0 – 10) and endoscopic scores (0 – 2) were also recorded using the above scoring system.

### Follow-up

Patients lost to follow-up were called up by the principal investigator and interviewed over the telephone. They were also given appointments to go for endoscopic reassessment. Whereas other studies often include revision surgery (when necessary) in reporting the overall success, we did not because of the short period of follow-up. All cases needing revision surgery were classified as "failures" and re-entered into the study.

## RESULTS

### Biostatistics

We studied 113 cases (108 patients, 5 revisions) with ages ranging from 14 to 80 years (mean 40.4). There were 60 male and 48 female patients.

### Diagnoses

Indications for surgery were mainly chronic rhinosinusitis (46.0%) and nasal polyposis(40.7%). Tumour/inverted papilloma was suspected in 7 cases, 5 patients presented with acute complicated sinusitis (orbital/intracranial complications, pyocoeles) and 3 patients had fungal sinusitis. There was associated asthma in 9 patients and bronchiectasis in 2 patients. Other associated diagnoses included hypertension (9), diabetes (6), ischaemic heart disease (1) and stroke (1).

### Operation statistics

Most operations were carried out under general anaesthesia (80.5%) and the duration of surgery ranged from 25 to 195 minutes (mean 94.4, SD 43.2).

### Post-operative medication

No post-operative analgesics were given to 31.0% of patients whilst 48.0% had adequate pain relief with paracetamol. Ponstan (15.0%) and Synflex (6.0%) were the other analgesics used. For post-operative antibiotics, the majority of cases were given Bactrim (35.0%) or Amoxil (31.0%). Augmentin (17.0%), Unasyn (5.0%) and Klacid (5.0%) were also used. About a third of patients (36.6%) were given oral steroids post-operatively for a variable period.

### Complications

Only 3 significant complications were recorded. One patient had a post-operative secondary haemorrhage which was easily controlled. Another patient developed temporary blindness post-operatively which rapidly recovered following removal of the nasal pack. In this case, the nasal pack was coated with tetracycline ointment which may have caused fluid accumulation and back pressure on an exposed optic nerve in an opened Onodi cell. There was one case of cerebrospinal fluid leakage following endoscopic biopsy of an ossifying fibroma of the ethmoid. The patient subsequently underwent open surgery to repair the leak and made a good recovery.

### Surgical outcome

a. *Based on symptoms*

The main complaints (first symptom) were predominantly nasal obstruction or congestion (40.6%) and rhinorrhoea (25.5%) (Table I). Improvement in the main complaint for patients with chronic rhinosinusitis and nasal polyposis was seen in 78.3% of patients whilst the overall symptomatic improvement was 81.9% (Table II). However, it is important to note that main

**Table I – Main complaints (first symptom)**

| | | |
|---|---|---|
| Nasal obstruction/congestion | 43 | (40.6%) |
| Rhinorrhoea | 27 | (25.5%) |
| Headache | 9 | (8.5%) |
| Postnasal drip | 8 | (7.5%) |
| Facial pain | 6 | (5.7%) |
| Foul smell | 5 | (4.7%) |
| Loss of smell/taste | 5 | (4.7%) |
| Fever/acute symptoms | 3 | (2.8%) |
| Total | 106 | (100.0%) |

* excluding 7 cases of tumours/'inverted papillomata'

**Table II – Subjective improvement of symptoms after surgery**

| | Asymptomatic (%) | Improvement (%) |
|---|---|---|
| 1st symptom | 39.8 | 78.3 |
| 2nd symptom | 31.1 | 73.0 |
| 3rd symptom | 41.5 | 84.9 |
| Overall | 22.9 | 81.9 |

complaints were completely eliminated in only 39.8%. Also, only 22.9% of patients were totally symptom free after their surgery. There was no significant difference between results in chronic rhinosinusitis and nasal polyposis, although a higher failure rate might have been expected in cases of nasal polyposis. This could be due to the relatively short follow-up period in our study.

b. *Based on visual analogue scores*
Visual analogue scores were improved significantly ($p < 0.001$) for all the symptoms (Table III). Predictably, nasal obstruction or congestion showed the most improvement, followed by nasal discharge, disorders of smell or taste as well as headaches and facial pain.

c. *Based on endoscopic scores*
We included a column to record the surgeon's opinion of the operative outcome. It was interesting to note that the surgeon's assessment (72.9%) was lower than the patient's perception of improvement (81.9%). This discrepancy may have been biased by the post-operative endoscopic findings. Although there were less polyps in 83.3% of patients and oedema had improved in 87.0% of patients, less discharge was noted in only 59.4% of patients (Table IV). Total absence of polyps was seen in 64.6% of patients who had small polyps pre-operatively and in only 54.2% of patients who had gross polyposis. This suggests that endoscopic findings might be a better indicator of the possibility of future recurrence than patients' symptom scores. No oedema was present in less than half the patients and no discharge was seen in over 30% of patients. Endoscopy also showed that 29.9% had developed post-operative adhesions, underlining the importance of meticulous post-operative toilet. Crusting was seen in only 7.7% of patients and does not appear to be a major problem in our warm and humid climate.

**Table III – Post-operative symptom score**

| Symptoms | Pre-op mean VAS (0 – 10) | Post-op mean VAS (0 – 10) | Mean of paired difference | 95% CI |
|---|---|---|---|---|
| Headache/facial pain | 3.8 | 1.6 | 2.2* | 1.3 to 3.2 |
| Blockage/congestion | 5.9 | 2.2 | 3.7* | 2.8 to 4.7 |
| Smell/taste | 4.9 | 2.3 | 2.6* | 1.7 to 3.4 |
| Discharge | 6.4 | 3.0 | 3.4* | 2.6 to 4.2 |

*$p < 0.001$

**Table IV – Post-operative endoscopic findings**

| Pre-operative findings | Post-operative findings | |
|---|---|---|
| Polyps | absent (%) | improved (%) |
| mild | 64.6 | na |
| gross | 54.2 | 83.3* |
| Oedema | absent (%) | improved (%) |
| mild | 48.6 | na |
| gross | 47.8 | 87.0* |
| Discharge | absent (%) | improved (%) |
| mild | 39.2 | na |
| gross | 31.3 | 59.4* |

Pre-operative score : 1 = "mild"; 2 = "gross"
Post-operative findings : "absent" = score of 0
"improved" = cumulative score of 0 and 1
If pre-operative score = 1, post-operative score = 1 is not applicable (na)

**Analysis of prognostic factors**

a. *Computer tomographic score*
The CT scores in the audit showed a relatively normal distribution. For the purpose of evaluating the impact of CT staging on prognosis, we divided the range of scores into percentiles. Scores below the 25th percentile were placed in category 1, those between the 25th to 75th percentile, in category 2 and those above the 75th percentile, in category 3. This system was used because it was felt that the extremes of scores would have more significance on prognosis. In category 1, 89.5% of patients showed improvement, 84.1% improved in category 2, and 78.3% in category 3. However these results were not statistically significant ($p = 0.33$) as a prognostic guide. This could be due to the relatively short follow-up period as well as the small numbers studied.

b. *Operative score*
The operative scores also showed a normal distribution. The scores were similarly divided into 3 categories using the 25th and 75th percentiles. No prognostic trend was evident.

c. *Revision surgery*
There was no overall difference in success rates between those who had undergone revision surgery (78.1%) and primary cases (84.3%). Prognosis seemed to worsen if multiple revisions (60.0%) were needed compared to those who had undergone only one revision (86.4%). This was however not statistically significant due to the small numbers.

d. *Grade of surgeon*
The degree of seniority of the surgeon seemed to affect the prognosis significantly ($p < 0.05$). The outcome was worse in cases performed by senior surgeons but this could be partially attributed to the greater complexity of operations allotted to them.

e. *Post-operative systemic steroids*
Post-operative oral steroids did not improve results. Also, patients placed on oral steroids did not have worse disease to begin with.

**Special problems**

a. *"Inverted papilloma"/tumours*
One patient had ossifying fibroma and "inverted papilloma" was the pre-operative diagnosis in 5 patients with subsequent histological

confirmation in 3 patients. Of these, one was well after the first operation, one required a revision operation (registered as 2 cases) whilst the third patient was found to have bilateral disease and was offered open surgery. The remaining 2 patients were found to have undifferentiated carcinoma and adenoid cystic carcinoma and were treated by radiotherapy and surgery respectively.

b. *Acute complicated sinusitis*
Five patients presented with acute complicated sinusitis. Of these, 2 patients suffered from orbital abscesses, one had orbital cellulitis with meningism, one had meningitis and one had a frontal pyocoele. All the above patients were treated successfully endoscopically except for one of the patients with orbital abscess, who was found to have an underlying lacrimal abscess, and underwent open drainage. All the patients have remained well on follow-up.

c. *Fungal sinusitis*
Three patients suffered from fungal sinusitis. One patient had aspergillus sinusitis showing invasion on histology and underwent systemic anti-fungal therapy which was stopped because of abnormal liver enzymes. She subsequently left the country for Hong Kong where she had revision surgery. The other 2 patients were well on follow-up.

## DISCUSSION

### Surgical outcome

This study was performed to audit an increasingly popular mode of surgical approach to nasal problems, ie. endoscopic sinus surgery, in order to evaluate its merits, failures and complications. While it is encouraging to report that there was overall symptomatic improvement in 81.9% of our patients, a figure comparable with international series, we have appraised our own results to be only 72.9% successful. Visual analogue scores improved significantly but endoscopic scores were less encouraging and more revealing. Total absence of pathology on post-operative endoscopy was less common than the symptom scores had predicted. Slightly less than 50% of patients had no oedema but the total absence of discharge was seen in only about a third of patients. Surprisingly, as many as 60% of patients had no evidence of residual polyps. This was probably due to the short follow-up period. Only one third of patients were symptom free with no evidence of disease on endoscopy. Another one third of patients were free from polyps but still had nasal discharge. We suspect that this persistent discharge might have been eliminated by more effective post-operative antibiotic therapy. In a separate unpublished study on the failures of endoscopic sinus surgery, we found that the nasal mucociliary clearance only begins to recover after 4 to 5 weeks of antibiotic therapy. We therefore believe that adequate antibiotic therapy is an important adjunct to surgery and should be prolonged for at least 6 weeks until mucociliary function is re-established. Although post-operative systemic steroid therapy was not shown to influence the prognosis, our study was simply an audit and not a randomised controlled study. We believe that such studies are necessary before we discount the value of post-operative oral steroids. In the meantime, we recommend their judicious use, especially in the presence of gross polyposis. Of the remaining third of patients with some pathology on endoscopy, about half showed symptomatic improvement but the endoscopic findings suggested that some of these patients might need revision surgery in future.

The above generalisation assumes that endoscopic findings correlate well with symptoms. This is not entirely true as some patients with gross pathology claim to be entirely symptom free whereas some with near 'perfect' ethmoidal cavities complain of severe symptoms.

### Prognostic factors

Prognostic factors are harder to evaluate in an audit versus a randomly-controlled study. Trends can however be detected which prompt further study. The only significant prognostic factor in our audit was the grade of the surgeon. This finding however is open to misinterpretation as senior surgeons tend to perform more complicated operations while junior surgeons are frequently supervised closely, thus ensuring better results.

CT scoring showed the most potential as a prognostic factor, a fact borne out by clinical experience. This lends support to its use as a staging system, as suggested by Lund and Mackay. However, while their scoring is simple and reproducible, they have not proposed a staging system which can be applied clinically and analysed. In our audit, we have suggested a 3-stage system based on percentiles.

The number of revision operations also showed potential as a prognostic factor where the prognosis deteriorated as their number increased. This suggests that more conservative measures, for example adequate antibiotic and steroid therapy should be tried initially, before revision surgery.

### Special problems

Our audit also demonstrated the advantage of endoscopic drainage in acute complicated sinusitis, avoiding disfiguring scars on the face from open surgery. This is especially important because complications occur frequently in the very young and open surgery can leave them psychologically scarred as well. Endoscopic sinus surgery was also shown to be useful in the management of fungal sinusitis. However, histological evidence of fungal invasion on histology is a bad prognostic factor irrespective of whether surgery is by an endoscopic or open approach. In tumour surgery, endoscopic sinus surgery is a new frontier and is potentially useful in limited benign disease.

## CONCLUSIONS

Analysis of surgical outcome is useful as a prognostic guide. We consider the following guidelines invaluable

in advising our patients on the benefits and risks of surgery:

1. Four out of five patients will experience significant improvement in their symptoms although they may not be cured of the disease.
2. One-third of patients will derive great overall benefit from the operation, another third will also benefit after adequate post-operative medication, and the remaining third are likely to require long term medication or even revision surgery.
3. The local complication rate from endoscopic sinus surgery is low and largely avoidable with proper training of surgeons and the use of CT scans in the pre-operative assessments.


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