

The endoscopic endonasal surgical technique in the treatment of chronic recurring sinusitis in children*

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SUMMARY

Chronic recurring sinusitis (CRS) is a difficult diagnosis to make in the paediatric patient. However, increased awareness by physicians and improved technology are contributing to an increasing frequency of this diagnosis. Children with their immature development of the paranasal sinuses and immunological systems present special problems in the treatment of CRS. Concern must be given to potential alteration of the development of the paranasal sinus system and tooth buds in the maxilla by a surgical procedure in children. Various surgical procedures have been recommended in the past in the treatment of CRS failing medical management. A review of 124 paediatric patients undergoing endoscopic endonasal sinus surgery using the technique of Messerklinger and Stammberger in the treatment of CRS over an 11-year period is presented. A detailed questionnaire regarding patient's satisfaction and symptomatic relief has been sent to all patients. The results indicate a successful outcome from this technique and a high level of patient satisfaction. No complications such as CSF leak or orbital injury have been encountered, and no evidence of altered facial growth and development has been noted. We find the endoscopic endonasal technique to be a safe and effective method in the treatment of children with CRS failing medical management.

Key words: paediatrics, chronic sinusitis, endoscopic endonasal surgery

INTRODUCTION

Our knowledge regarding treatment of diseases involving the nasal cavity and paranasal sinus system in the paediatric population has been primarily deduced from our experience in adults. In the past, little specific attention has been given to the development of the sinuses and the immunological system of children, which is still immature (Wald, 1985). Acute sinusitis in children and the associated complications are well-defined and discussed in the literature with regard to both diagnosis of the disease and surgical therapy. However, this is not the case for chronic recurring sinusitis (Beck, 1926; Albegger, 1977). Chronic recurring sinusitis (CRS) is a disease of increasing importance and is even more prevalent a disease in children than was recognized in the past (Lusk and Muntz, 1990). The increasing incidence of CRS may be attributed to a variety of factors, including pollution in large cities and industrial areas by inhalant irritants as well as an increase in allergic disease (Stammberger, 1993). The increased frequency of diagnosis may be partially attributed to improved technology including

paediatric endoscopes for the paranasal sinuses and radiological advancements allowing rapid and accurate diagnosis of diseases of the paranasal sinuses and nasal cavity. Increasing awareness of CRS by both paediatricians and otorhinolaryngologists may also play a significant role in the frequency of diagnosis of CRS. Unlike the well-documented surgical techniques and surgical indications for acute sinusitis and its complications, the literature contains different opinions about definitions of disease, surgical technique and their successes for chronic sinusitis. Many surgical recommendations can be found in the literature for the paediatric patient with CRS, e.g. adenoidectomy, tonsillectomy and adenoidectomy, sinus irrigations, fenestration of the maxillary sinuses through the inferior or middle meatus, Caldwell-Luc operations, and endoscopic endonasal surgical techniques of Messerklinger and Stammberger have all been advocated (Messerklinger, 1966, 1967; Merck, 1974; Stammberger, 1986; Lund, 1988; Fukuda et al., 1989; Gross et al., 1989; Lusk and Muntz, 1990; Muntz and Lusk, 1990; Lusk, 1992; Kuttner et al., 1992). In our department the technique of

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Messerklinger and Stammberger has been used for many years in the surgical treatment of CRS, either alone or in cases with complications of acute sinusitis in combination with an external approach (Stammberger, 1991). It is our opinion that the technique of Messerklinger and Stammberger are well suited for the paediatric patient, especially when one considers the potential to alter the growth and development of the paranasal sinus system as well as the tooth buds in the maxilla (Wald, 1985; Lusk, 1992). The purpose of this study has been to review our experience over the past 11 years with the use of the Messerklinger and Stammberger technique in the paediatric population with CRS in order to determine the safety and efficacy of this procedure in this particular patient population.

MATERIAL AND METHODS

A retrospective review of the charts of 124 patients between the ages of 3 and 16 years who underwent endoscopic endonasal sinus surgery over the past 11 years at our clinic was performed. In addition to the chart review, a detailed questionnaire was sent to all patients. The questionnaire attempted to determine overall surgical success as well as the success at relieving specific complaints such as nasal discharge, nasal obstruction, recurrent sinus infections, headache, pulmonary symptoms, and persistent cough. Chart review included but was not limited to the following analysis: pre-operative symptoms, diagnostic endoscopic findings, radiographical findings, predisposing factors that may have been responsible for the development of paranasal sinus disease, surgical indications, the surgery itself including both procedure and surgical extent, intra-operative problems, anaesthetic complications, post-operative course, recurrences, and the reasons for the recurrences if they could be determined.

RESULTS

A total of 124 paediatric patients were identified which had undergone endoscopic endonasal sinus surgery between 1981 and 1991 at our clinic for CRS. Of these patients, 65 were female and 59 were male. The patients' ages ranged from 3–16 years

with a mean of 12 years (Figure 1). Charts were available for review in all of these patients and questionnaires were sent to all patients. Seventy-one patients (57.3%) responded to our questionnaire.

Indications for surgery were as follows. Of the 124 patients, CRS alone was the indication for surgery in 71 patients. Fifty-three patients were operated on for CRS with diffuse polyposis and/or antrochoanal polyps (Table 1). All patients had undergone extensive medical therapy pre-operatively and failed medical management. Forty out of 124 patients had pre-operative adenoidectomy without success. In 84 patients, the adenoids were not clinically significant enlarged or were related to symptoms. In addition to a clinical diagnosis of disease of the paranasal sinus system failing medical management, pre-operative radiographical confirmation was performed in all patients prior to surgical intervention. In the earlier years of this study radiographical evaluation was done by conventional tomograms in the coronal plane, in later years computerized tomography was used.

Table 1. Surgical indications.

chronic sinusitis	n = 71
diffuse nasal polyposis	n = 53
total	n = 124

Pre-operative symptoms at presentation were seen in the following frequencies: persistent nasal discharge in 53%; nasal obstruction in 51%; recurring sinusitis in 41%; headache in 27%; pulmonary symptoms in 15%; and otological symptoms in 11% (Table 2).

Table 2. Pre-operative symptoms.

rhinorrhoea	53.3%
nasal obstruction	50.8%
recurrent sinusitis	41.1%
headache	27.4%
pulmonary symptoms	14.5%
otological symptoms	11.3%

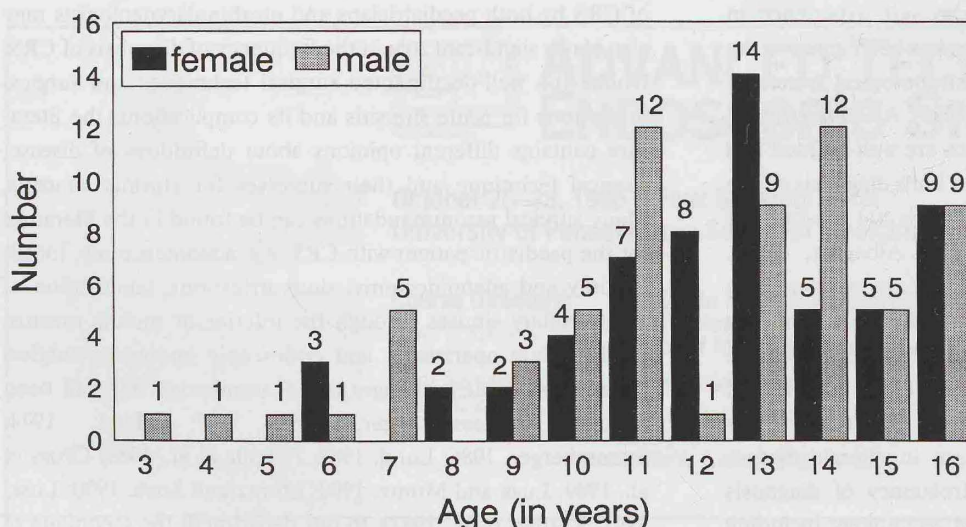


Figure 1. Patients' demographics.

Predisposing factors that may lead to the development of CRS are identified much more frequently in the paediatric population than in adults (Table 3). In our patients we found the following: diffuse polyposis with or without antrochoanal polyp in 43%; inhalational allergies in 25%; bronchial asthma in 4%; immunodeficiency syndromes in 3%; cystic fibrosis in 2%; and Kartagener's syndrome in 2%. When looking at the predisposing factors (allergy, asthma, and polyposis) 64 patients (72%) displayed only one predisposing factor; however, 12 patients had two predisposing factors, and one patient had three predisposing factors (Figure 2).

In the immunodeficiency group were four children between the age 12–15. One child presented a relative IgG deficiency. The other three children suffered from a selective IgA deficiency, one of them showed a reduced T-cell activity. Peri-operatively antibiotics were given, no immunoglobulins were administered peri-operatively. In these patients FESS was regarded to improve symptoms in addition to repeated antibiotic treatment.

Table 3. Predisposing factors leading to the development of CRS.

	number	%
diffuse nasal polyposis with/without antrochoanal polyp	53	42.7
allergy	31	25.0
asthma	5	4.0
immunodeficiencies	4	3.2
cystic fibrosis	3	2.4
Kartagener's syndrome	2	1.6

The surgical technique used in all patients was the endoscopic endonasal technique described by Messerklinger and Stammberger (Messerklinger, 1967, 1978; Stammberger, 1986). The extent of surgery was determined by the pre-operative radiographical assessment and intra-operative findings.

Paranasal sinus surgery was unilateral in 43 patients (35%), and bilateral in 78 patients (63%). In three patients (2%) only a maxillary sinus endoscopy was performed. Disease was noted to involve both the anterior and posterior ethmoidal sinuses in 31 patients (25%) with all other patients showing involvement of only the anterior ethmoids. The procedures also varied in the choice of anaesthesia over the 11 years of the study. Initially, we primarily used local anaesthesia with premedication in 56 patients (45%). General endotracheal anaesthesia was more commonly used in the later years and was employed in 68 patients (55%). Post-operatively, all patients received antibiotics and topical corticosteroids to prevent synechia and post-operative oedema. If considered beneficial by the surgeon, a Merocell sponge was placed for 24–48 h into the middle meatus.

The surgical procedure was considered very difficult, in technical terms, in 33 patients (27%) with the difficulty attributed to a narrow anatomy in 21 patients (17%) or being due to diffuse mucosal bleeding in 13 patients (11%). Four cases were terminated prior to their completion, three cases secondary to diffuse mucosal bleeding, and one case being performed under local anaesthesia due to severe pain (Table 4).

Table 4. Problems encountered during surgery.

	number	%
anatomical	21	16.9
diffuse bleeding	13	10.5
pain due to local anaesthesia	1	0.8
total	33	26.6

procedure terminated in 0.8%

Seventy-one patients responded to the questionnaire (Figure 3) and the following data were collected. Of the patients with pre-operatively persistent rhinorrhoea, 53% noted complete resolution, 40% were improved, 3% noted no difference, and 3% were

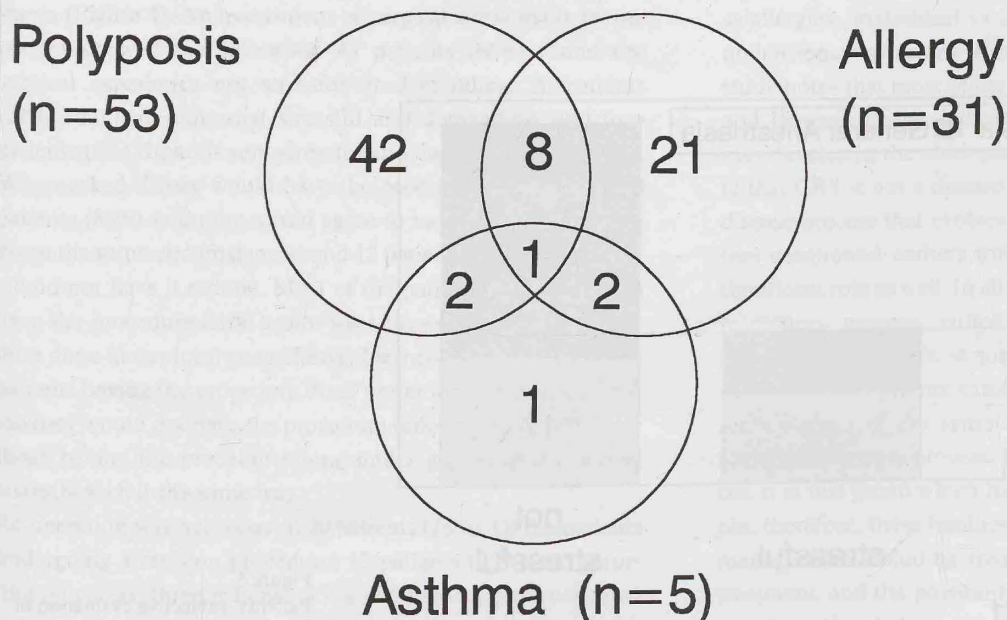


Figure 2. Incidence of multiple predisposing factors.

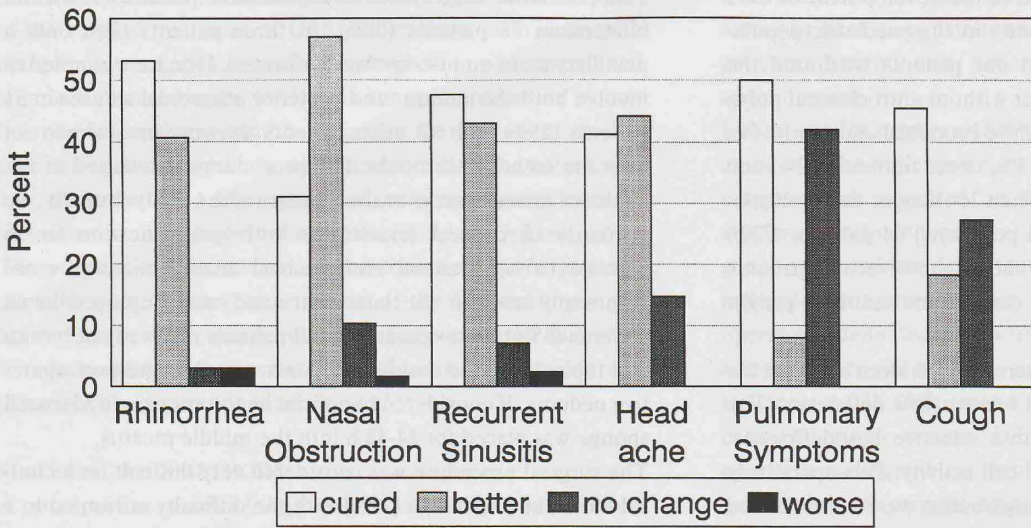
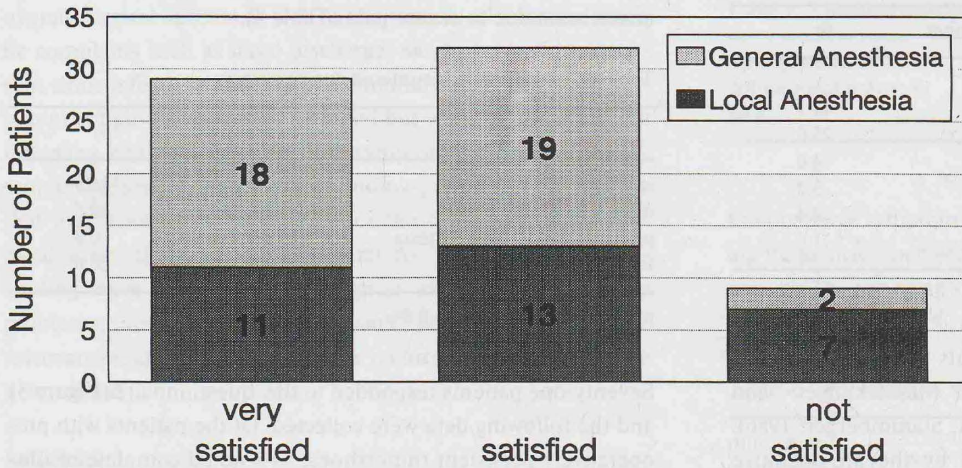
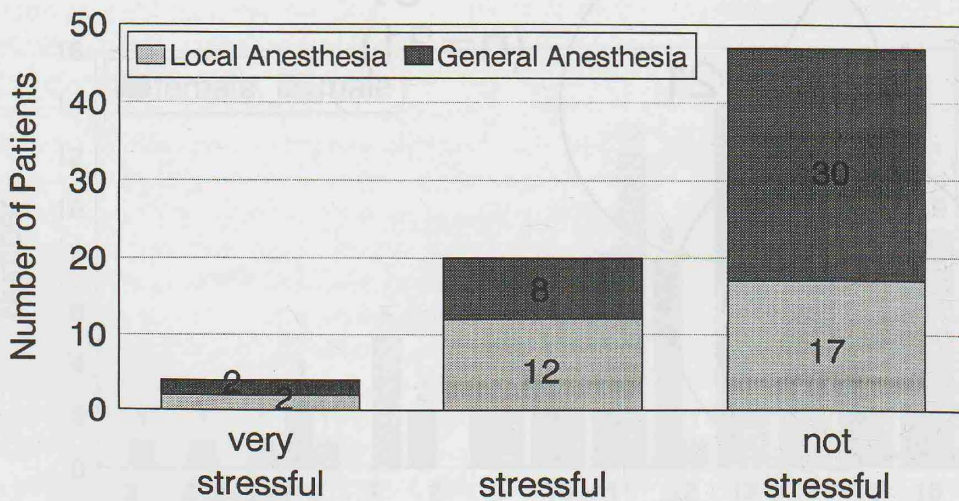


Figure 3. Patient questionnaire response regarding post-operative symptom relief.



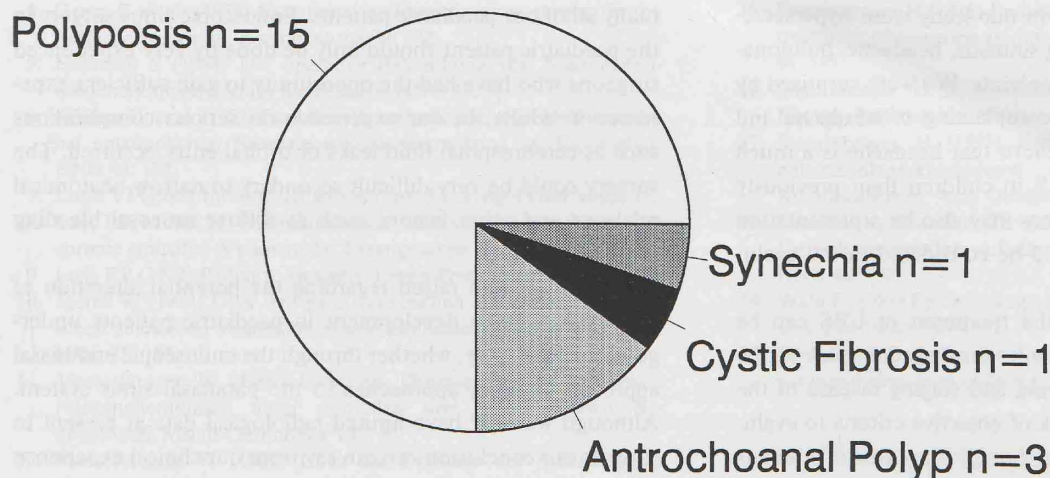
* Total responding n=70

Figure 4. Patients' subjective evaluation of satisfaction with surgical result.



* Total responding n=71

Figure 5. Patients' subjective evaluation of surgical stress.



* Total requiring revision n=20 (16.1%)

Figure 6.
Indications for revision surgery.

worse. The sensation of nasal obstruction was completely relieved in 31%, improved in 57%, no difference in 10%, and worsened in 2%. Recurrent infections were eliminated in 48%, decreased in frequency in 43%, no change in 7%, and increased in 2%. Headache – a common symptom in almost 30% of our patients – was relieved in 41%, improved in 44%, and not changed in 15%. Pulmonary symptoms were relieved in 50%, improved in 8%, not significantly changed in 42%, and worsened in no patients. Persistent cough was relieved in 45%, improved in 27%, and no change in 27%.

Subjective assessment of the surgery as indicated by the patient's parents or the patient himself (many of them were adults by the time of assessment) is as follows: in an overall assessment, 29 patients (41%) were very satisfied, 32 patients (46%) were satisfied, and only 9 patients (13%) noted dissatisfaction. Of note is that almost all of the patients which displayed dissatisfaction had their procedure done under local anaesthesia (Figure 4). An assessment of surgical stress made by the patient showed the following: 47 patients (66%) found the surgical experience not stressful or demanding, 20 patients (28%) found it somewhat stressful and demanding, and four patients (6%) found it very stressful and demanding (Figure 5). When asked if they would have the procedure done again, 59 patients (83%) said they would agree to have the surgery again given the same circumstances, and 12 patients (17%) stated they would not have it redone. Most of the patients that would not have the procedure done again, were those that had the procedure done under local anaesthesia. Twenty-nine per cent of the patients having the procedure done under local anaesthesia stated they would not have the procedure redone, and only 7.5% of those having the procedure done under general endotracheal anaesthesia felt the same way.

Re-operation was necessary in 20 patients (16%). Of the patients undergoing a revision procedure, 15 patients (75%) had recurring polyposis, three patients (15%) had recurring antrochoanal polyp, and only one patient (5%) required revision surgery for

post-operative synechia. One patient with cystic fibrosis required another surgical procedure (Figure 6).

DISCUSSION

The presentation of chronic sinusitis in children may be extremely variable and, thus, often making the correct diagnosis very difficult (Terrahe and Potrafke, 1991; Lusk, 1992). In contrast to CRS, acute sinusitis presents itself with clear and typical symptoms making the diagnosis and appropriate treatment easier. The burden is on the physician to maintain a high level of suspicion and to investigate the paranasal sinuses appropriately if indicated, because in addition to the typical signs and symptoms of CRS, atypical symptoms are frequently found.

In adults, CRS is primarily a localized problem in the nasal cavity and paranasal sinus system. However, in children it is often part of a multifactorial and complex disease process, and much more frequently associated with predisposing factors such as allergies, anatomical variations, ciliary dyskinesia, or immunodeficiency syndroms than in adults (Table 3; Figure 2). Our study notes that most of the diseased children were between 11 and 16 years of age, indicating that sinusitis requiring surgery may develop in the older paediatric age group. This may indicate that CRS is not a disease the child is born with, but rather a disease process that evolves secondary to the predisposing factors mentioned earlier, with environmental factors playing a significant role as well. In all patients with diseases involving the respiratory mucosa, either directly or indirectly (e.g., cystic fibrosis, Kartagener's syndrome and "ASA triad") one must explain to the parents carefully that surgery will only lead to improvement of the symptoms, and that it will not cure the underlying disease process. As we know from clinical experiences, it is this group which has the greatest number of recurrences; therefore, these families need to be prepared for long-term management including frequent follow-up, repeated medical treatment, and the possibility of further surgical procedures for symptomatic relief.

Common presenting symptoms in our study were hypersecretion, nasal obstruction, recurring sinusitis, headache, pulmonary symptoms, and otological complaints. We were surprised by the large numbers of patients complaining of headache and facial pain, and this made us believe that headache is a much more frequent symptom of CRS in children than previously assumed. Behavioural disturbances may also be a presentation of CRS and this diagnosis should be considered in the evaluation of such patients.

Various recommendations for the treatment of CRS can be found in the literature. This may be attributed in part to the difficulties encountered in defining and staging disease of the paranasal sinus system and a lack of objective criteria to evaluate the success of any particular therapy. In cases of mucous retention in the nasal cavity secondary to hypertrophic adenoids, adenoidectomy may be beneficial (Merck, 1974; Fukuda et al., 1989). Irrigation of the sinuses may lead to improvement of the disease located within the ostiomeatal complex, especially in cases of acute sinusitis. However, this is a difficult procedure to perform in the paediatric population. As with sinus irrigations, inferior meatal anastomies risk damaging the tooth buds or entry into spongiotic bone underneath the floor of the maxillary sinus with manipulations in the paranasal sinus region (Wald, 1985). This risk is especially increased in paediatric patients in which the maxillary sinus is not fully developed and the floor of the maxillary sinus is at a level above that of the floor of the nasal cavity. Investigations of Lusk (1992) and Muntz and Lusk (1990) have shown that inferior meatal anastomies are not a satisfactory method of maintaining ventilation and drainage of the maxillary sinus secondary to the tendency of scar formation. In a retrospective study Lund (1988) has found that 45% of windows in the inferior meatus close. Furthermore, fenestrations of the inferior meatus may lead to stenosis of the ethmoidal infundibulum by a fracture in the inferior turbinate and lateralization of the uncinate process. We believe that Caldwell-Luc operations in children are obsolete as disturbances in facial growth of the skull and destruction of the tooth buds may occur.

Of all the recommended surgical procedures, we prefer the endoscopic endonasal technique to cure disease in the ostiomeatal complex and to provide ventilation and drainage of the paranasal sinus system. We believe that this method is ideally adapted to the physiology of the respiratory mucosa and is associated with a significantly decreased risk of injury to the tooth buds and alteration of facial bone development. In the first years of the investigation we performed this surgery under local anaesthesia in an attempt to decrease the incidence of diffuse mucosal bleeding and to offer an increased level of safety for the patient. After having reviewed the subjective assessments of our patients concerning satisfaction, surgical stress and willingness to undergo a second procedure, it was obvious that the younger patients preferred general endotracheal anaesthesia. This subjective assessment, combined with the review of our 11-year experience failing to show any complications associated with the use of general endotracheal anaesthesia, has led us to change to the use of general endotracheal anaesthesia in vir-

tually all of our paediatric patients. Endoscopic sinus surgery in the paediatric patient should only be done by very experienced surgeons who have had the opportunity to gain sufficient experience in adults. In our experience no serious complications such as cerebrospinal fluid leaks or orbital entry occurred. The surgery could be very difficult secondary to narrow anatomical relations and other factors, such as diffuse mucosal bleeding (Table 4).

Concern has been raised regarding the potential alteration of future facial bony development in paediatric patients undergoing sinus surgery, whether through the endoscopic endonasal approach or other approaches to the paranasal sinus system. Although we only have limited radiological data at present to support our conclusion, we can say from our clinical experience and from the subjective evaluations of the patients that there were no clinically significant disturbances in facial bone development. This was noted to be true for those either undergoing unilateral or bilateral procedures.

Our results with the use of the endoscopic endonasal technique are encouraging, showing satisfactory relief of symptoms (e.g., hypersecretion, nasal obstruction, and headache) as well as a decrease in the frequency of recurring episodes of sinusitis. In 87% of our patients the patient and/or his parents were satisfied with the surgical result and determined the surgery to be a success. Worsened symptoms were only noted in 4% of the patients. We feel that in most of the latter patients the problem was most often secondary to synechia or recurrence of polyps. The results of the subjective assessments by the patients were encouraging with regard to both patients' satisfaction and stress.

CONCLUSION

A period of 11 years and 124 patients allows us to evaluate the endoscopic endonasal surgical technique in the treatment of chronic recurring sinusitis. We feel that the endoscopic endonasal technique is particularly suited for the paediatric patient, in that it is very gentle and a more physiological treatment than other procedures recommended in the past. In the proper hands it seems to be a safe procedure with minimal risks. Despite these facts it is our opinion that indications for surgery in children should be very restrictive and the surgery should only be done by experienced hands. As a consequence of our retrospective investigation and the subjective responses of our patients, we think that the endoscopic endonasal technique should be the primary technique used for the surgical management of inflammatory diseases of the paranasal sinuses in children if medical management fails.

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ANNOUNCEMENT

VIIth INTERNATIONAL COURSE ON ENDOSCOPIC SURGERY OF THE PARANASAL SINUSES

Brussels (Belgium) – Cologne (Germany)
 July 26-29, 1995

The Seventh International Course on Endoscopic Surgery of the Paranasal Sinuses is being organized at the Free University of Brussels by Prof. P. Clement, and at the University of Cologne by Prof. E. Stennert. The purpose of the course is to familiarize ENT specialists with this new type of surgery which represents one of the major advances in paranasal sinus surgery in recent years. The course will take place in two major historical cities of Europe. It will start in Brussels. The faculty consists of international experts in this new type of surgery:

C. Bachert (Düsseldorf), P. Clement (Brussels), L. Close (New York), O. Michel (Cologne), G. Rettinger (Ulm), D. Rice (Los Angeles), S. Schaeffer (New York), E. Stennert (Cologne), W.F. Thumfart (Innsbrück). Special Guest of Honour: Prof. Dr. W. Messerklinger (Graz)

Venues: Brussels and Cologne, two days each

Language: English

Course Fees: full course including cadaver surgery: US\$ 1,000 for specialists; US\$ 800 for residents; US\$ 600 for lectures only

Information: Secretariat Prof. P.A.R. Clement, attn. Mrs. K. Nuyts, ENT Department, AZ-VUB, Laarbeeklaan 101, B-1090 Brussels, Belgium. Tel. +32-2.4776002; telefax +32-2.4775800