Objective: To compare the 3-year results of 2 endoscopic surgical approaches in the management of nasal polyposis.

Design: Retrospective medical record review.

Setting: Private or institutional practice.

Patients: A total of 127 patients with nasal polyposis were operated on by the same surgeon between January 1, 2003, and September 31, 2005.

Intervention: The patients underwent radical ethmoidectomy (n=77) and polypectomy (n=50).

Main Outcome Measures: Outcome measures were global functional score, calculated by summing the scores (0-3) of each symptom (congestion, rhinorrhea, anosmia, hyperreactivity, and pain); global anatomical score (GAS), calculated by summing the score of polyp development for each nasal cavity; computed tomography score; adherence to corticosteroid therapy; oral corticosteroid consumption; and complication and subsequent operation rate. Efficacy was evaluated by comparing these data preoperatively and postoperatively (at 3 months, 1 year, and 3 years).

Results: The global functional score and GAS were significantly improved 3 years after these techniques were performed (global functional score changes from 8.65 to 3.11 for ethmoidectomy and from 8.15 to 4.2 for polypectomy; GAS, from 5.95 to 1.83 for ethmoidectomy and from 6.57 to 3.58 for polypectomy). Congestion, pain, and GAS were improved to a significantly greater extent in the ethmoidectomy group. The subsequent operation rate for symptomatic polyp recurrence was comparable (9.1% vs 8.0%), with fewer local complications in the polypectomy group.

Conclusion: Polypectomy seems to represent a valuable alternative in the armamentarium of first-hand surgical procedures for treating nasal polyposis.
functional and anatomical results of polypectomy and radical ethmoidectomy in a homogeneous group of patients operated on by a single surgeon (A.C.).

METHODS

PATIENTS

Between January 1, 2003, and September 31, 2005, the same surgeon in our otorhinolaryngology department operated on 141 consecutive new patients with NP by bilateral radical ethmoidectomy or bilateral polypectomy with middle meatus antrostomy (hereafter referred to as polypectomy). Patients with secondary polyposis (cystic fibrosis, primary ciliary dyskinesia, or Churg-Strauss syndrome) and those who had previously undergone sinus surgery were excluded from this study. Only patients with primary NP with a minimum postoperative follow-up of 3 years were included. The diagnosis was based on clinical history, presence of bilateral polyps on nasal endoscopic examination, and presence of bilateral opacities in the paranasal sinuses on computed tomography (CT). Asthma, aspirin intolerance, allergies, or active smoking were detected by clinical examination and appropriate tests (ie, respiratory and skin prick tests). The 3-year postoperative review was missing for 14 patients, who therefore were excluded from the study. A total of 127 patients were included and divided into 2 groups: 77 undergoing radical ethmoidectomy and 50 undergoing polypectomy.

TREATMENTS

The indication for surgery was suggested only when symptoms were refractory to long-term medical therapy (ie, at least 2 short-course treatments with oral corticosteroids and continuous daily treatment with topical corticosteroids). Each patient was clearly informed regarding the principles of the 2 surgical procedures and potential constraints, risks, and benefits of ethmoidectomy or polypectomy. After information and a minimum 2-week reflection period, the patient chose between these 2 procedures and gave informed consent for surgery.

Polypectomy was performed with the patient under local or general anesthesia by means of a microdebrider (XPS 3000; Medtronic Inc, Minneapolis, Minnesota) under endoscopic control. Polyps were removed from back to front in the nasal fossa and superior and middle meatus, sparing the turbinates. Polypectomy was also systematically performed during the 3 months before surgery. The extent of sinus opacities was evaluated by a staging system based on the Lund-Mackay score (0, no opacity; 1, partial opacity; and 2, total opacity) applied to each sinus cavity on each side (maxillary, anterior ethmoid, posterior ethmoid, frontal, and sphenoid), with a maximum CT score of 20." Preoperative data were collected by retrospective review of the medical files in which functional and endoscopic findings were always recorded and graded in the same way. Five functional criteria were determined: nasal congestion, anosmia, rhinorrhea, nasal hyperreactivity (itching and pruritus), and facial pain. The severity of each symptom was evaluated according to a 4-point semiquantitative scale: 0, no symptoms; 1, moderate symptoms; 2, mild symptoms that slightly interfere with daily activities or sleep; and 3, severe symptoms that severely interfere with daily activities or sleep. For each patient, a global functional score (GFS) was calculated by summing the scores of each symptom, with a maximum GFS of 15.

Endoscopic examination determined the anatomical score of polyp size for each nasal cavity: 0, no polyps; 1, mild polyps in the middle meatus; 2, polyps reaching the lower edge of the middle turbinate; 3, polyps extending below the lower edge of the middle turbinate; and 4, polyps reaching the floor of the nasal cavity." For each patient, a global anatomical score (GAS) was calculated by summing the scores of each nasal cavity, with a maximum GAS of 8.

A CT examination of the sinuses (axial and coronal planes) was systematically performed during the 3 months before surgery. The extent of sinus opacities was evaluated by a staging system based on the Lund-Mackay score (0, no opacity; 1, partial opacity; and 2, total opacity) applied to each sinus cavity on each side (maxillary, anterior ethmoid, posterior ethmoid, frontal, and sphenoid), with a maximum CT score of 20. Preoperative data were recorded at 3 months, 1 year, and 3 years after surgery in all patients. Symptoms and polyp size were evaluated using the same functional and endoscopic scoring systems as those used preoperatively, without postoperative CT evaluation. Adherence to nasal corticosteroid therapy (1, good daily adherence; 0, poor occasional adherence) and oral corticosteroid consumption (0, none; 1, one short-course treatment; 2, more than one short-course treatment) in the past 6 months before the visit (in the past 3 months for the 3-month postoperative visit) were scored. Intraoperative and postoperative complications and subsequent surgical procedures (for polyp recurrence or postoperative complications) were recorded.

STATISTICAL ANALYSIS

The time course of the various scores was compared between the radical ethmoidectomy group (n=77) and the polypectomy group (n=50) at baseline (preoperative) and at 3 months, 12 months, and 3 years. The various scores were then compared between the 2 groups at each time point. The GFS and GAS were compared between the Samter triad patients of each group at each time point. All analyses were performed using a statistical software package (Statview 4; SAS Institute Inc, Chicago, Illinois). Data were expressed as mean (SD). Comparisons among the variables were performed via the unpaired t test for continuous variables or the χ² test for categorical variables. When necessary, a Yates correction or a Fisher exact test was used. Analysis of variance for repeated measures was performed to test the relationship between time and effect. When a significant difference was found, individual means were compared using the Scheffe test. Comparisons between groups were performed using 2-way analy-
sis of variance for repeated measures. For each comparison, \( P < .05 \) was considered significant.

### RESULTS

#### BASELINE DATA

The characteristics of the 127 patients included in the study are given in Table 1. At baseline, the radical ethmoidectomy group (n=77) and polypectomy group (n=50) were statistically comparable for all items except the facial pain score, which was significantly higher in the radical ethmoidectomy group (\( P = .02 \)), and GAS, which was significantly higher in the polypectomy group (\( P = .04 \)).

#### POSTOPERATIVE FUNCTIONAL RESULTS

##### Time Course of Symptom Scores in Each Group

All the various symptom scores and GFS improved significantly at each time point compared with baseline value. This result occurred in the radical ethmoidectomy and polypectomy groups (Figure 1 and Figure 2). The global anatomic score changed from 5.95 to 1.83 for ethmoidectomy and from 6.57 to 3.58 for polypectomy.

##### Comparison of Symptom Scores Between Radical Ethmoidectomy and Polypectomy Groups at Each Time Point

The anosmia, rhinorrhea, nasal hyperreactivity, and GFS scores were not significantly different at any time point after surgery (Figure 1B-D and Figure 2). The nasal congestion score was significantly higher in the polypectomy group at 1 year (\( P = .03 \)) and at 3 years postoperatively (\( P = .01 \)) (Figure 1A). The facial pain score was significantly higher in the radical ethmoidectomy group at baseline (\( P = .02 \)), but no significant difference was observed between the 2 groups at each postoperative time point (Figure 1E). The GFS was not statistically different between the Samter triad patients isolated from the polypectomy and radical ethmoidectomy groups.

##### Postoperative Anatomical Results

The GAS was significantly improved at each time point compared with baseline values in the radical ethmoidectomy and polypectomy groups (\( P < .001 \)) (Figure 3). The GAS changed from 5.95 to 1.83 for ethmoidectomy and from 6.57 to 3.58 for polypectomy. The GAS was significantly higher in the polypectomy group than in the radical ethmoidectomy group at baseline (\( P = .045 \)) but also at each postoperative time point (\( P < .001 \)) (Figure 3). The same statistical difference was observed between the 2 groups when comparing the Samter triad patients only.

##### Postoperative Treatments

A significant decrease in adherence to nasal corticosteroid therapy was observed over time in the radical ethmoidectomy and polypectomy groups with no significant difference between those groups at any time point (Figure 4A).

In contrast, a significant increase in oral corticosteroid use was observed over time in the radical ethmoidectomy and polypectomy groups with no significant difference between groups at any time point (Figure 4B).

#### Complications and Subsequent Operations

No severe complication was observed in either group (Table 2). However, more local complications, including synechia, local infection, nasofrontal duct stenosis, and mucocele, were observed in the radical ethmoidectomy group. Another surgical procedure was required in 7 individuals in the radical ethmoidectomy group (4 because of poly recurrence, 2 for ethmoidofrontal mucocele, and 1 for nasofrontal duct stenosis) and in 4 individuals in the polypectomy group (all for poly recurrence).

### COMMENT

In the present study, we compared for the first time, to our knowledge, the functional and anatomical results of polypectomy and radical ethmoidectomy in a homogeneous group of patients operated on by a single surgeon. Our data demonstrate that, at 3 years after surgery, the global functional results and the rate of surgery for recurrence are not significantly different with the 2 techniques. Surgery should generally be considered after failure of medical treatment in NP. The choice between the various surgical options, ranging from simple polypectomy to radical ethmoidectomy, depends on the severity of polyposis but also on the individual surgeon’s experience, practice, and philosophy. If limits between polypectomy and radical or functional ethmoidectomy seem clear, those between functional and radical ethmoidectomy remain subjective and poorly defined, which often impairs the understanding, interpretation, and especially the comparison of various published trials.
Functional ethmoidectomy, designed to remove polyp tissues in the nose and sinuses with preservation of anatomical structures and mucosa, is mainly performed in the United States and the United Kingdom. In France, most authors, such as Serrano et al, Bonfils, and Jankowski and Bodino, believe that better functional results are achieved by more radical surgery. These authors report that radical ethmoidectomy should be preferred to functional ethmoidectomy or polypectomy in the presence of very extensive polyps in the paranasal cavities to decrease the risks of early recurrence and functional failure. However, recent studies have suggested that polypectomy associated with topical corticosteroids can effectively treat NP while reducing the duration of surgery, postoperative complications, and healing time. However, until now, no study has directly compared the functional results of polypectomy with those of radical ethmoidectomy, to our knowledge. Another interesting option, in a future study, could be to include a third group of patients undergoing functional ethmoidectomy.

This study was based on strict inclusion criteria (failure of medical treatment, a single surgeon for both techniques, and minimum postoperative follow-up of 3 years).
and exclusion criteria (secondary polyposis, particular clinical course, and history of previous sinus surgery). Preoperative and postoperative data were systematically collected in the medical records, and few patients were lost to follow-up (12/139 [8.6%]). The bias related to the retrospective nature of the study can therefore be considered limited. Moreover, although this study was not randomized, bias was limited by providing patients with the choice between the 2 types of surgery. The 2 study groups were of sufficient size (>30) and statistically comparable because they were homogeneous in terms of age, sex ratio, prevalence of atopy, asthma, aspirin intolerance, smoking, and severity of NP (based on the GFS and global CT scores). However, a significant difference was observed between the 2 groups for the GAS and facial pain scores. The GAS (polyp size in the nasal fossa) was higher in the polypectomy group. It can therefore be hypothesized that patients who chose polypectomy may have had more severe nasal congestion. However, the congestion score that was not significantly different between the 2 groups did not support this hypothesis. The facial pain score was significantly higher in the radical ethmoidectomy group. This finding could suggest that patients could consider pain to be a sign of sinus obstruction and therefore more readily chose radical ethmoidectomy after being informed that this procedure included wide opening of the sinuses. However, comparison of CT scan scores, which did not demonstrate more severe sinus opacities in either of the 2 groups, did not corroborate this hypothesis.

The functional results of each technique are in accordance with those reported in the literature for polypectomy and radical ethmoidectomy and showed a significant improvement for all symptoms 3 years after surgery, especially for nasal congestion, which remained the most markedly improved symptom. Comparison of the 2 surgical techniques showed that the GFS was similar in the 2 groups (even when considering only the Samter triad patients) at 3 years of follow-up, suggesting an overall comparable effectiveness of the 2 techniques. However, comparison of the time course of each symptom between the 2 groups showed that radical ethmoidectomy was more effective regarding nasal pain and nasal congestion. In parallel, a better result was also observed on the GAS with radical ethmoidectomy (factor 3 reduction at 3 years postoperatively) compared with polypectomy (factor 1.8 reduction at 3 years postoperatively). It is not surprising that radical ethmoidectomy was more effective in reducing polyp volume because the initial resection of polyps is much more extensive with this technique than with polypectomy. In contrast, despite the lower GAS score, the GFS score was not lower in the radical ethmoidectomy group 3 years postoperatively. Similarly, the rate of patients operated on again for symptomatic polyp recurrence was the same in the 2 groups (9.1% vs 8.0%). These results contrast with those of previous studies, which included simple polypectomy without long-term topical corticosteroid treatment. Our data may highlight the benefit of postoperative topical corticosteroid therapy with fairly consistent adherence, although it tended to decrease with time. Only 1 published study has compared polypectomy and functional ethmoidectomy. In this multicenter retrospective study (ie, with different surgeons), the authors compared 844 patients after polypectomy to 1004 patients after functional ethmoidectomy and found no difference in terms of symptoms (Sinonasal Outcome Test 22 questionnaire) or surgical recovery after 3 years. Jankowski et al compared radical ethmoidectomy (34 cases) to functional ethmoidectomy (29 cases), which is a more extensive procedure than polypectomy. This retrospective study with a high dropout rate (47%) showed that radical ethmoidectomy provided better improve-
ment of symptoms than functional ethmoidectomy, particularly for nasal congestion, rhinorrhea, and facial pain. Similar results were obtained with the 2 techniques on anosmia,\textsuperscript{6} as reported in the present study. In the literature, the mean improvement of anosmia is approximately 31% but can vary widely from 13% to 91%.\textsuperscript{5} Although some authors, such as Blomqvist et al,\textsuperscript{18} consider that functional surgery has no additional effect on anosmia compared with medical management, other authors, such as Bonfils,\textsuperscript{11} have reported significant improvement in anosmia after radical ethmoidectomy in 44.6% of cases. These marked differences reflect the difficulty of evaluating this symptom, which remains a challenge in the management of NP.

No severe complication was reported in either group, but fewer local complications were observed in the polypectomy group (8.0% vs 18.3%). This tendency, confirmed by another study,\textsuperscript{19} can be explained by the limited dissection with minimal healing process in the narrow zones of the anterior ethmoid and frontal recess. The use of the microdebrider may also help to prevent scar tissue formation, as previously suggested.\textsuperscript{19,20} Moreover, polypectomy was always performed in a 1-day surgery unit. These aspects may therefore improve patient comfort and reduce hospital costs and length of sick leave, although these points were not specifically evaluated in this study.

This study suggests that polypectomy with middle antrostomy represents a possible alternative to radical ethmoidectomy when surgery is required for NP. Although the results after 3 years of follow-up are less satisfactory concerning facial pain and nasal congestion with more anatomical recurrences, the global functional results and the rate of surgery for recurrence are comparable with fewer local complications, at least during the first 3 years. Larger series with longer follow-up are, of course, mandatory to confirm these results. Polypectomy has a number of advantages: short duration and minimal invasiveness of the procedure, better patient comfort, better tolerance, and lower costs. In the current climate of medicolegal pressures and in view of the benign nature of the disease, the alternative between minimally invasive surgery and radical surgery, requiring long training to avoid rare but potentially significant complications, must be considered. Patient information and education are of prime importance, and the results of this study may help surgeons provide patients with better information in the future. Finally, because the goal of surgery in NP is not to cure the disease but to improve the patient’s quality of life and ensure better control of the disease, we think it is reasonable to provide the patient with an enlightened choice of the type of surgery while emphasizing the need for long-term topical corticosteroids in every case.

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Author Contributions: Drs Devars du Mayne, Coste, and Papon had full access to all the data in the study and take responsibility for the integrity of the data and the accu-

Table 2. Complication and Subsequent Operation Rates in the Radical Ethmoidectomy and Polypectomy Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Radical Ethmoidectomy, No. (n=77)</th>
<th>Polypectomy, No. (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSF leak</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ocular problems</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Severe bleeding</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Synechia</td>
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<td>5</td>
</tr>
<tr>
<td>Local infection</td>
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<td>0</td>
</tr>
<tr>
<td>Nasofrontal duct stenosis</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mucocele</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Subsequent operation</td>
<td>7\textsuperscript{a}</td>
<td>4\textsuperscript{a}</td>
</tr>
</tbody>
</table>

Abbreviation: CSF, cerebrospinal fluid.

\textsuperscript{a} Four operations for poly recurrence.

Figure 4. Adherence to corticosteroid therapy at various postoperative time points (3 months, 1 year, and 3 years postoperative), in the radical ethmoidectomy and polypectomy groups. A, Nasal corticosteroids. B, Oral corticosteroids. * P<.001. AU indicates arbitrary units; error bars, standard deviation.
racy of the data analysis. Study concept and design: Devars du Mayne and Coste. Acquisition of data: Devars du Mayne and Coste. Analysis and interpretation of data: Devars du Mayne, Prulière-Escabasse, Zerah-Lancner, Coste, and Papon. Critical revision of the manuscript for important intellectual content: Devars du Mayne, Prulière-Escabasse, Zerah-Lancner, Coste, and Papon. Statistical analysis: Zerah-Lancner. Drafting of the manuscript: Devars du Mayne, Coste, and Papon. Critical revision of the manuscript for important intellectual content: Devars du Mayne, Prulière-Escabasse, Zerah-Lancner, Coste, and Papon. Statistical analysis: Zerah-Lancner. Administrative, technical, and material support: Coste. Study supervision: Coste. Financial Disclosure: None reported.

REFERENCES