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Evaluation of powered instrumentation in out-patient revisional sinus surgery*

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SUMMARY

A feasibility study was carried out to prove the benefits of powered instrumentation, i.e. microdebrider in revisional surgery under local anaesthesia of chronic sinusitis in out-patients. Acceptance by the patients was investigated by questionnaire. Out-patient surgery is well tolerated by the majority (79,2%) of patients. Ninety-four percent would undergo the treatment again if necessary. An operation under general anaesthesia could be avoided in the cases we submitted to investigation. The cost-effectiveness of the method is thus an important consideration, despite calculating high prime costs and rather expensive, expendable instrumentation.

Special consideration is attributed to a new feature added to the debrider device. To improve out-patient care, we developed an integrated electrocoagulation unit which supplements the microdebrider. It proved to be effective and easy to use. Bleeding was reduced to a minimum. Hence, nasal packing could be avoided in all out-patient cases.

The possibility of causing severe complications using the microdebrider-technique is not eliminated as was shown in the anatomical specimens.

Based on our experience, reduction of strong bony structures is subject to limitations at present. We therefore recommend the use of microdebriders for soft tissue manipulations, especially in revisional surgery. The microdebrider proved to be a significant advantage in out-patient surgery for recurrent sinusitis.

Key words: powered instrumentation, sinus surgery, revisional surgery, chronic sinusitis, microdebrider

INTRODUCTION

In order to achieve improved results and avoid adverse effects, powered instrumentation was developed for the use in sinus surgery since it proved effective in joint surgery (Reinert and Fritzemeier, 1988). Meanwhile, microdebrider systems are widely considered to be an advantageous technical introduction in sinus surgery instrumentation (Christmas and Krouse, 1996a; Setliff, 1996; McGarry et al., 1997; Nguyen and Leopold, 1997).

Recurrent polyposis following sinus surgery is a common phenomenon. In about 10% of the cases, revisional surgery is required (Hosemann et al., 2000). Keeping this aspect in mind, the authors favor functional sinus surgery for cases of advanced diffuse polyposis that avoids remnants of cell septs and leaves behind smooth ethmoid walls and edges. We refer to this approach as "Compartment Surgery" (CS), a term introduced by Hosemann in 1996. In case of recurrent polyposis requiring surgery, an operation is done fairly easily since landmarks are in place and polypoid tissue may be removed along the ethmoid and sphenoid walls. Ideal conditions for the application of microdebriders are given therefore.

In this study we focused on revisional out-patient surgery with the microdebrider. Its acceptance in the office is described psychometrically. Encouraging results in out-patient revisional surgery gave rise to technical improvement of the microdebrider system. We modified the commercial system to provide high-frequency cautery as an additional feature of the microdebrider. The accuracy of manipulation is improved, bleeding minimized and thus progress of the operation is not interrupted.

In first-step surgery we encountered the following limitations of the XOMED-System:

Surgical intervention in the sinus system for chronic sinusitis consists of either work on soft tissue only, which can be done easily with the microdebrider, or on tissue including bony structures with low mechanical resistance which can be removed with some patience. Manipulations on strong bones such as fenestration of the anterior sphenoid wall are more difficult.

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Questions as to the safety of the procedure were studied separately on anatomical specimens.

METHODS

Instrumentation and development

In this study the "Blackstar Wizard" Micro Debrider System (XOMED Surgical Products) was used. The cutter is available in various designs. We preferred straight serrated cutters with a diameter of four millimeters. In first-step surgery, a curved cutter was used as well. We introduced a new feature to the microdebrider. With a cautery function, simultaneous coagulation is allowed now concurrently to ablation of tissue and suction. Thus, visibility is significantly improved during the course of surgery (Figure 1).

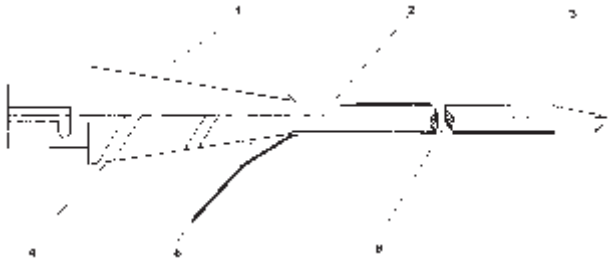

Figure 1. Modified cutter of the "BlackStar Wizard". Insulation covers the metal part of the tube, leaving the windowed tip free for tissue contact. A wire connects the device to the coagulation unit: 1 body of cutter, 2 insolation of cutter tube, 3 electric conducting working tip of cutter, 4 suction, 5 electric wire, 6 cutter blade in insulated metal tube.

The microdebrider tube is covered with insulation. Only the tip of the tube with the window to the inner tube remains conducting metal. A wire connects the tube with a commercial monopolar cautery (Erbe). Electricity is shielded except at the working tip of the device. The ground plate is attached to the patient's neck. A four millimeter cutting blade with serrated edges on the outer and inner tube is used in the oscillating mode at 1500rpm. With every turn of the cutter tube, the window of the outer sheeth closes and tissue which is cut is energised as well. Cautery can be applied while simultaneously cutting tissue. Bleeding is stopped in the instant it occurs and, for the economy of the surgical procedure, coagulation can be performed without removing the instrument. If a vessel comes into sight, it may be coagulated in a common way using the tip of the tube. Fumes are driven away immediately and thus visibility is not compromised.

Revisional surgery

Sixty adult patients suffering from relapse of chronic sinusitis irrespectice to prior endoscopic 'compartment'-surgery were studied in a prospective study during the last 4 years. All patients were subjected to revisional surgery by the same surgeon using 30°- and 70°-angled endoscopes. The median age was 46 years (14-86), with an equal number of males and females. Elapsed time between the primary operation and reoperation with the microdebrider ranged from 2 to 181 months, with an average of 41 months. Five patients suffered from ASA-triad, 36 from recurrent chronic polyposis with no concomitant analgesic intolerance, the others from scarring or pyoceles. Nasal endoscopy was performed in all patients prior to surgery, and a CT scan of the paranasal sinuses was also obtained.

Surgery for recurrent polyposis was performed in this study with the patient in the upright position under local anaesthesia. An intravenous inlet was placed and continuous surveillance of the patient was secured by a nurse until discharge. Premedication was carried out in 25 patients by intramuscular injection of 5 to 10 mg of triflupromacine and of 50 mg pethidin 45 minutes prior to surgery. The mucosa was anaesthetized with cocaine/HCl pledgets and decongested by administration of neurosurgical swabs soaked with 1:1000 epinephrine for 10 minutes. Additionally, the lateral nasal wall and middle turbinate was injected with 1:200 000 epinephrine and xylocaine. Cotton pledgets saturated with 1:1000 epinephrine were placed under the middle turbinate a second time. A minimum of 10 minutes were allowed to pass in order to obtain maximal vasoconstriction and anaesthesia. Blood loss was measured in the same way as in first-step surgery. All manipulations were controlled by rigid endoscopes. Polyps were dissected beginning in the rear of the ethmoid searching for the sphenoid sinus as a landmark. Starting from the roof of the sphenoid, dissection of polypoid masses, granulation tissue and scars was carried out along the skull base serving as the leading structure on the way to the frontal recess. A mucosa-preserving surgery was performed, although identification and preparation of the major landmarks was carried out. Synechia or scarring had to be dissolved. Nevertheless, nasal packing could be avoided in all cases. All patients were discharged within one hour postoperatively. In both patient groups endoscopic photo documentation was obtained pre- and postoperatively.

Patient questionnaire

To examine the acceptance of the method in reoperations, we sent questionnaires to 58 patients. Eighty-two percent were returned. Twelve questions had to be answered by checking one out of three or four choices.

Discomfort induced by routine postoperative care is a common phenomenon familiar to all ENT-surgeons and operated sinus patients. In order to produce a vivid picture of discomfort accompanying the intervention, we asked patients to compare sensations they felt during the microdebrider operation with discomfort related to endonasal care following primary surgery.

We were interested in whether the patient would choose this treatment again knowing the various pros and cons. Details such as localization, endurance and pain characteristics were obtained. In an additional item we asked the patient to describe his state of health using a visual analog scale.

RESULTS

No intraoperative surgical complications occurred.

Revisional surgery

Premedication proved to be helpful in some cases subjectively. However, the evaluation of the questionnaires did not show significant benefit for suplementary analgetic and neuroleptic medication with pethidin and triflupromazine.

Operation time ranged from 10 to 45 minutes. Blood loss did not exceed more than 20 ml in any case.

Differences in the amount of bleeding for interventions performed with the use of the cautery-feature compared to those without were not significant. Visibility was distinctly improved, however, by use of integrated monopolar cautery.

Ninety-four percent of our patients claimed, that they would undergo microdebrider treatment again if necessary (Figure 2).

Most patients perceived postoperative care as well as microdebrider treatment as being "tolerable". Summarizing the checkmarks "insignificant" and "tolerable", we learned that 87% of

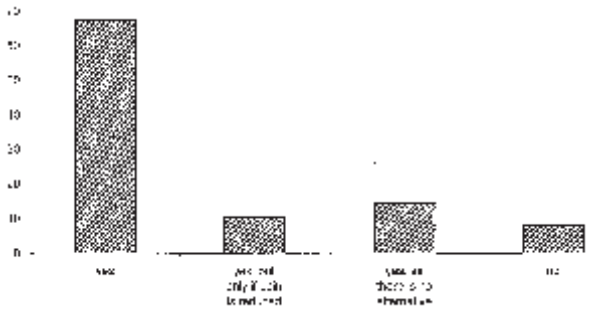

Figure 2. Global acceptance of out-patient microdebrider surgery in the office: if necessary, another microdebrider operation under local anaesthesia or preferation to undergo a revisional operation under general anaesthesia?

the patients find microdebrider reoperation less or just as annoying as usual postoperative care with suction and debridement of crusts which is carried out after having applied pantocain and xylomethazoline spray (Figure 3).

Immediately after either intervention, microdebridement as well as routine postoperative care, tension or a feeling of pres-

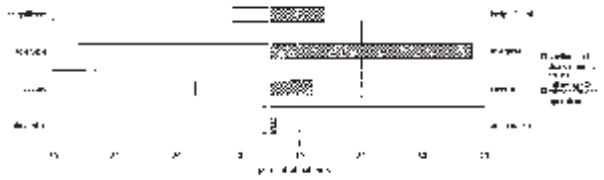

Figure 3. Degree of inconvenience. Comparison of postoperative care including debridement of crusts and suction vs. microdebrider reoperation.

sure was the predominant problem. Other complaints were "blocked nose" in those who received partial or total ethmoidectomy and "rhinorrhea" in microdebrider patients.

The site of discomfort or pain varied in the different postoperative protocols: compartment surgery left patients with frontal headache, in most cases described as pressure and tension. After microdebrider treatment patients complained - if at all - of overall discomfort in the nose, mostly as profuse secretion, diffuse headache.

Figure 4 illustrates how patients rated the outpatient microdebrider procedure using a visual analog scale as an alternative to surgery under general aneasthesia.

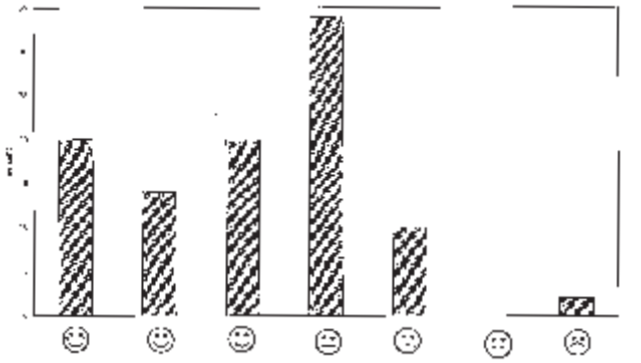

Figure 4. Degree of satisfaction with the performed management of recurrent polyposis. Self assessment of the current well-being of patients investigated using a visual analog scale.

DISCUSSION

A review of the literature (Christmas and Krouse, 1996b) shows that (Setliff and Parsons, 1994; Christmas Jr. and Krouse, 1996; Goode, 1996; Krouse and Christmas Jr., 1996; Bernstein et al., 1998) powered dissection has been adopted by an increasing number of advocates. This study aimed to evaluate its advantages in out-patient revisional surgery. The study describes the favorable effect of a new cautery-feature. Furthermore, the pros and cons in first-step surgery are taken in consideration.

In about 30% of patients who received surgery for chronic, polypoid sinusitis, recurrent polyposis is diagnosed later on. Revisional surgery was needed in 13%. Topical and systemic administration of steroids does not lead to satisfactory relief of symptoms in these cases (Bouton, 1992). In our hands surgery is performed under general anesthesia, the patients are hospitalized for four days following the operation and nasal packing is removed after two days.

Concerning the current limitations in primary sinus surgery we concentrated on revisional surgery under local anaesthesia in the office. The aim was to treat patients sufficiently in only one session and discharge them the same day without nasal packing. In treatment with traditional instrumentation, bleeding - even if only to a minor extent - prohibited further manipulation for safety reasons in several cases.

In the series of patients involved in this study interruption of the procedure because of bleeding was not necessary in any case due to the simultaneous suction feature of the device (Bernstein et al., 1998).

The operator's field of vision was substantially improved by use of integrated cautery. It may be used continuously, delivering its electrical current with each rotation of the inner tube which avoids bleeding in the very instant of cutting tissue. It may be applicated selectively as well. The operation is easy to perform and does not need to be interrupted for removal and reinsertion of the instrument. Coagulation can be applied without changing the scheduled movement of the microdebrider tip. The flux of the operation is maintained to a great extent.

The results described in this study are priliminary. The insulated shaver-tip is custom made and may not fit general requirements of safety and reliability asked for medical products. Further development of the device should be performed.

Monopolar cautery near the skull base may imply danger to the patient, particularly in general anethesia. It should be used with low power and great care near susceptible structures.

Discomfort or pain that patients have to tolerate is no limitation for the employment of the method. On average, the patients experience the intervention compareably to routine postoperative care following primary surgery.

Premedication is not essential, local anesthesia is sufficient in most cases. We recommend thorough local anesthesia to the mucosa of the lateral nasal wall. We are going to disclaim premedication.

In first-step surgery, mucosa-conserving, functional surgery aimed at circumscript targets in the sinus system has proven beneficial for most patients and is accepted by the majority of surgeons (Kennedy et al., 1985; Kennedy, 1985; Stammberger et al., 1987; Wigand and Hosemann, 1994). During surgery for chronic, diffuse polypoid sinusitis we put great effort into creating an operative cavity, limited by smooth walls while still preserving local mucosa to the utmost of our possibilities. We refer to this type of intervention as "Compartment Surgery" (Hosemann, 1996). The reasoning behind this method is to allow easy access and control in the postoperative period, and it is very suited to microdebridement in revisional surgery. Excellent conditions are provided for reoperation in case of recurrent polyps, scarring, and in selected cases for pyoceles and mucoceles as well.

Microdebrider reoperation is done in a convenient and safe manner under local anaesthesia (Christmas and Krouse, 1996b). Polypectomy is performed to a satisfactory degree since visibility is superior. The use of integrated cautery emphasizes this point impressively.

In a small series, 10 out of approximately 400 patients treated in a year using the traditional functional endoscopic sinus technique were compared to the approach with the "Blackstar Wizzard". Solid bone unlike soft tissue could not be removed with the "Xomed Black Star" in a reasonable amount and access to the far ends of the sinuses is not possible (Goode, 1996). Therefore, exclusive use of the microdebrider in endoscopic sinus surgery, i.e. primary surgery, is not yet suggestive. In addition, single use devices are still expensive and reimbursement by health insurance companies has not been satisfactorily resolved.

The risk of severe complications is not eliminated by application of powered instrumentation (Bernstein et al., 1998). Penetration of the orbit and anterior skull base can occur. Anatomical preparations of human anatomical specimens show the risk involved with the microdebrider if misplacement occurs without being immediately recognized by the surgeon. The impact necessary to penetrate the skull base and orbit of the anatomic specimens was quite similar in our hands whether using the microdebrider, 45 degree Blakesley-foreceps, or a Hajek-punch.

Nonetheless, differences do exist as the microdebrider is less rigid in itself. Accidential penetration of the delicate structures is less likely. There is also no need for pulling or tearing as with foreceps. Frontal and maxillary sinuses are not completely within reach and thus conventional instruments must also be made available.

CONCLUSIONS

We used the Xomed-Microdebrider for out-patient surgery with the best results if the patient had undergone Compartment Surgery beforehand. The method is widely accepted by patients and hospitalization can be avoided in many cases. Operations done exclusively with a microdebrider in the first step of endonasal surgery still show limited benefit to date since drilling and removing bony structures is not yet effective enough. The results achieved are encouraging nevertheless. The authors believe that powered instrumentation will expand to all stages of endonasal sinus surgery due to its favorable characteristics which were emphasized in this study as follows: keeping the operative field clear, restriction to fewer instruments, the cutting approach of the device and benefits in revisional surgery.

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ANNOUNCEMENT