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Endoscopic endonasal sinus surgery. Approaches and post-operative evaluation

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SUMMARY

Recently, by using a rigid endoscope and a VIDEO system (CCD camera and TV monitor) for endonasal sinus surgery, surgical complications have been prevented. This is because a decrease in the dead angles achieves wide and clear visualisation of the site of manipulation of the paranasal sinuses, which have a delicate and complicated structure. Our endonasal sinus procedures under local anaesthesia consist of removal of pathologic mucosa within the anterior and posterior ethmoid sinuses, opening of the cellulae and establishment of sufficient communication between the ethmoid sinus and the maxillary and frontal sinuses. Even if pathologic mucosa is present in the maxillary sinus, we leave it intact and attempt to heal it by achieving good ventilation. The surgical technique often includes correction of septal deviations and conchotomy.

In patients with moderate to severe sinusitis (62 cases, 102 examples) who underwent endoscopic endonasal sinusectomy by the same surgeon, X-ray studies of post-operative changes of the maxillary sinus were performed. Fifteen cases showed excellent results, 47 good results, 30 fair results and 10 were unchanged. Clinical symptoms exhibited an overall improvement rate of 73%. Improvement of nasal discharge and nasal obstruction was more easily achieved than improvement of post-nasal discharge.

INTRODUCTION

The report by Kenzo Takahashi in 1921, on intranasal surgery for chronic sinusitis constituted the beginning of endonasal sinusectomy in Japan. Endonasal sinusectomy has been developed and performed in our department

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for many years as a useful method for treating chronic sinusitis (Takahashi, 1950). The main features of this surgical technique, under local anaesthesia, are removal of pathologic mucosa of the anterior and posterior ethmoid sinuses by an endonasal approach, opening of the cellulae and establishment of sufficient communication between the ethmoid sinus and both the maxillary and frontal sinuses. Even if pathologic mucosa is present in the maxillary sinus, we leave it intact and attempt to heal it indirectly by achieving good drainage and ventilation. The sphenoidal sinus is opened if necessary. Severe cases requiring surgery of the sphenoid are relatively rare, accounting for less than 10% of all cases. A deviated septum (especially upper deviation), where present, should be corrected. Any swelling of the inferior turbinate is also treated. Where there is a severe lesion of the maxillary sinus and this is considered to be a mucosal condition, antrostomy is performed in the wall of the inferior meatus, or a Caldwell-Luc approach is used at the same time. Healing of the frontal sinus can be obtained easily by sufficient opening up of the nasofrontal duct.

Presently, endonasal sinus surgery using an endoscope, based on these principles, is carried out in our hospital. In this paper, we describe these surgical techniques and their post-operative evaluation.

INSTRUMENTS

It is considered that recent advances achieved in optical equipment and apparatus have remarkably broadened the range of safety and conservative therapy. Namely, with the use of the rigid endoscope the operation site can be visualized clearly and close observation becomes possible.

Moreover, by connecting a CCD camera and observing the image on a TV monitor, a broad operational field can be obtained. The operation can be performed by viewing the operative field directly through an endoscope or by watching the image on the TV monitor.

Since there are many dangerous sites around any sinus, such as the orbit, the optic nerve, the ethmoid nerve, the ethmoid artery, the inner carotid artery and the medial cranial wall, conventional sinus operations without the use of an endoscope are not infrequently associated with cranial or ocular complications. Apart from anatomical hazards, the presence of dead angles and problems of difficult visualization are contributory. However, with the development of endoscopy, it becomes possible to obtain a wider and brighter visual field, to decrease dead angles, to obtain clear vision and to approach the visual field more closely. Thus, treatment of the nasofrontal duct and the ostium of the maxillary sinus (fontanelle) becomes easier and dangerous sites such as the optic canal, the roof of the ethmoid sinus and the orbital medial wall can be detected early with less blood loss (Ashikawa et al., 1982). In addition, diagnosis of the severity of the mucosal lesions has become easier permitting more thorough cleansing of

lesions with more rapid post-operative epithelization. Recently, a variety of nasal operations using the endoscope has been attempted (Yamashita, 1983; Kennedy, 1985; Stammberger, 1985; Moriyama et al., 1988; Wigand et al., 1988). We have developed various instruments such as a fine forceps, a forceps for the naso-frontal duct, a flexible suction tube, a forceps which can open the fontanelle sufficiently (Figure 1) and those which can treat pathologic mucosa in the maxillary sinus through the fontanelle under endoscopic observation.

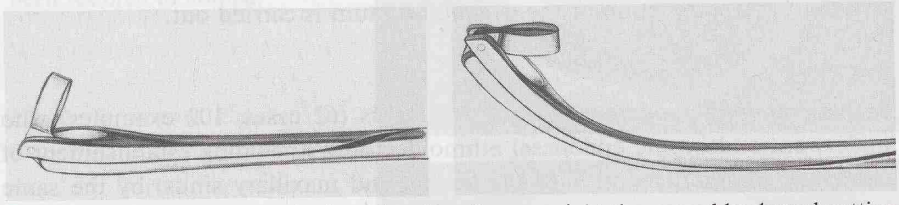

Figure 1. Left an ordinary backward cutting forceps, right the curved backward cutting forceps which we developed.

Usually a rigid endoscope is used and two types, 0° and 70° are available. The 0° endoscope is used for operations of the ethmoid sinus and the 70° endoscope is used for treatment of the nasofrontal duct and the fontanelle. Occasionally, an endoscope of 110° may be required for observation of the ostium of the maxillary sinus. Regarding the size of the endoscope, 4 mm diameter models are easy to manipulate during operation. However, clearer images can be obtained on the monitor with endoscopes of 5 mm or 6 mm in diameter. Unfortunately, the thickness of these endoscopes makes it difficult to manipulate the forceps. We use an Olympus endoscope of 0° or 70° with a diameter of 5 mm and Storz endoscopes of 0° with a diameter of 6 mm diameter and 0°, 30°, 70° or 110° with a diameter of 4 mm, according to the individual conditions.

SURGICAL TECHNIQUE

Surface anaesthesia by application of 4% xylocaine is performed. Moreover, 2% xylocaine (containing epinephrine) may be injected around the aggar nasi. In cases where thorough treatment of the fontanelle is required, a nerve block of the second branch of the trigeminal nerve (anaesthesia to fossa pterygopalatinus) is performed. Usually, surface anaesthesia with xylocaine is sufficient for intranasal operations under endoscopic observation, with less pain and less blood loss. Operations are performed with patients in a semi-reclining position. In practice, intranasal procedures are conducted in close anatomical relationship to the ground lamella in the ethmoid sinus. The operation is started from the concave

side of the septal deviation. First of all, the bulla is opened through the middle meatus, then the III ground lamella is removed and the posterior ethmoid sinus is opened. By removal of the ground lamella the middle turbinate becomes movable. Then infundibular cells are removed and the communication with the frontal sinus is enlarged. If a lesion is present in the maxillary sinus, the fontanelle is removed and sufficient communication with the maxillary sinus is established. If necessary, the sphenoidal sinus is opened and cleansed. If the inferior turbinate shows hypertrophy, conchotomy is performed. The olfactory cleft is opened by correcting the position of the middle and superior turbinates. If necessary, reconstruction of the deviated septum is carried out.

RESULTS

In patients with moderate to severe sinusitis (62 cases, 102 examples) who underwent endoscopic endonasal ethmoidectomy (including establishment of sufficient communication with the frontal and maxillary sinus) by the same surgeon, X-ray tomography studies of post-operative changes of the maxillary sinus were performed. There are five classifications of the shadow of the maxillary sinus (−, ±, +, ++, +++). Out of the 102 examples, we had 15 with excellent results (three levels up; Figure 2), 47 with good results (two levels up), 30 with fair results (one level up) and 10 were unchanged.

Post-operative endoscopical observation usually showed epithelization of the ethmoid sinus. Although scar formation, adhesions and development of edematous mucosa and polyps in the ethmoid sinus were observed in some patients, in most cases, the patient's mucosal condition was improved in proportion to the severity of the preoperative sinus condition.

For clinical symptoms there are four classifications (−, +, ++, +++). An improvement jump of three levels is considered excellent. A jump of two levels is considered good. A jump of one level is considered fair. Concerning nasal obstruction, excellent improvement occurred in 27% of cases and good improvement in 59%, with a total improvement rate of 87%. None of the cases was rated as unchanged or aggravated. The improvement rates (including excellent and good improvement) for nasal discharge and postnasal discharge were 45% and 43%, respectively, with 10% and 15% of the cases rated as unchanged and aggravated, respectively. For headache, 65% of the cases obtained excellent or good improvement and 35% fair improvement and there were no cases rated as unchanged or aggravated. For olfactory disturbance, 31% of the cases showed good improvement and 32% were unchanged. None of the cases showed aggravation.

These findings show improvement of nasal discharge and nasal obstruction to the more easily realized than improvement of postnasal discharge. The overall improvement rate, including excellent and good improvement was 73% (excellent improvement 18% and good improvement 55%). Thus, overall a considerable

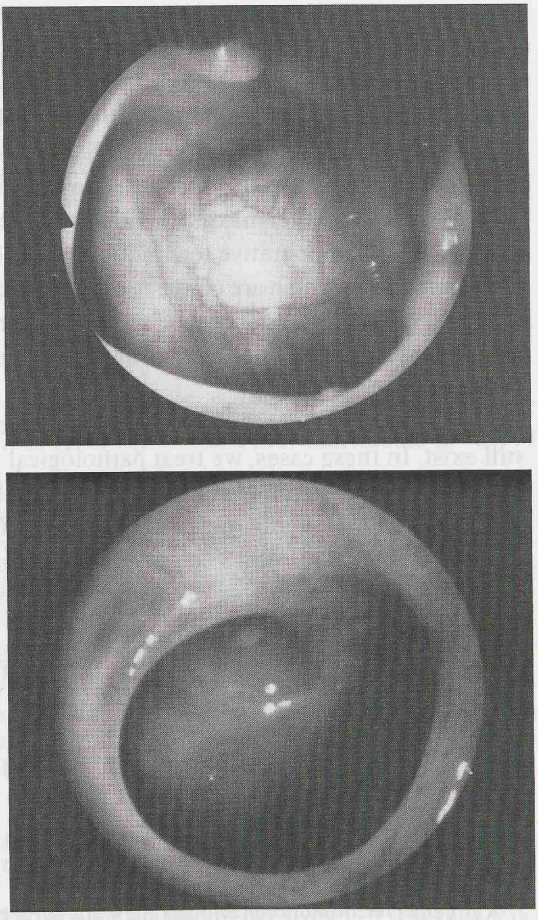

Figure 2. Post-operative findings of two fontanelle cases (maxillary sinus), one year after endonasal surgery. Each of the opened fontanelles still remains wide open. The drainage and aeration between the maxillary sinus and the ethmoid sinus is unimpeded and the mucosa of the maxillary sinus has been restored to normal.

number of favourable results were obtained. However, local findings and symptoms were not always consistent. It is unnecessary to state that post-operative care such as irrigation of the maxillary sinus plays an important role in maintaining these satisfactory results.

CONCLUSION

In conclusion, a clear visual field provided through endoscopy enables us to perform successful operations on the ethmoid sinus, nasofrontal duct and fontanelle. Therefore, endonasal sinusectomy with correction of intranasal structural deformities can be carried out safely and easily and the indications for this type of surgery will be widened. Most mild, moderate and severe lesions of the maxillary sinus can be improved by sufficient opening of the fontanelle. In cases where morphology of the ostium of the maxillary sinus is almost normal, the fontanelle should be opened if a lesion is seen in the maxillary sinus.

In order to perform safe operations of the sinuses, which have delicate and complicated structures, the use of the endoscope is essential. Various improved forceps have made it possible to treat the nasofrontal duct and the fontanelle under direct observation and to establish sufficient communication. Moreover, intranasal-maxillary sinus treatment via the fontanelle can be performed more easily today, we apply our procedures to the worst cases of sinusitis which have severe lesions in the maxillary sinus and achieve favourable post-operative results. Thus, this operative technique can also be applied in most cases of severe chronic sinusitis which are conventionally performed as an intranasal, combined with a Caldwell-Luc, operation. Taking into consideration the increased number of mild cases of sinusitis today, this technique can be utilized more and more frequently.

However, severe cases of sinusitis which cannot be improved by this technique still exist. In these cases, we treat pathological mucosa in the maxillary sinus by means of a laser via the widely opened fontanelle. A Nd-YAG laser with a laser-guide of 1.8 mm in diameter (non-contact type) is used, and the lesion is irradiated at 25–30 W for 2 sec per dose. It can be applied as treatment of very severe lesions in the mucosa of the maxillary sinus as well as other post-operative mucous membrane difficulties.

Because of the small number of cases treated by this method and the short observation period, no definitive conclusions can be drawn. However, we believe that this technique provides a better improvement rate for lesions of the maxillary sinus when compared to conventional procedures.

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