

Unilateral choanal atresia. A possible indication for computer aided surgery ?

”A report of two cases”*

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SUMMARY

Choanal atresia (CA) is a congenital obstruction of the posterior nose. Bilateral CA is a paediatric emergency and must be treated surgically in the first few weeks after birth. This is in contrast to unilateral CA, because surgical management can be planned more selectively. Transpalatal surgery for CA is a safe procedure. The endonasal technique is minimally invasive and less traumatic; however, a major disadvantage is a limited field of vision. Computer aided surgery using images acquired by computer tomography (CT) or magnetic resonance imaging (MRI) is an application that has emerged in the last few years. This application provides an additional safety factor for endoscopic surgery to resolve choanal atresia, especially in cases of another malformation. We report results from two cases of unilateral CA who were surgically managed with Computer aided surgery.

Key words: choanal atresia, computer aided surgery, endonasal approach, malformation, microdebrider

INTRODUCTION

The surgical approach for unilateral or bilateral choanal atresia (CA) can be transpalatal, transantral, transseptal or endonasal (Pirsig, 1986). Although transpalatal and transantral procedures are safe with few complications (Owens, 1965), transseptal and endonasal techniques are minimally invasive and less traumatic (Anderhuber and Stammberger, 1997). The drawback of these latter procedures is the limited field of vision; however, in the last several years, more surgeons have preferred to operate endoscopically and have had good results and few complications (Stankiewicz, 1990; Sadek, 1998). To improve upon this procedure, a computer aided surgery (CAS) system can be used to provide an additional safety factor. This allows the surgeon to use a precise and more efficient surgical approach.

We report two cases in which an optical frameless CAS system developed in Bern was used with an endoscopic procedure (SurgiGATE-ORL™, Medivision, Synthes-Stratec Inc, CH-4436 Oberdorf) (Figure 1) (Caversaccio et al., 1997). Preoperative planning includes an axial computer tomography (CT) of the skull with a slice thickness of 1.5 mm and a spacing of 1.5 mm or a helical scan. During the operation, and after matching of the actual position of the head with the CT findings by means of anatomical landmarks, the CAS system allows an online pursuit of the instrument as well as the endoscope using an in-



Figure 1. Visible is the infrared camera (top left), the workstation with integrated endoscopic picture and the position of the surgeon.

frared camera for the detection of the tools (equipped with light emission diodes).

CASE 1

A 6-year-old boy had repeated rhinitis and an obstruction of the right nostril but no history of allergies or known hyperplasia of the adenoids and tonsils. The development of the child was nor-

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mal with no other known malformation. A contrast-choanography revealed an obstruction on the left side. The preoperative CT done for exclusion of another malformation of the skull and for the preparation of CAS, confirmed a unilateral bony choanal atresia. The boy was operated endoscopically with the help of our CAS system. The vomer and the bony plate was taken away; it did not exist a normal inferior or middle turbinate. In the narrow orifice of this young child, the CAS system was very useful especially to see the borders to the orbita and the parasphenoidal area. Additionally, we were able to be more radical than usual during endoscopic opening of the bony plate. To maintain the space we inserted a silicone tube which was

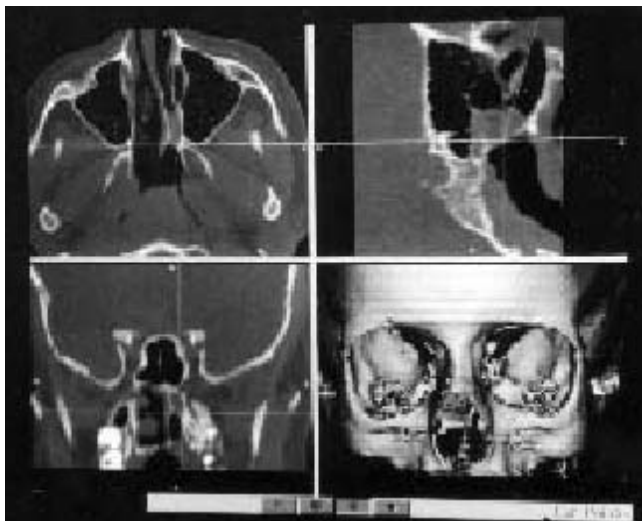


Figure 2. Monitor view (axial, sagittal, coronal view and 3D reconstruction) of a deformity of the septum and a bony unilateral choanal atresia on the left side. The crosshair indicate the position of the pointer tip on the bony plate (good visible on the sagittal view). On the coronal view of the CT is shown impacted teeth on the maxilla, the septum deformation as an absence of the inferior and middle turbinate on the left side [case 2].

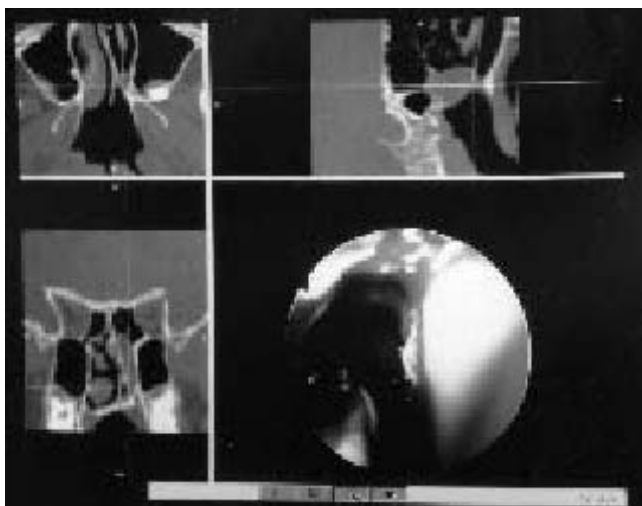


Figure 3. Perforation and cut of the bony plate with the guided microdebrider. The position of the microdebrider is visible on the CT layer (line going to the crosshair) and on the endoscopic view with the opening of the bony plate. On the coronal view of the CT is shown the asymmetry of the palate, the septum deformation and the absence of a normal inferior and middle turbinate on the left side [case 2].

removed after 6 weeks. The patient was discharged after 2 days without further intervention (follow-up: one year).

CASE 2

A 13-year-old girl had not been seen for several years by a physician although she had an incomplete cleft palate. No operation was done. She suffered of repeated rhinitis, obstruction of the left nostril, teeth deformation and speech disorder. The preoperative CT revealed a septum deformation with a complete bony obstruction of the nose and absence of a normal inferior and middle turbinate on the left side as an asymmetry of the palate (Figures 2 and 3). On clinical examination, a patent soft palate, a growth deformation of the teeth and small tonsils and adenoids were noted. An endoscopic operative procedure aided by the CAS was done. It provided more security and reduced stress in a delicate area without normal anatomical landmarks as inferior or middle turbinate. In addition it allowed the surgeon to preview and to measure the distance to the bone border on the CT slices. The vomer, the bony plate and a part from the pterygoid was taken away (Figure 3). No complications occurred. To maintain the space we inserted a silicone tube which was removed after 6 weeks. On account of the teeth problems a further intervention is presented in the discussion (follow-up: one year).

DISCUSSION

Choanal atresia is a congenital obstruction of the posterior nose. The first case was described by Röderer in 1755 (in Otto, 1830). Bilateral CA is a paediatric emergency and must be treated surgically in the first few weeks after birth. This is in contrast to unilateral CA, because surgical management can be planned more selectively.

In the last several years, endoscopic surgery has become more familiar to the rhinologist; however, for the paediatric surgeon, the transpalatal approach often remains the gold standard. The paediatric surgeon is often confronted with bilateral stenosis because of its presence after birth. The disadvantage of the transpalatal approach can be poor development of the maxilla and injury of the soft palate resulting in future problems with rhinophonia.

The endoscopic procedure is minimally invasive, often delicate in a small nostril with a rigid endoscope of 2.7 mm (Anderhuber and Stammberger, 1997). The incidence of CA is not high - 1:5000 to 1:7000 (Hengerer and Newburg, 1990; Maniglia and Goodwin, 1981). Because the surgery is done so infrequently, surgeons are perhaps more conservative because they are inexperienced in the procedure. Additionally, the CA can be associated with other malformations (e.g. CHARGE syndrome) (Pagon et al., 1981; Coniglio et al., 1988). The failure rate of the endoscopic procedure due to restenosis, in comparison to the transpalatal procedure, is not clear because of the small samples reported in the literature. A prospective study from the same surgeon using both techniques under the same condition has not been done. In one case, the stenosis was on the right side (case 1), and in one case on the left side (case 2). The right side is usually more affected than the left side by 2 :1 (Hengerer and Newburg, 1990).

The diagnosis of bilateral stenosis is made soon after birth by attempting to aspirate through the nose, and using a nasal rigid endoscope (2.7 mm). Endonasal endoscopy is recommended certainly in older children (Anderhuber and Stammberger, 1997). For exclusion of a malformation, often a CT or a choanographia is done (Brown et al., 1986). A choanographia with a contrast medium has a lower irradiation dose than a CT, but for visualisation of the anatomical structures especially in cases with other malformation the CT is superior. The same CT data can be used (stored on a magnetic optical disk) by our system for the CAS because the system does not work on pre-CT reference holders or markers. Our opto-electronic system (Figure 1) with an infrared camera and optically tracked tools (equipped with light emission diodes) is frameless and uses only anatomical landmarks as reference markers in the case of surgery of the paranasal sinuses (e.g. fronto-zygomatic suture on both sides, point A and nasion). Additionally, we use a dynamic reference base, which is a small transitory maxillary splint fixed with a silicone mass. The CAS system allows immediate and exact pursuit of the instrument on the monitor with a clinical accuracy of 0.5-2 mm. This is an advantage over an endoscopic view alone and increases the safety factor, especially when CA is associated with another malformation of the skull. The CAS can allow a more efficient surgical procedure.

The operative time is no longer than usual, apart from the installation time.

In both cases the atresia plate was perforated using the drill and to enlarge the opening by means of a microdebrider (Dyonics™, Smith Nephew, Andover, USA). The microdebrider was equipped with light emission diodes to be detected by the infrared camera. We believe that it is useful to have a navigated microdebrider because it gives the exact position of the tool on the monitor, cut away and not break the bone as a normal forceps.

The insertion of a space holder remains controversial in unilateral choanal atresia, whereas in bilateral choanal atresia the necessity of a calibration is more accepted (Anderhuber and Stammberger, 1997; Josephson et al., 1998; Sadek, 1998). Short intranasal stents allows to sit in the operative area where the atretic plate had been removed and lessens the chance of intranasal synechia formation (Grundfast et al., 1990). With the improvement of the endoscopic surgical performance the space holder seems not indispensable, but a prospective randomised study does not exist in the literature (Wiatrak, 1998).

On account of our good results with space holders in the past we have decided for a stenting in both cases, but we think that with the more "radical" CAS-procedure we will renounce of a calibration in older children in the future.

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