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Transnasal repair of unilateral choanal atresia*

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SUMMARY

***Objectives**: To evaluate the outcomes of the surgical correction of unilateral choanal atresia using a transnasal approach.*

***Patients and method**: Over a 36-months period (from 1999 to 2001), seven children underwent endoscopic endonasal repair of an unilateral choanal atresia using the microdebrider (powered instrumentation). At the end of the procedure, topical application of Mitomycin-C was performed. No postoperative nasal stenting was inserted. Clinical characteristics of these patients, CT scan examination, complications of the procedure and outcomes were analysed and compared to historical cases treated in the same institution from 1990 to 1998.*

***Results**: Seven patients (2 M/5F) (age 6 to 46 months) presented with primary unilateral choanal atresia and were operated during the period from 1999 to 2001. All the patients were symptomatic before surgical correction. No patients showed other facial anomaly. Of the 7 patients procedures, 6 (85.7%) remained patent (follow-up range 12 to 36 months). Mean surgical repair per patient before obtaining patent choana was 1.14. One patient required surgical transnasal revision nine months after the initial procedure with a patent choanal after this second procedure (follow-up 9 months). Minor turbinoseptal synechiae diagnosed 6 months after the surgical correction occurred in one patient and was the only postoperative complication. When compared to historical cases of unilateral choanal atresia (19 patients from 1990 to 1998) repaired without endoscopic control and without Mitomycin-C, it was shown that this current method provided better results; mean surgical repair per patient; 1.14 vs 1.89 and 85.7% of patent choanae at twelve months vs 47.3%.*

***Conclusion**: An endoscopic endonasal approach without postoperative stenting, using the microdebrider seems to us the treatment of choice for unilateral choanal atresia. The exact role of the topical application of Mitomycin-C needs to be further investigated.*

Key words: unilateral choanal atresia, endonasal endoscopic repair

INTRODUCTION

Choanal atresia is defined as a developmental failure of the posterior nasal cavity to communicate with the nasopharynx. Choanal atresia has an incidence of 1 in 5000 to 8000 births, occurs more commonly in females than in males and is more often unilateral than bilateral (Pirsig, 1986). Bilateral choanal atresia requires rapid management at birth and prompt diagnosis because neonates are predominantly obligate nasal breathers. Unilateral choanal atresia is often diagnosed after several months of life. Unilateral choanal atresia is usually not associated with other facial anomaly or with syndromic malformations although hemifacial microsomia has been described in association with the anomaly (Graamans et al., 1976). Persistent unilateral rhinorrhea or failure to pass a catheter through the obstructed nasal fossa (during a general anaesthesia for example) make the diagnosis of choanal atresia probable (Figure 1).

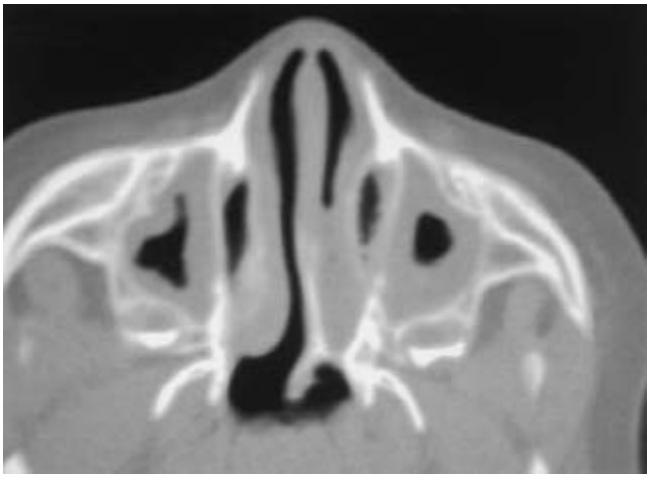

Figure 1. CT Scan, horizontal plane: Right unilateral choanal atresia.

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The surgical correction of an unilateral choanal atresia can be performed using different approaches: transnasal, transpalatal, sublabial or trans-septal. When using an endoscopic endonasal approach, the use of powered instrumentation (microdebrider) seems to be very effective and appropriate (April, 1996). Powered instrumentation with its protected blades and drills allows for precise removal of the atretic plate contributing to a more satisfactory surgical procedure.

However, the incidence of surgical failure using a transnasal approach due to the restenosis of the choana by scar tissue formation is high and led us to study the topical application of Mitomycin-C at the end of the procedure. Mitomycin-C is known as an antiproliferative agent that can inhibit fibroblast proliferation. It has been already used in ophthalmic surgery (glaucoma) to decrease scar formation and restenosis (Chen, 1990).

The preliminary results of seven children with unilateral choanal atresia treated by an endoscopic endonasal approach with the microdebrider and topical application of Mitomycin-C and without post operative stenting have been reported and compared to 19 historical cases of children treated without endoscopic control, without powered instrumentation and without Mitomycin-C application.

PATIENTS AND METHOD

A retrospective medical record analysis of patients with unilateral choanal atresia (UCA) seen at the University Hospital of Louvain in Brussels between January 1999 and December 2001 was performed. Seven patients were treated during this period using an endoscopic endonasal approach. No patient had been previously treated before for this UCA. Patient's age at the time of surgery, sex and type of stenosis defined at the CT scan examination (osseous, membranous or mixed) and follow-up results were reported (Table 1). All the patients were symptomatic before surgery (persistent unilateral rhinorrhea). One patient was diagnosed during an adenotomy procedure performed in an other institution and was then transferred to our hospital for UCA surgical repair. The six remaining patients had no medical and no surgical history. All the patients were examined by an ENT specialist and by a paediatrician in order to exclude other facial anomaly. Fiberoptic examination and CT scan were performed before surgery for the seven children.

The seven patients were operated under general anaesthesia. The nasal cavity with UCA was packed with cottonoid pledgets soaked in a solution of epinephrine (one gamma/kg). Co-operation with the paediatric anaesthesiologist is mandatory during this procedure. These packs are left in the nasal cavity during ten minutes. UCA was treated using an endoscopic endonasal approach. Endoscopes that were used were 2,7 mm and 4 mm diameter, 0° or 30° (Storz-Hopkins telescope) and were clipped to a camera. Powered instrumentation employed was the XPS Model 2000 (Xomed) with blade (Tricut blade 2,9 mm) and burr (paediatric round burr 2,9 mm). Using this powers soft and bone tissue shaver and under an endoscopic control, the atretic plate was repaired.

Surgical procedure began with an examination of the nasal cavity and with a suctioning of the mucopurulent secretions founded in the nasal cavity (Figure 2).
Then the posterior nasal choana was opened using a dissection tip or a straight canula usually in the inferior-medial part of the atretic plate because this junction is the less dangerous one and the thinnest portion of the atretic plate. Then the opening was widened with the blade and the round bur of the shaver.

Table1. Characteristics of the cohort. n = 7 (1999 – 2001).

Patient N° Sex,age	Other facial anomaly	Side	Atresia Type	Comments	Followup	Post op. complication	Result
1/M/24	-	Right	Mixed	-	36	synechiae	Patent
2/M/22	-	Right	Bony	Previous adenotomy	27	-	Patent
3/F/6	-	Left	Mixed	-	21	-	Patent
4/F/10	-	Right	Bony	adenotomy	18	-	Closed Second repair
5/F/20	-	Left	Bony	-	14	-	Patent
6/F/6	-	Right	Mixed	-	12	-	Patent
7/F/46	-	Left	Bony	-	12	-	Patent

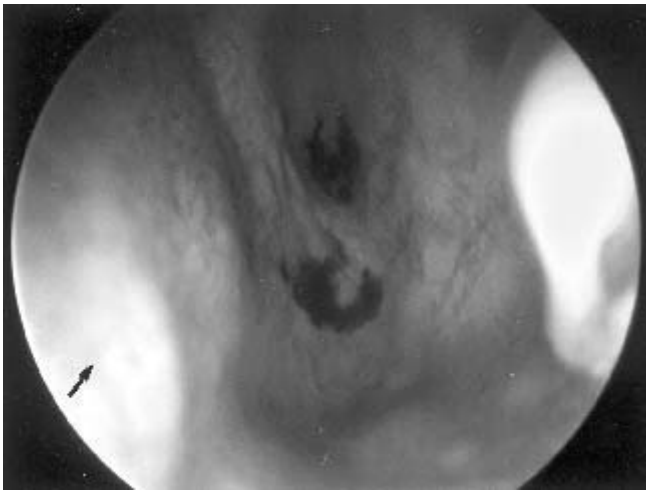

Figure 2. Left unilateral choanal atresia. Arrow: septum. (Endoscopic view: 30°).

This procedure removed a portion of the posterior aspect of the vomer in order to widen medially the neochoana.
Careful widening of the superior end of the lateral part of the neochoana ended the procedure. The diameter of this newly created choana usually reached the theoretical diameter of the patient's endotracheal tube. Topical application of Mitomycin-C (0,4 mg/ml) with 5 ml of the solution soaked in cottonoid pledgets was left in place during 3 minutes in the neochoana. Saline-sterile irrigation of the nasal cavity was performed after the cottonoid pledgets removal using 3 x 20 cc. No postoperative stenting with an endotracheal tube was used but the nasal cavity was packed with a Merocel during 24 hours. Patients were usually discharged within 24 hours after the surgery. After the packing removal, parents were asked to apply into the nasal cavity saline solution and a vasoconstrictive agent until the first post operative visit planned one week after the surgical procedure. Then the children were followed on a monthly basis during 3 months and every 6 months after this period. Patients who remained free of symptom during the follow-up period and whose choana remained patent under fiberoptic examination were considered as operative successes (Figure 3).

Results at twelve months were compared to historical cases of UCA repaired without endoscopic control, without the microdebrider and without Mitomycin-C application treated from 1990 to 1998 in the same hospital. Nineteen children were studied in this cohort with all of them equipped with postoperative nasal stenting.

RESULTS

Table 1 gives the clinical characteristics and the results for the cohort of patients.
Among these 7 children, there were 2 males and 5 females. The age in months at the time of surgery ranged from 6 to 46. Unilateral choanal atresia was found 4 and 3 times respectively in the right and left nasal cavity. On CT-Scan examination, choanal atresia was defined as bony in 4 cases and as mixed in 3 cases. No pure membranous choanal atresia was reported. Any of the 7 patients showed other facial anomalies neither other concurrent congenital anomaly. Neither preoperative excessive bleeding nor preoperative complications were reported. The follow-up period ranged from 12 to 36 months. Six neochoana remained patent with asymptomatic children. One patient needed a surgical re-opening using the same procedure 9 months after the initial treatment. One patient showed a minor turbino-septal synechiae not requiring any treatment. One patient underwent a concurrent adenotomy during the choanal repair. No complication due to the topical application of Mitomycin-C was mentioned.
The mean surgical repair per patient before achieving a patent choana was 1.14 and the succes rate after 12 months was 85.7%.

Nineteen children served as the control group. In this cohort of patients, there were 15 females for 4 males. Congenital anomalies were found in 5 children and treatment options are listed in Table 2.
Historical cases of patients with UCA revealed that the mean surgical repair per patient before achieving a patent choana was 1.89 and that the success rate at 12 months was 47.3% (Table 2 and Table 3).

DISCUSSION

Although the symptomatology of unilateral choanal atresia is not life threatening and less dramatic than the bilateral one, surgical repair is indicated for all the affected children (Pirsig, 1986; Schwartz, 1986; Morgan, 1990; Stankiewitz, 1990; Richardson, 1998; Wiatrak, 1998). Persistent unilateral rhinorrhea make the occurrence of a surgical repair mandatory. Unlike bilateral choanal atresia, prompt surgical repair is not required as the diagnosis of unilateral choanal atresia is often delayed.

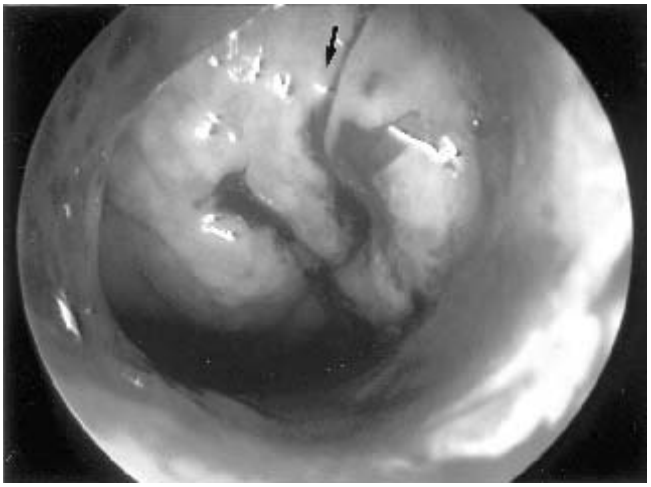

Figure 3. Endoscopic view (30°) case report 7. Left unilateral choanal atresia after transnasal repair. Arrow: adenoid.

Table 2. Historical cases with type of choanal repair and results at 12 months (n = 19) from 1990 to 1998.

	Number of children	Results at 12 months
Transnasal without endoscopic control + nasal stent	7	3 patent
Transpalatal + nasal stent	5	3 patent
Transnasal with CO2 laser + nasal stent	5	1 patent
Transnasal with YAG laser + nasal stent	1	1 patent
Transeptal + nasal stent	1	1 patent
Total	19	9 patent (47.3%)

Table 3. Number of surgical repair before achieving a patent choanae for present study (n = 7 from 1999 to 2001) and for historical cases (n = 19 from 1990 to 1998).

	Number of surgical repair and number of patients	Mean surgical repair per patient	
Present study	1 : 6 2 : 1	8/7	1.14
Historical cases	1 : 7 2 : 7 3 : 5	36/19	1.89

The mean age at which surgical repair is performed is often superior for unilateral than for bilateral choanal atresia (Friedman, 2000; Gordts, 2000; Rombaux, 2001).

When surgical repair is planned, one must seek for a technique which offers excellent visualisation of the atretic plate, instrumentation easy to use and appropriate to the dimensions of the nasal fossa and a procedure with low morbidity. When treating unilateral choanal atresia, the other choanal will be patent in the postoperative period and the child therefore would not be very affected to breathe through his nose during this period. It permits to choose a procedure with low morbidity and with a short period at the hospital.

The age of our patients as well as the side of the atresia and its type is representative of those found in the literature (Schwartz, 1986; Stankiewitz, 1990). Follow-up in our work is limited though it has been demonstrated that if restenosis occurs, it will occur within the first year of the initial operation (Richardson, 1998). It is also important to note that none of our patients had shown any other facial anomaly and that no CHARGE or others syndromes were present among these children. These features are commonly known as risk factors for restenosis (Duncan, 1998). It also explains why mean surgical repair is low in this cohort of patients.

The first endonasal approach using the microscope was published in 1985 (Dehaen, 1985) and the first experience with an endoscopic endonasal repair of choanal atresia was described in 1990 by Stankiewitz et al.. After this, some authors have published their results with the endoscopic approach with very satisfactory results (El Gundy, 1992; Reda, 1994; Cumberworth, 1995; Josephson, 1998; Friedman, 2000; Gordts, 2000). However, comparisons between these cohorts of patients are difficult to perform: patients with or without other facial anomaly, unilateral of bilateral choanal atresia, powered instrumentation or not, endoscope or microscope and finally postoperative stenting or not.

In our hands, it seems that an endoscopic view using an endonasal approach offers an excellent control when repairing choanal atresia.
Powered instrumentation with soft tissue shavers and drills are believed to be less traumatic for the nasal mucosa and allow a better healing of the mucosa with less scar tissue formation. The continuous suction device of the powered instrumentation offers to the surgeon to quickly perform the procedure without too much in-out passages through the nasal vestibule, the nasal and turbinate mucosa.
In our experience, the simultaneous passage of the endoscope and the microdebrider in one nasal fossa during the repair was easy to perform though we should consider those patients were infants not newborn. Performing the procedure under excellent visualisation also reduces the risk of any damage and provides an optimal drilling of the vomerian process which is known as the most important area in order to decrease the risk of restenosis (Schwartz, 1986; Friedman, 2000).

Postoperative nasal stenting has been advocated in order to maintain the neochoana wide open. The type and duration of stenting were greatly discussed among ENT surgeons (Grundfast, 1990). We used a bilateral nasal stenting in the post operative period in bilateral choanal atresia (Rombaux, 2001), but there is a tendency to avoid nasal stenting even for bilateral atresia referencing to more recently papers where it appears that this stenting may be avoided (van den Abbeele, 2002).
It is really important to ensure the opening of both nasal fossa after bilateral choanal repair. However in unilateral choanal atresia the disadvantages of an unilateral nasal stenting (discomfort, formation of granulation tissue, vestibule damage) are not counter balanced by the risk of restenosis.

The topical application of Mitomycin-C is more and more used in ENT procedures when restenosis after a surgical repair may occur (Selik, 2000; Eliashar, 1999; Yassir, 2001).
Mitomycin-C is an anti-metabolic agent that has been shown to inhibit fibroblast proliferation when applied topically. In our work, dose and time of application are based to those used in glaucoma surgery (Chen, 1990). Its clinical use as a modulator of the wound healing response has no systemic side effects when applied topically (Yassir, 2001). We didn't observe any local side effects when applying this agent at the end of the choanal atresia repair.
Recently, two studies have tried to report the positive benefit of the adjunct of topical Mitomycin-C at the end of the procedure when repairing choanal atresia.
Holland et al. (2001) compared 8 children treated through different approaches with Mitomycin-C application to 15 historical controls children treated without this application. The success rate of the repair as determined by the postoperative need for dilation or revision surgical procedures was in favour of the Mitomycin-C group (0.375 +/-0.183 dilations vs 3.667 +/-0.583).

Prasad et al. (2002) reported 20 patients treated with endoscopic endonasal repair and Mitomycin-C application and demonstrated that 17 of them remained with patent choanae after the procedure.
Although these studies have shown a trend to justify topical application of Mitomycin-C after the repair, there is no placebo-controlled study in the literature, which demonstrated an objective benefit of this application.

In the post operative period, nasal application of a sterile saline solution and of a vasoconstrictive agent are very useful as well as post-operative care with adequate cleaning and frequent suctioning of the nasal fossa. It clearly helps to decrease crust formation during this period.

With a transnasal repair, many instrumentation's have been employed such as CO_2 laser, YAG laser, KTP laser or drilling instruments (Muntz, 1987; Panwar, 1996; Pototschnig, 2001). We have chosen an advanced yet relatively easy approach for the treatment of unilateral choanal atresia using powered instrumentation.
Powered instrumentation with blade and drill are easy to use and give postoperative results quite comparable to others techniques with the great advantage that any postoperative stenting is needed. However, we must accept as a fact that it is not clear in our study which is the major advantage of our technique: the use of Mitomycin-C, the use of the microdebrider or the absence of any postoperative stent. Some studies comparing these different effects through a larger cohort of patients with a control group should be investigated in the future.

Endoscopic endonasal repair with powered instrumentation, topical application of Mitomycin-C without postoperative nasal stenting seems to be the treatment of choice for UCA. When considering bilateral choanal atresia, the same procedure can be performed. Comparison between this cohort of patients with historical cases has shown that this approach is superior to older approaches.

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