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Nasal endoscopy in asthmatic children: clinical role in the diagnosis of rhinosinusitis*

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SUMMARY

The aim of the study was to determine the role of rigid nasal endoscopy in the diagnosis of rhinosinusitis and adenoiditis in asthmatic children. Hundredfortyfive asthmatic children (aged 2-15 years) with recurrent upper respiratory symptoms were evaluated with complete ENT examination and nasal endoscopy by rigid endoscope during local anaesthesia. A step by step endoscopic procedure is described.

Endoscopy was successfully performed in 128 patients (88.3%).

Purulent rhinosinusitis was diagnosed in 61 subjects (47.6%) and adenoiditis in 45 subjects (35.1%). Rhinosinusitis was associated with adenoiditis in 35 subjects (27.3%), more frequently in younger children (i.e. 2-5 years). Nasal bacteria occurred in 90% of rhinosinusitis patients. Numerous anatomical anomalies were identified.

Endoscopy of nasal cavity and rhinopharynx is less traumatic and more readily accepted than other methods. Nasal endoscopy may be proposed as an appropriate routine diagnostic tool in children since it is well tolerated, easily and quickly performed, cost-efficient, and useful in diagnosing rhinosinusitis.

Key words: nasal endoscopy, asthmatic children, rhinosinusitis, adenoiditis, fiberscope

INTRODUCTION

Rhinosinusitis and rhinopharyngeal infections with recurrent, shifting or subclinical course are frequent in children, mainly in allergic and asthmatic subjects (Rachelefsky et al., 1984; Fireman, 1999). The course of rhinosinusitis in children may be asymptomatic or with few clinical signs, and children are often unable to correctly refer symptoms (Rachelefsky et al., 1988). Thus, the diagnosis of rhinosinusitis is difficult and often uncertain in children. X-ray examination does not guarantee sufficient sensibility to be routinely used (Lusk et al., 1989; McAlister et al., 1989; Wald, 1993). CT may be considered the gold standard, but is expensive and not recommended as routine exam in children.

Asthma and rhinosinusitis are frequently associated and the work-up of asthmatics must consider upper airways evaluation (Slavin, 1992). The present report assessed the role of rigid nasal endoscopy in the diagnosis of rhinosinusitis and rhinopharyngeal diseases in a group of asthmatic children, and evaluates its feasibility and tolerability.

MATERIALS AND METHODS

We studied 145 asthmatic children aged 2-15 years (mean age: 7.3 years), 97 males and 48 females, with recurrent upper respiratory symptoms. Eighty children were allergic (55.2%). They complained about respiratory symptoms for 10 to 30 days.

A detailed history highlighted major and minor criteria for the clinical diagnosis of sinusitis (Shapiro and Rachelefsky, 1992).

Complete ENT work-up, including examination of inferior turbinate volume and mucosa before pharmacological decongestion, was performed on each subject. The child was placed in a supine position with the head bent at 45°. Cotton wool-soaked with equal parts anaesthetic (ossibuprocaine chlorhydrate 1%) and decongestion solution (xylometazoline chlorhydrate 0.1%) was placed into the nose for 5 minutes, between the medial face of the inferior turbinate and the septum mucosa. This solution does not cause burning or tickling, although can cause bitter taste if swallowed. The endoscopy was performed with a pediatric rigid 2.7 mm diameter endoscope with a 30° angle of vision and a 250 watt light source. A number of endoscopies were video-recorded with a micro-

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camera connected to a VHS video-recorder-monitor-set. We utilized a flexible endoscope (3.5 mm diameter) in subjects under 3 years old, in restless children and in those with narrow nasal fossa due to anatomical abnormalities. Cotton wool was removed and the endoscope was inserted along the nasal fossa floor to evaluate: the inferior turbinate volume and mucosal aspect following decongestion, the inferior meatus, the inferior part of the septum, and the presence of obstruction or abnormal secretions. While proceeding towards the rhinopharynx with the endoscope, we evaluated the condition of the lymphatic tissue and Eustachian tube and the presence of edema and abnormal drainage. The contralateral side was evaluated by rotating the endoscope by 45°.

In the second step, the endoscope was returned to the vestibulum with an upward 45° inclination to evaluate the agger nasi area, olfactory tract, and shape of the head of the middle turbinate. With an additional 45° rotation turned toward the lateral wall, we evaluated the fontanella area (FA), posterior osti and the half posterior of the nasal septum.

The third step was an assessment of the middle meatus. When the space inside the nasal fossa was adequate, it was possible to examine the uncinate process morphology, the ethmoidalis bulla, jatus semilunaris, abnormal drainage and the contact points of septum with the lateral nasal wall if present. We then evaluated the crucial area represented by the crossover between the FA and the spheno-ethmoidal recess (SER). These areas are separated from the tail of the medium turbinate and delimited from the superior choanal edge inferiorly.

Finally, a small flexible cotton swab was used for obtaining nasal culture directly from the drainage under endoscopic view, as near as possible to the natural ostium of the affected sinus.

The endoscopic procedure took approximately 3-5 minutes to be performed for both nasal cavities.

To correlate the shape of the adenoid and the post-nasal space with our clinical findings, the adenoid size was classified into three categories according to the distance between the vomer and the adenoid tissue, as reported by Wang (1997): 1= distance $>$ 1 cm., 2= distance between 0.5 and 1 cm., 3= distance $<$ 0.5 cm., total= invasion of tissue into nasal cavity.

We utilized previously validated criteria to diagnose sinusitis or rhinosinusitis (Rachelefsky, 1984a; Levine, 1990; Lusk and Muntz, 1990; Parsons and Phillips, 1993).

Data were evaluated by using χ-square and Fisher's exact tests. All tests with p values less than 0.05 were considered statistically significant.

RESULTS

Nasal endoscopy was performed in 128 out of 145 (88.2%) children (mean age: 8.5 years). Seventeen children were unwilling to undergo the procedure. The flexible fibre-optic endoscope was used in 7 children (0.5%). One anterior epistaxis was the only minor complication that was caused by the tip of the endoscope, due to a sudden movement of the child (while sneezing).

Sixty-seven children had no endoscopic findings of infection (52.4%). Sixty-one children had purulent rhinosinusitis (47.6%). According to the most recent report of the Consensus Conference on Paediatric Sinusitis, 6 subjects had chronic rhinosinusitis, 46 had recurrent acute rhinosinusitis, and 9 had acute rhinosinusitis (Clement et al, 1996). Table 1 shows associations with other disorders.

Table 1. Purulent sinusitis and relationship with other pathological findings.

	n.	%
sinusitis without adenoiditis	26/128	20.3
sinusitis + adenoiditis	35/128	27.3
adenoiditis without sinusitis	10/128	7.8

In patients with rhinopharyngeal obstruction caused by adenoid tissue, abnormal secretion was often located in the nasal floor and in the coana, covering the lymphatic tissue, while rhinosinusitis without rhinopharyngeal obstruction was located in the FA or SER area.

The association of rhinosinusitis with adenoiditis was more frequent in younger children (2-5 years).

The anatomic anomalies, which are considered pathogenic for rhinosinusitis (Benninger, 1997), are reported in Table 2.

The relationship between clinical diagnosis and endoscopic findings was statistically significant ($p<0.001$, Odd Ratio 3.0). Rhinosinusitis and adenoiditis, diagnosed by endoscopy, were significantly associated ($p<0.001$, Odd Ratio 8.1).

Nasal cultures were positive in 90% of endoscopic diagnosis of rhinosinusitis (Table 3) with a statistically significant positive relationship ($p<0.001$).

Table 2. Anatomical anomalies during nasal endoscopy in 128 children with airway complaints.

Anatomical anomaly	*With Infection*	*Without infection*	*Overall*
septal deviation	38 (73%)	14 (27%)	52/128
middle turbinate anomalies (paradoxical,concha bullosa, triangolar)	20 (62.5%)	12 (37.5%)	32/128
nasal polyps	10 (100%)	0	10/128
enlarged or rotated processus uncinatus	18 (75%)	6 (15%)	24/128
accessorius maxillary ostiom	8 (66%)	3 (37%)	12/128

Table 3. Pathogens collected from the sinus specimens in children with endoscopic sinusitis and adenoiditis.

Bacteriology	Sinusitis(61)	Adenoiditis(35)
Streptococcus pneumoniae	18 (29.5%)	10 (28.5%)
Haemophilus influenzae	12 (19.6%)	10 (28.5%)
Moraxella catharralis	4 (6.5%)	3 (8.5%)
Staphylococcus aureus	7 (11.4%)	5 (14.2%)
Streptococcus pyogenes	2 (33.2%)	2 (5.7%)
Other	1 (1.6%)	2 (5.7%)
Negative	7 (11.4%)	3 (8.5%)

Pathogen microbic flora grew in 5% (3 patients) of specimens from clinically normal secretions recovered from patients with negative endoscopic examination. At follow-up (3-6 weeks later), 4 had developed rhinosinusitis and adenoiditis.

DISCUSSION

Rhinosinusitis is a common disease in children and can be classified as acute, subacute, recurrent acute or chronic infection (Arimand and Lusk, 1995; Clement et al., 1996).

Upper respiratory infections are complicated by acute sinusitis (Rachelefsky, 1984b; Friday et al., 1990) in about 0.5% of the cases. As children suffer from upper respiratory inflammation from 4 to 8 times per year (depending on age), the diagnosis of sinusitis is actually underestimated and its true incidence is unknown. Moreover, rhinosinusitis is frequent in allergic and asthmatic patients (Yaniv et al., 1992).

The clinical diagnosis of recurrent or chronic sinusitis should not be considered as the gold standard in clinical practice as symptoms are not pathognomic and may overlap with other respiratory disorders.

The present study suggests that rigid nasal endoscopy in children represents a fruitful diagnostic tool, since most of our subjects accepted this technique. Moreover, endoscopy may be repeated and allows direct collection of drainage. The more effective method for collecting sinus secretions is sinus aspiration, although this is painful, and thus, rarely performed in children.

Trans-nasal rhinopharyngeal endoscopy for studying adenoid tissue is less traumatic and more readily accepted by young patients than the indirect vision using a mirror.

X-Ray exam should not be considered an option for diagnosing children with suspected rhinosinusitis as it is not sensitive nor specific and exposes young patients to radiations (Manning et al., 1996). Two or more basic X-Ray films would be required to differentiate between reversible and permanent sinus disease, arousing ethical and safety arguments (Kovatch et al., 1984; Manning et al., 1996). On the other hand, computed tomography (CT) is performed using a high spatial resolution program and minimum scannings (120-140 Kv and 40 mA). CT scan is appropriate for patients indicated for sinus or nasal surgery (Manning et al., 1994). Moreover, trans-illumination and ultrasonography are useless for diagnosing rhinosinusitis.

Flexible fiberoptic rhinoscopy may be a valid alternative to nasal rigid endoscopy when there are anatomical reasons, in agitated children or in subjects under the age of 3 years.

Flexible fiberoptic rhinoscopy is a more expensive, more delicate instrument, and often does not provide the same level of visualization as the rigid endoscope. Moreover, it is difficult to use the flexible rhinoscopy and simultaneously to collect secretions during the procedure since both hands are required to use it. The crucial crossover area between the FA and the SER, in our hands, is easily examined with the rigid endoscope using the lateral view.

In the anterior view, the endoscopic examination of this area is much simpler and faster to be performed than that of the ostiomeatal complex, superior meatus or sphenoid ostium, and it provides the same diagnostic accuracy. This simplification of the endoscopic technique has a particular importance in young patients because it significantly improves compliance with the procedure.

The FA drains pathological secretions from the ostiomeatal complex (frontal sinus, anterior ethmoidal cells, maxillary sinus), whereas the SER collects the pathological drainage from the posterior ethmoidalis cells and sphenoid sinus. This crossover clearly distinguishes sinusitis of the anterior or posterior compartment from adenoiditis, in which case secretions are found behind or around the lymphatic tissue.

Nasal endoscopy may easily detect sinus pathology that might be missed or underestimated with routine anterior rhinoscopy and nasopharingeal examination.

Though the presence of anterior nasal drainage or posterior purulent rhinopharyngeal secretion may suggest sinus infection, nevertheless the visualization of the infected region and the anatomic alterations in the nasal fossae and the differentiation between sinusitis and adenoiditis is of outstanding importance to assess the best therapeutic strategy.

A primary objective in clinical practice is the evaluation of the grade of rhinopharyngeal obstruction by an adenoid pad to detect obstruction of the nasal secretions which predispose patients to sinusitis. Thus, adenoidectomy should be performed a minimum of three months before performing pediatric sinus surgery (Vandenberg and Heatley, 1997). In addition, the cost/benefit ratio for nasal endoscopy during an office visit is highly advantageous.

In conclusion, we believe that rigid nasal endoscopy with local anaesthesia should be considered an appropriate routine exam in children with recurrent upper respiratory tract infections, clinical indications of sinus infection, or recurrent asthmatic attacks, as children with asthmatic attacks and asociated rhinosinusitis improve only when sinusitis is adequately recog-

nized and treated (Rachelefsky et al., 1984c; Oliveira et al., 1992; Slavin, 1992).

REFERENCES

1. Arjmand EM, Lusk RP (1995) Management of recurrent and chronic sinusitis in children. Am J Otolaryngol 16: 367-382.
2. Benninger MS (1997) Nasal endoscopy: its role in office diagnosis. Am J Rhinol 11: 177-180.
3. Clement PA, Bluestone CD, Gordts F (1996) Management of rhinosinusitis in children. Consensus Meeting, Brussels, Belgium. Arch Otolaryngol Head Neck Surg 124: 31-34.
4. Fireman P (1992) Diagnosis of sinusitis in children: emphasis on the history and physical examination. J Allergy Clin Immunol 9:433-436.
5. Friday G, Fireman P, Sukanich A, Steinberg M (1990) Sinusitis. In: Naspitz CK, Tinkleman DG (Eds) Childood rhinitis and sinusitis. Marcel Dekker, New York pp. 199-215.
6. Kovatch AL, Wald ER, Ledesma-Medina J (1984) Maxillary sinus radiographs in children with nonrespiratory complaints. Pediatrics 73: 306-308.
7. Levine HL (1990) The office diagnosis of nasal and sinus disorders using rigid nasal endoscopy. Otolaryngol Head Neck Surg 102: 370-373.
8. Lusk RP, Lazar RH, Muntz H (1989) The diagnosis and treatment of reccurent and chronic sinusitis in children. Pediatric Clin North Am 36:1411-1421.
9. Lusk RP, Muntz HR (1990) Endoscopic sinus surgery in children with chronic sinusitis. A pilot study. Laryngoscope 100: 654-658.
10. Manning SC, Biavati MJ, Phillips DL (1996) Correlation of clinical sinusitis signs and symptoms to imaging findings in pediatric patients. Int J Pediatr Otolaryngol 37: 65-74.
11. Manning SC, Wasserman RL, Silver R, Phillips DL (1994) Results of endoscopy sinus surgery in pediatric patients with cronic sinusitis and asthma. Arch Otolaryngol Head Neck Surg 120: 1142-1145.
12. McAlister WH, Lusk R, Muntz HR (1989) Comparison of plain radiographs and coronal CT scans in infants and children with recurrent sinusitis. Am J Rhinol 153: 1259-1264.
13. Oliveira C, Solè D, Naspitz C, Rachelefsky G (1997) Improvement of bronchial hyperresponsiveness in asthmatic children treated for concomitant sinusitis. Ann Allergy Asthma Immunol 79: 70-74.
14. Parsons DS, Phillips SE (1993) Functional endoscopic surgery in children: a retrospective analysis of results. Laryngoscope 103: 899-903.
15. Rachelefsky GS (1984b) Sinusitis in children, diagnosis and management. Clin Rev Allergy 2: 397-408.
16. Rachelefsky GS, Goldberg M, Katz RM (1984a) Sinus disease in children with respiratory airway infections. J Allergy Clin Immunol 74: 185-189.
17. Rachelefsky GS, Katz RM, Seigel SC (1984c) Chronic sinus disease with associated reactive airway disease in children. Pediatrics 73: 526-529.
18. Rachelefsky GS, Katz RM, Seigel SC (1988) Chronic sinusitis in the allergic child. Pediatr Clin North Am 35: 1091-1101.
19. Shapiro G, Rachelefsky G (1992) Introduction and definition of sinusitis. J Allergy Clin Immunol 90: 417-418.
20. Slavin RG (1992) Asthma and sinusitis. J Allergy Clin Immunol 90: 534-537.
21. Vandenberg SJ, Heatley DG (1997) Efficacy of adenoidectomy in relieving symptoms of chronic sinusitis. Arch Otolaryngol Head Neck Surg 123: 675-678.
22. Wald ER. Radiographic sinusitis: illusion or delusion? (1993) Pediatr Infect Dis J 12: 792-793.
23. Wang DY, Bernheim N, Kaufman L, Clement P (1997) Assessment of adenoid size in children with fibreoptic examination. Clin Otolaryngol 22: 172-177.
24. Yaniv E, Oppenheim D, Fuchs C (1992) Chronic sinusitis in children. Int J Ped Otolaryngol 23: 51-57.

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