



The role of 24-h pH recording in pediatric otolaryngologic gastroesophageal reflux disease

Thierry Van Den Abbeele^{a,*}, Vincent Couloigner^a,
Christophe Faure^b, Philippe Narcy^a

^a*Service d'Otorhinolaryngologie pédiatrique, AP-HP Hôpital Robert Debré,
48 Boulevard Sérurier, 75019 Paris, France*

^b*Service de Gastroenterologie pédiatrique, AP-HP Hôpital Robert Debré, Paris, France*

Abstract

The purpose of this study was to investigate the role of 24-h pH monitoring for the diagnosis of otolaryngologic including rhinologic manifestations of GER in children and if possible to correlate the results with the efficacy of medical treatment.

This is a retrospective study of 72 children from January 1997 to December 1999. The children were separated into three groups according to the main symptoms (although association of symptoms was frequent): rhinologic ($n=28$), laryngotracheal ($n=28$) and pharyngeal-otologic ($n=16$).

With the classical gastroenterologic criterion ($\geq 4.2\%$ of total time at $\text{pH} < 4$), the pH monitoring was positive in 56% of the patients. However, this criterion does not seem to be sensitive for otolaryngologic GERD because multiple daytime short reflux episodes are often involved. Indeed, the pH monitoring was positive in 75% of the patients (82% in the rhinologic group) when a number of 40 episodes/24 h was also taken into account. The success rate of medical treatment was about 80% in case of positive pH recording. This study underlines that GER is an important factor in pediatric otolaryngologic diseases.

© 2003 British Association for Paediatric Otorhinolaryngology (BAPO). All rights reserved.

Keywords: GER; gastroenterologic; pH monitoring

1. Introduction

GERD in children has been implicated in various extra-gastrointestinal (GI) pathologies especially in pulmonary or laryngotracheal diseases such as laryngotracheal stenoses [1],

* Corresponding author. Tel: +33-1-40-03-24-49; fax: +33-1-40-03-47-17.

E-mail address: thierry.van-den-abbeele@rdb.ap-hop-paris.fr (T. Van Den Abbeele).

recurrent croup [2] or even otitis media with effusion [3]. The development of 24-h pH monitoring has been one of the most significant advances in the diagnosis of GER-related otolaryngologic diseases in children [4]. However, the responsibility of GER in rhinologic symptoms is debated, recent studies suggesting the role of GER in pediatric patients in the pathogenesis of chronic rhinosinusitis [5,6].

GER causes predominantly GI symptoms such as nausea, vomiting or pyrosis, but extra-GI manifestations are not exceptional in children (chronic cough, hoarseness, pharyngitis, recurrent bronchitis, reflex apnea in infants...). The relative frequency of these manifestations is not precisely known and they are not limitative.

In this paper, we report the results of a systematic 24-h pH-monitoring study in chronic and/or recurrent otolaryngologic and rhinologic diseases in children and discuss the role of GER in these pathologies and the efficacy of medical treatment.

2. Material and methods

Seventy-two children presenting with chronic and/or recurrent otolaryngologic pathology without identified cause (allergy, immune deficiency, cystic fibrosis were excluded)

Table 1
Clinical manifestations of GER

Gastrointestinal
• Vomiting
• Regurgitations
• Nausea
• Pyrosis
• Abdominal pain
• Appetite loss
Extra-GI manifestations
• Bronchial
• Asthma
• Recurrent bronchitis
• Laryngotracheal
• Cough
• Dyspnea
• Dysphonia
• Laryngotracheal stenosis
• Pharyngeal
• Tonsillitis
• Pharyngitis
• Halitosis
• Recurrent AOM
• OM with effusion
• Rhinologic
• Rhinosinusitis
• Nasal polyposis
• Nasal obstruction
• Purulent rhinorrhea
• Recurrent headache

and refractory to medical treatment had a 24-h pH recording and were included between January 1997 and December 1999. Forty-four males and 28 females participated in the study (average age, 7.6 ± 5 years, extremes 2 months–17 years). Initial history was recorded and included classical gastrointestinal symptoms of GER but also various otolaryngologic manifestations (see Table 1).

Ambulatory 24-h pH monitoring was performed using a single-channel esophageal probe calibrated to pH 7 and always placed by the same method through the nasal fossa around 3 cm above the esophageal inferior sphincter. A chest X-ray was performed to verify the situation of the probe. GER medical treatment (prokinetics, antacid) was stopped at least 2 days before the pH recording. The traces were then analyzed with the EsophGram Software (Ver 5.60, Gastrosoft) that gives the reflux index (RI = percentage of time at pH less than 4.0), the total number of refluxes, the number of refluxes longer than 5 min and the duration of the longer reflux. The pH recording was considered positive using the classical gastroenterologic criterion (RI greater than 4.2%). However, in some cases (see Results), a total number of refluxes greater than 40 was also considered as significant.

The medical treatment associated prokinetics such as cisaprid during 3–9 months and antisecretory drugs during 1–3 months (ranitidin or omeprazole). The efficacy of the medical treatment was evaluated after 2 months during follow-up examinations. The surgical treatment (Nissen's fundoplicature) was discussed only in case of failure of the medical treatment.

3. Results

3.1. Distribution of otolaryngologic manifestations

The distribution of main symptoms encountered in the children is represented in Fig. 1. The children were classified in three groups according to their dominant symptoms. Twenty-eight children (39%) had mainly laryngotracheal symptoms and formed the “larynx” group. Rhinologic symptoms were dominant in 28 other children (39%) and were grouped in the “sinus” group. The 16 remaining children (22%) suffered mainly from recurrent otitis and pharyngitis and were pooled in the “pharynx-otitis” group. Only seven children (10%) reported significant symptoms (vomiting, nausea, pyrosis, abdominal pain). The most frequent symptoms were rhinologic including nasal obstruction, rhinorrhea, headache and were reported by 36 children (50%).

3.2. Characteristics of pH monitoring

Tables 2 and 3 show results of pH monitoring in each group. Only 40 recordings (56%) were positive on the basis of the classical GI criterions but 54 (75%) were positive when a number of episodes greater than 40/24 h were taken into account.

The group “sinus” presented the most important score of positive recordings (23/28 children, i.e., 82%) but there was no significant difference between the three groups.

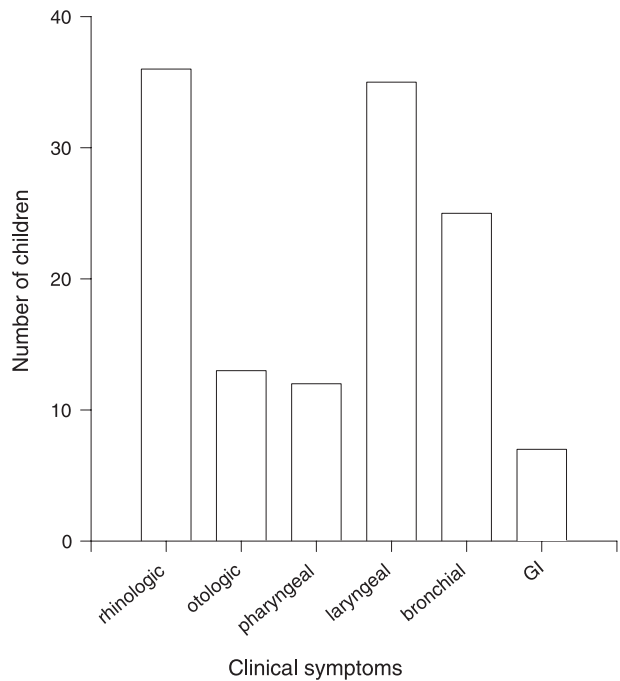


Fig. 1. Relative frequency of the main GER-related symptoms in the 72 children included.

Fig. 2 shows a typical positive pH recording of a child with predominant sinus pathology. This typical pattern of recording with multiple short daytime episodes of reflux was found in 48 out of 55 positive pH recordings (87%) contrasting with a reduced number of nocturnal episodes. Interestingly, the 13 children who had a typical posterior laryngitis during laryngeal flexible endoscopy all had a positive pH recording. The mean RI ($9.5 \pm 9\%$) and the mean number of reflux episodes (76 ± 26) were significantly higher in this subgroup than in other children (Student’s *t*-test, $p = 0.03$).

3.3. GER and rhinologic symptoms

The 28 children forming the “sinus” group, 15 females and 13 males (46%) had a mean age of 10.6 ± 4.6 years significantly older than in the two other groups (5.5 ± 4.1 years in the “larynx” group and 5.9 ± 4.7 years in the “pharynx-otitis” group, $p < 0.001$, Student’s

Table 2
Results of 24-h pH monitoring

	Patients (number)	Mean age (years)	Index (%)	Episodes/24 h
Total	72	7.6 ± 5.0	6.2 ± 6.2	61 ± 36
Group “larynx”	28	5.5 ± 4.2	7.2 ± 8.4	57 ± 42
Group “pharynx-otitis”	16	6.0 ± 4.7	5.3 ± 3.4	59 ± 39
Group “sinus”	28	10.6 ± 4.6	5.8 ± 4.8	65 ± 29

Table 3
Analytic results of pH monitoring

	Patients (number)	Criterion (1)	Criterion (2)	Global (1 or 2)
Total	72	40 (56%)	51 (71%)	54 (75%)
Group “larynx”	28	13 (46%)	19 (68%)	20 (71%)
Group “pharynx-otitis”	16	10 (62%)	11 (68%)	11 (68%)
Group “sinus”	28	17 (61%)	21 (75%)	23 (82%)
Posterior laryngitis	13	8 (61%)	13 (100%)	13 (100%)

Criterion (1): RI $\geq 4.2\%$ of time with pH < 4.

Criterion (2): number of episodes $\geq 40/24$ h.

t-test). The main rhinologic pathologies were chronic or recurrent rhinosinusitis (15 children, 54%), obstructive rhinitis (10 children, 36%) and unilateral polyposis (three cases of recurrent Killian polyp with chronic postoperative intractable inflammation). Other otolaryngologic symptoms were found in 15 children (54%), GI symptoms in four cases (14%) and one case of asthma.

Twenty-three children had a positive recording with a mean RI of $5.8 \pm 4.8\%$ and a mean number of 64 ± 29 reflux episodes/24 h. All the positive pH recordings had the typical pattern of multiple daytime refluxes.

3.4. Efficacy of medical treatment

Fig. 3 shows the efficacy of the medical treatment in each group. The outcome of 66 children was analyzed. Forty children (61%) received both antisecretory and prokinetic drugs, 6 (8%) prokinetics alone, 5 (7%) antisecretory drugs alone and 15 (24%) had no treatment (negative pH-monitoring). Forty-one (80%) out of the 51 treated children were clinically improved, whereas only 5 out of the 15 untreated children (χ^2 test, $p < 0.001$). The “sinus” group obtained the best rate of success (19 out of 22, i.e., 86%), whereas the “larynx” group obtained 79%, and the “pharynx-otitis” group only 70%. Six children (11%) received medical treatment despite a negative pH recording because clinical symptoms were highly suggestive of GER. Five out of these six children (80%) were improved.

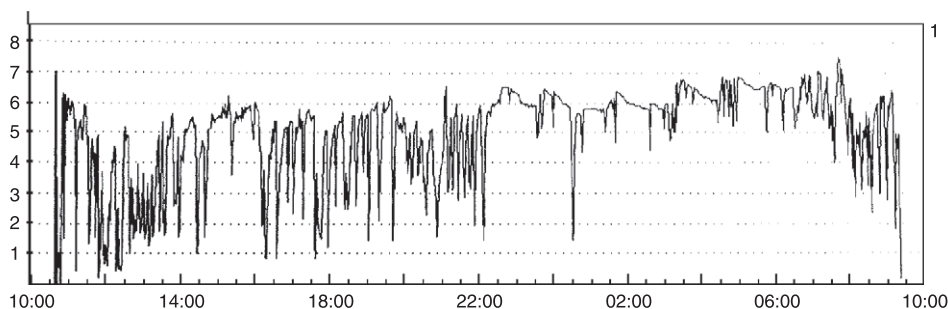


Fig. 2. Typical 24-h pH recording. The vertical axis represents the esophageal pH. The horizontal axis represents the time of recording (hour). Note the typical pattern with multiple daytime refluxes. The RI is 5.9 and the total number of episodes is 75. Only three episodes lasted more than 5 min.

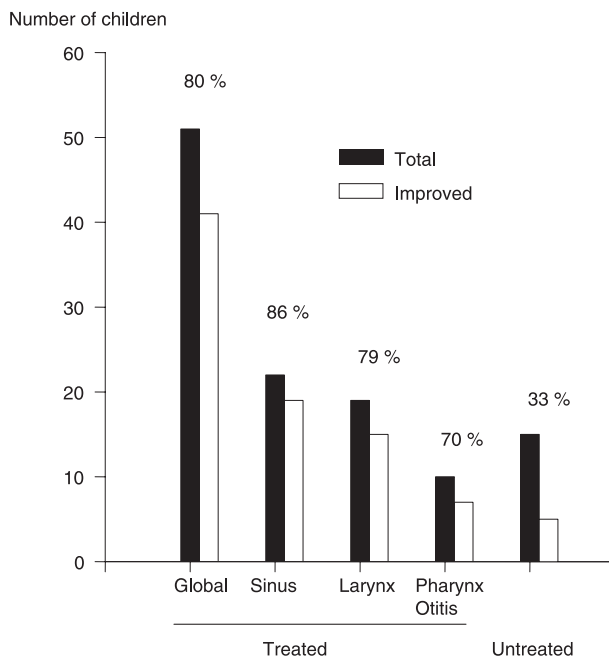


Fig. 3. Efficacy of medical treatment.

In addition, three children presenting with severe laryngeal pathology and history of subglottic stenosis were operated on (laparoscopic Nissen fundoplicature).

4. Discussion

GERD is a frequent condition in young children (almost two-thirds of infants younger than 4 months) that spontaneously resolves in the first 18 months of life [7]. Thus, newborn and neonates normally have RI up to 10% of total time, but it has been demonstrated that RI of children becomes comparable to adult values in children older than 1 year [8].

Gastroenterologic manifestations are less frequent in older children than in adults as suggested in our study (less than 10% of GER cases) probably because the children are not able to recognize the symptoms.

Esophageal pH monitoring is considered by most authors the “gold standard” for the diagnosis of GER. Naso- or hypopharyngeal refluxes of gastric content have been demonstrated in children suffering from laryngeal, pulmonary [6,9] or pharyngeal diseases [10,11] by double-probe pH monitoring. These findings reinforce the possible association between GER and rhinologic diseases.

However, the classical criterion used by gastroenterologists does not seem always adapted to the upper airway GER-related diseases. Contencin and Narcy [10] proposed to increase the threshold level from pH 4 to 6 but with a loss of specificity. In our experience,

visual interpretation of the recordings shows in most cases of GER-induced otolaryngologic disease a typical pattern with multiple daytime refluxes of short duration. These “microrefluxes” are probably too short to induce gastroenterologic symptoms but aggressive enough for the delicate pharyngolaryngeal mucosa. The total number of refluxes could be an adequate criterion to take into account these short episodes and increase the sensitivity of pH monitoring. In our study, the combination of an index $>4.2\%$ and the threshold of 40 episodes/24 h increased the sensitivity of pH recording of 20%.

The role of GER in rhinosinusitis remains controversial and rarely studied. The underlying mechanisms are unknown. The mechanism involved could be direct contact of the gastric juice on the nasopharyngeal mucosa, inducing an inflammatory response with ostial edema and resulting sinonasal infection. An alternative theory proposes the existence of an esophagonasal reflux similar to the mechanism suggested in GER-induced bronchial disease [12]. The gastropharyngeal reflux theory is reinforced by Beste et al. [11] who reported four cases of children presenting with a congenital choanal atresia presenting postoperative granulations and restenosis that required prolonged stenting. All these children had a nasopharyngeal reflux evidenced by double-probe pH monitoring or scintiscan. A recent prospective study shows a high prevalence (63%) of GER in children with chronic sinus disease [6], one-third of whom had a documented nasopharyngeal reflux using dual-probe pH monitoring.

Another argument for the contribution of GER in the pathogenesis of otolaryngologic and rhinosinusitis inflammation is the efficacy of prokinetics and antisecretory treatments. Barbero [13] reported several convincing cases of refractory chronic sinus diseases that improved after medical GER treatment. Bothwell et al. [5] demonstrated that the aggressive treatment of GER in children dramatically reduced the number of surgical procedures. Phipps et al. [6] recently showed by a prospective analysis that almost 80% of 30 children presenting with chronic sinus disease were improved by GER treatment.

In our study, the efficacy of medical treatment in both “larynx” and “pharynx-otitis” groups is on the order of 80% and more than 85% in the “sinus” group. Unfortunately, the optimum duration of the treatment is unknown. Some children required several months of antisecretory treatment, if necessary, iterative courses in case of recurrence. Some authors [5,14] proposed surgical treatment by laparoscopic Nissen including for rhinologic diseases in selected cases. Although the development of laparoscopic techniques has considerably increased the safety of antireflux surgery, prolonged medical treatment is our first choice for the “sinus” and “pharynx-otitis” groups, whereas surgery can be discussed in severe laryngeal or bronchial diseases.

References

- [1] T. Van Den Abbeele, N. Bruhier, P. Narcy, Severe laryngeal manifestations of gastro-esophageal reflux in children, *Pediatr. Pulmonol.*, Suppl. 120 (1997) 237–238.
- [2] D.M. Burton, S. Pransky, R.M. Katz, D.B. Kearns, A.B. Seid, Pediatric airway manifestations of gastro-esophageal reflux, *Ann. Otol. Rhinol. Laryngol.* 101 (1992) 742–749.
- [3] W.S. Gibson, W. Cochran, Otolgia in infants and children: a manifestation of gastroesophageal reflux, *Int. J. Pediatr. Otolaryngol.* 28 (1994) 213–218.
- [4] J.A. Koufman, The otolaryngologic manifestations of gastroesophageal reflux disease (GERD): a clinical

- investigation of 225 patients using ambulatory 24-hour pH monitoring and an experimental investigation of the role of acid and pepsin in the development of laryngeal injury, *Laryngoscope* 101 (1991) 1–64.
- [5] M.R. Bothwel, D.S. Parsons, A. Talbot, G.J. Barbero, B. Wilder, Outcome of reflux therapy on pediatric chronic sinusitis, *Otolaryngol. Head Neck Surg.* 121 (1999) 255–261.
 - [6] C.D. Phipps, W.E. Wood, W.S. Gibson, W.J. Cochran, Gastroesophageal reflux contributing to chronic sinus disease in children. A prospective analysis, *Arch. Otolaryngol. Head Neck Surg.* 126 (2000) 831–836.
 - [7] S.P. Nelson, E.H. Chen, G.M. Syniar, K.K. Christoffel, Prevalence of symptoms of gastroesophageal reflux during infancy: a pediatric practice-based survey, *Arch. Pediatr. Adolesc. Med.* 151 (1997) 569–572.
 - [8] Y. Vandenplas, L. Sacre-Smits, Continuous 24-hour esophageal pH monitoring in 285 asymptomatic infants 0–15 months old, *J. Pediatr. Gastroenterol. Nutr.* 6 (1987) 220–224.
 - [9] J.P. Little, B.L. Matthews, M.S. Glock, Extraesophageal pediatric reflux: 24-hour double/probe pH monitoring of 222 children, *Ann. Otol. Rhinol. Laryngol.* 106 (Suppl. 169) (1997) 1–16.
 - [10] P. Contencin, P. Narcy, Nasopharyngeal pH monitoring in infants and children with chronic rhinopharyngitis, *Int. J. Pediatr. Otorhinolaryngol.* 22 (1991) 249–256.
 - [11] D.J. Beste, S.F. Conley, C.W. Brown, Gastroesophageal reflux complicating choanal atresia repair, *Int. J. Pediatr. Otolaryngol.* 29 (1994) 51–58.
 - [12] D.L. Hamilos, Gastroesophageal reflux and sinusitis in asthma, *Clin. Chest Med.* 16 (1995) 683–697.
 - [13] G.J. Barbero, Gastroesophageal reflux and upper airway disease, *Otolaryngol. Clin. North Am.* 29 (1996) 27–38.
 - [14] D.L. Suskind, G.P. Zeringue III, E.A. Kluka, J. Udall, D.C. Liu, Gastroesophageal reflux and pediatric otolaryngologic disease, *Arch. Otol. Rhinol. Laryngol.* 127 (2001) 511–514.