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May chronic rhinosinusitis in children be diagnosed by clinical symptoms?

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ABSTRACT

Objectives: Chronic rhinosinusitis (CRS) is a common disease in childhood but is often underdiagnosed because the symptoms are subtle and similar to other nasal pathologies. No clinical symptom is pathognomonic, and consensus documents suggest nasal fibroendoscopy (NF) or imaging criteria (computed tomography, magnetic resonance imaging) as the gold standards for diagnosis of CRS. However, considering the frequent unavailability of such tools to physicians, we designed this study to evaluate whether combinations of symptoms may achieve a clinical diagnosis of CRS in children as confirmed by NF.

Methods: The study population consisted of 275 children with a clinical diagnosis of CRS, in 228 of whom diagnosis of CRS was confirmed by NF, while in 47 diagnosis was not confirmed by NF and they served as the control group. The symptoms considered were nasal obstruction, nasal discharge, cough, facial pain, and halitosis, using for statistical analysis multivariate logistic regression, Wald tests, and receiver operating characteristic (ROC) curve.

Results: The multivariate logistic regression for CRS symptoms indicated rhinorrea as the strongest predictor of CRS. With three symptoms the probability of CRS was from 60% to 75% without rhinorrea and 77-91% in the presence of this symptom, with four symptoms the probability was over 93%, and with all the five symptoms the probability of having CRS was virtually 100%.

Conclusions: These findings suggest that an initial symptoms assessment may help to recognize children with a high probability of CRS, thus reducing the need of NF or imaging techniques.

1. Introduction

Chronic rhinosinusitis (CRS) is a common disease in childhood, being defined as an inflammatory disorder of the nasal cavity and paranasal sinuses lasting over 12 weeks [1], CRS is generally underestimated, although a recent study found that its prevalence in 12 European countries was on average 11%, ranging from 7% in Finland to 27% in Portugal [2]. The clinical symptoms of CRS include nasal discharge, post nasal drip, nasal obstruction, cough, and facial pain [3]. Nevertheless, these symptoms are often subtle and non-specific, being present also in other nasal disorders [4]. This makes the diagnosis of CRS based on symptoms uncertain, and confirmation by nasal fibroendoscopy (NF) or by computed tomography (CT) is suggested, regardless of the patient's age, in the consensus document on rhinosinusitis [3]. However, such techniques are not always readily available and the possibility of a symptom based diagnosis should be particularly useful for general practitioners and pediatricians. Concerning adult patients, it was reported that the diagnosis of CRS obtained by clinical symptoms was not confirmed in more than 70% of cases by both NF [5] or CT [6]. For children, there is no contraindication to perform fibroendoscopy, while there is literature supporting limitation in using CT, based on excess radiation exposure [7,8]. Moreover, CRS symptoms in children may be quite different than in adults, with higher importance for persistent cough, prolonged nasal drainage, and behavioral difficulties [9].

This study was aimed at evaluating whether combinations of symptoms may achieve a clinical diagnosis of CRS in children as confirmed by NF.

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2. Material and methods

From a population of 2439 children referred to our clinic for evaluation of recurrent or chronic respiratory symptoms, we have selected children because of suspected CRS. According to the European Position Paper on Rhinosinusitis and Nasal Polyps (EP^3OS 2012) the suspicion of CRS had been considered if there were two or more symptoms, one of which should be either nasal blockage/obstruction/congestion or discharge (anterior/posterior nasal drip), facial pain/pressure, cough lasting for ≥12 weeks. Moreover, other symptoms such as epistaxis and halitosis have been evaluated. A NF was performed in all children to confirm the diagnosis of CRS. As suggested by EP^3OS the presence of nasal polyps, mucopurulent discharge, as well as edema or obstruction of the middle meatus, were assessed by endoscopy performed by a ENT specialist. For the purpose of the analysis, the patients were divided into two age groups, <6 and ≥6 years.

The data were obtained through standard practice not requiring ethics approval. However, the local Ethical Committee was informed about the procedure of the study, and parents or tutors gave their consent to the inclusion of children in the study.

2.1. Endoscopy

Nasopharyngeal endoscopy was performed by fiberoptic flexible nasopharyngoscope Storz 11101 SK of 2.5 mm of diameter (Karl Storz GmbH & Co. KG D, Tuttlinghen, Germany); in all cases endoscopic evaluation included nasal turbinates and middle meatus, and the rhinopharynx to evaluate adenoid and Eustachian tube orifice.

2.2. Statistical analysis

We used the chi-square test to compare categorical variables between children with and without CRS. Using NF as the gold standard, the clinical symptoms were evaluated in terms of sensitivity and specificity. Using a multiple logistic regression model we also calculated odds ratios (OR), their 95% confidence intervals (CI), Wald tests, and the area under curve (AUC) of the receiver operating characteristic (ROC) curve for symptoms (excluding epistaxis). We then calculated the predicted probability of CRS for different combinations of symptoms. Analyses were performed with Stata 13 (Stata-Corp. 2013. Stata: Release 13. Statistical Software. College Station, TX: StataCorp LP).

3. Results

Two hundred and seventy-five children with clinical diagnosis of CRS were enrolled in this study (159 males and 116 females, mean age 5.3, range 1.9-14 years). Diagnosis of CRS was confirmed by endoscopy in 228 children (96 females and 132 males), 171 of whom aged <6 years. In 47 children (20 females and 27 males) diagnosis of CRS was not confirmed by endoscopy and they served as the control group. Clinical and epidemiological data are shown in Table 1. Sensitivity of symptoms ranged from 7% (epistaxis) to 96% (rhinorrea). Specificity ranged from 19% (rhinorrea) to 91% (facial pain).

The multivariate logistic regression model for CRS symptoms (not including epistaxis) yielded the results shown in Table 2. The strongest predictor of CRS was rhinorrea, with an OR of 15.9. The overall usefulness of the selected symptoms is described by the ROC curve (Fig. 1) which had an AUC of 87.1%. Using the equation:

$CRS = -4.59 + 1.45 \times H + 2.16 \times C + 1.94 \times FP + 2.76 \times R + 1.60 \times NO$, where H = halitosis, C = cough, FP = facial pain, R = rhinorrea, and NO = nasal obstruction, we estimated the probability of CRS and 95% confidence intervals for different combinations of symptoms (Table 3). Two children had only one symptom and the probability of CRS was quite low (8% and 14%). Children with two symptoms were 51, with probability of CRS ranging from 26 to 30% among a few children without rhinorrea and 44–58% among those (the majority) with rhinorrea. With three symptoms (92 children) the probability of CRS was from 60% to 75% without rhinorrea and 77–91% in the presence of this symptom (again the majority of children). When there were four symptoms (92 children) the probability of CRS was over 93%. For the 38 children who had all the five symptoms the probability of having CRS was virtually 100%.

Frequencies of halitosis, rhinorrea, and epistaxis were similar in children aged <6 and those aged ≥6 years (Table 4). Conversely, younger children had a higher frequency of cough and lower frequency of facial pain and nasal obstruction. However, in univariate logistic models there were no significant interactions between each

Table 1
Characteristics of the 275 children included in the study.

	CRS/yes		CRS/no		p-Value*
	No.	%	No.	%	
All	228	83	47	17	
Gender					0.96
Females	96	42	20	43	
Males	132	58	27	57	
Age class					
<6 years	171	75	33	70	0.50
6+ years	57	25	14	30	
Halitosis					
No	75	33	34	72	<0.001
Yes	153	67	13	28	
Sensitivity % (IC 95%)		67 (61–73)			
Specificity % (IC 95%)				72 (57–84)	
Cough					
No	40	17	20	43	<0.001
Yes	188	82	27	57	
Sensitivity % (IC 95%)		82 (77–87)			
Specificity % (IC 95%)				43 (28–58)	
Facial pain					
No	156	68	43	91	0.001
Yes	72	32	4	9	
Sensitivity % (IC 95%)		32 (26–38)			
Specificity % (IC 95%)				91 (80–98)	
Rhinorrea					
No	8	4	9	19	<0.001
Yes	220	96	38	81	
Sensitivity % (IC 95%)		96 (93–98)			
Specificity % (IC 95%)				19 (9–33)	
Nasal obstruction					
No	37	16	15	32	0.01
Yes	191	84	32	68	
Sensitivity % (IC 95%)		84 (78–88)			
Specificity % (IC 95%)				32 (19–47)	
Epistaxis					
No	211	93	42	89	0.46
Yes	17	7	5	11	
Sensitivity % (IC 95%)		7 (4–12)			
Specificity % (IC 95%)				89 (77–96)	

CI, confidence interval.
* From chi-square test.