

The ImmunoCAP[®] rapid wheeze/rhinitis child test is useful in the initial allergy diagnosis of children with respiratory symptoms

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Recurrent upper or lower respiratory symptoms, possibly allergy-related, are very frequent in childhood. It is therefore important that physicians involved in the primary care of these children have an accurate initial diagnostic tool available. In this study, we investigated the value of an *in vitro* diagnostic device testing 10 common allergens, the ImmunoCAP[®] rapid wheeze/rhinitis Child, for the primary evaluation of allergy. Children with non-infectious upper or lower respiratory symptoms possibly related to allergy were recruited in the primary health care setting of private practices of physician trained in immunology/allergology. The investigators carried out their usual diagnostic work-up including IgE tests, and the ImmunoCAP[®] Rapid test was performed with capillary whole blood in a blinded way to the investigator. The investigators' conclusions on major triggering allergens were compared to the ImmunoCAP[®] Rapid test results. In the whole patient population ($n = 185$), the sensitivity of the ImmunoCAP[®] Rapid test for unveiling allergic disease was 92% (95% CI: 86–96%) and the specificity 97% (95% CI: 86–100%). Current guidelines for allergy diagnosis suggest screening children with recurrent, moderate/severe diseases for allergies. For children with asthma falling into these categories, sensitivity was 100% (95% CI: 88–100%) and specificity 100% (95% CI: 69–100%); for children with moderate and severe rhinitis sensitivity was 93% (95% CI: 86–97%) and the specificity 100% (95% CI: 79–100%). The ImmunoCAP[®] Rapid test is an accurate test, in particular with regard to high specificity, for diagnosing allergy in children with recurrent respiratory diseases in primary care settings.

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Recurrent obstructive respiratory symptoms in childhood might be related or not to allergy (1, 2). Similarly, sneezing and a runny nose often occur, mostly without an allergic background but rather

due to a viral infection (3). Establishing the diagnosis of allergy in these children is difficult, as sensitization, i.e., positive allergy tests, may not necessarily be ensued by symptoms.

Pediatricians and general practitioners are the primary healthcare providers for the pediatric population, and in many countries they do not perform routine allergy testing. The European

Abbreviations: ImmunoCAP[®] Rapid, ImmunoCAP[®] Rapid Wheeze/Rhinitis Child.

Academy of Allergy and Clinical Immunology (EAACI) recommends that primary care physicians, in collaboration with specialists, increase their competence in the diagnosis and the treatment of allergy and allergy-like diseases. Guidelines were published by the EAACI Section on pediatrics in order to improve early allergy diagnosis in childhood. By following the canvas of 'why, who, when and how,' children with symptoms suggestive of allergy should be investigated (4). In addition to symptoms possibly suggesting allergy, the severity of the symptoms was identified as an important criterion for an indication to perform allergy testing.

'How' addressed the type of allergy tests for the primary healthcare providers and stressed the importance of having reliable and easy to use tests available for allergy diagnosis in the primary care setting. Providing this group of physicians with a diagnostic tool for identifying allergic patients at the point-of-care leads to better patient management and allows for *in vitro* allergy tests to be performed easily by paramedical personnel. A correct diagnosis is important for the doctor to choose the proper treatment, to make the correct referrals to a specialist and, if appropriate in case of allergy, to give a recommendation of avoidance when the offending allergen can be identified. As a consequence, such an efficient approach can result in reduced costs for the patient and society and an improved quality of life for the patient.

The purpose of this study was to evaluate the utility of ImmunoCAP® Rapid wheeze/rhinitis Child (ImmunoCAP® Rapid), an *in vitro* diagnostic medical device testing 10 common allergens, as a tool, within primary care, in the initial handling of children with allergy-like respiratory symptoms. This evaluation was made by comparing the results from ImmunoCAP® Rapid with the investigators' conclusion on major triggering allergens for the child's allergy-related respiratory symptoms, based on information from the patient history, physical examination and IgE tests.

Methods

This study was a prospective one-visit study in primary care in Switzerland and included five study sites. The investigators were pediatricians additionally trained and board-certified in clinical immunology and allergy. Their private practice represents the typical pediatric patient profile of primary care. The study was reviewed by the Local Ethics Committees of each study

site and inclusion was subjected to written consent by the patient or legal guardian.

Children up to 16 yr of age with recurrent wheezing, asthma and/or rhinitis, i.e., more than one episode not suspected to be caused by an infection, consecutively coming for a regular appointment to the investigator within the study period (May 2006–January 2007) were asked to participate.

Patients with an allergy diagnosis made during the 2-yr prior to the study were excluded. At the study visit, the child was taken care of in accordance with standard routines at the site. The investigator documented the patient's case history, allergy-like symptoms, triggering factors, exposure at home and any ongoing symptom treatment. The severity of rhinitis was graded according to the ARIA classifications (5, 6) as follows; *Mild*: if none of the following items were present: sleep disturbance, impairment of daily activities, impairment of leisure and/or sport, impairment of school or work, or troublesome symptoms; *Moderate-to-severe*: if one or more of the following items were present: sleep disturbance, impairment of daily activities, impairment of leisure and/or sport, impairment of school or work, or troublesome symptoms. The severity of asthma was graded following the GINA classification (7) as follows: *Intermittent*: Symptoms less than once a week, brief exacerbations, nocturnal symptoms not more than twice a month; *Mild-persistent*: symptoms more than once a week but less than once a day, exacerbations maybe affecting activity and sleep, nocturnal symptoms more than twice a month; *Moderate-persistent*: symptoms daily, exacerbations maybe affecting activity and sleep, nocturnal symptoms more than once a week, daily use of inhaled short-acting β_2 -agonist; *Severe-persistent*: symptoms daily, frequent exacerbations, frequent nocturnal asthma symptoms, limitation of physical activities.

To allow proper comparison of the ImmunoCAP® Rapid test with clinical practice in primary care, the research protocol implicated that the choice of the method, specific IgE tests and/or skin prick tests, as well as the choice of tested allergens should be chosen according to the routine clinical procedure of the investigator. At the end of the investigation the doctor made a conclusion on major triggering allergens i.e., which allergen/-s that causes the child's most pertinent symptoms. This conclusion was based not only on positive-specific IgE tests and/or skin prick tests (sensitization), but also on the clinical judgment based on a history corresponding to the positive tests (allergy).

IgE testing for study specific purposes

The ImmunoCAP® Rapid Wheeze/Rhinitis Child is a near patient assay for qualitative determination of allergen-specific IgE antibodies in capillary whole blood. Ten allergens (egg white, cow's milk, cat epithelium and dander, dog dander, timothy (*Phleum pratense*), mugwort (*Artemisia vulgaris*), wall pellitory (*Parietaria judaica*), olive pollen (*Olea europaea*), common silver birch pollen (*Betula verrucosa*), and house dust mite (*Dermatophagoides pteronyssinus*) were tested, and 10 separate results (positive or negative), i.e., one per allergen, were reported. The results were available within 30 min. The test was performed by a nurse, in accordance with the manufacturer's instructions, for all patients at the end of the study visit and in a way blinded to the investigator. The results were recorded separately and disclosed to the investigator only after study completion. In patients agreeing to provide a serum sample from venous blood, specific IgE was also performed by ImmunoCAP® specific IgE with the arbitrary cut-off levels 0.35 kU_A/l, 1.0 kU_A/l and 2.0 kU_A/l and compared with ImmunoCAP® Rapid test results.

Statistical method

The diagnostic performance; sensitivity and specificity with 95% confidence intervals (8), was calculated for ImmunoCAP® Rapid using the conclusion of the doctor as the reference. Primarily, the performance was calculated for the 10 allergens collectively, (any of the allergens positive or all allergens negative), but secondarily also for each allergen separately.

The analysis of the performance for the 10 allergens collectively was repeated for subgroups of asthma according to the GINA classification, rhinitis according to the ARIA classification, age <7 (an age below which many primary care physicians are reluctant to test for allergies) or ≥7 yr, and indication to test according to Host et al. (4).

Results

Demographics

A total of 185 patients (median age: 8.1 yr, range: 0.7–16 yr) were recruited in the five study sites. Each site recruited between 7 and 60 patients (median 35). One hundred-and-twenty-eight (69%) patients were male and 57 (31%) were female. Seventy (38%) were <7 yr of age and 115

(62%) were between 7 and 16 yr of age. The gender distribution was similar in both groups. Seventy-one patients (38%) were suffering from asthma and rhinitis, 48 (26%) from asthma exclusively, and 66 (36%) from rhinitis exclusively.

ImmunoCAP® Rapid test results compared to doctor's conclusions

Our primary end-point was to assess the reliability of the ImmunoCAP® Rapid in unveiling whether allergy caused the presenting symptoms or not. We thus compared the conclusion reached by the pediatric allergologist using his routine work-up (specific IgE and/or SPT interpreted in correlation to the history of the patient) to the results of the ImmunoCap® Rapid test (at least one positive allergen or all allergens negative). The overall sensitivity of the test in this comparison was 92% (95% CI: 86–96%), the specificity 97% (95% CI: 86–100%) (Table 1).

ImmunoCAP® Rapid test results according to the severity of the disease

Allergy tests should be performed according to the disease severity criteria. First, we analyzed the accuracy of the ImmunoCAP® Rapid test in children with asthma alone, or asthma and rhinitis according to the severity of asthma by the GINA classification (7). Overall, the sensitivity of the test, 91% (95% CI: 83–96%), and the specificity of the test, 97% (95% CI: 82–100%), in patients with asthma (including those with asthma and rhinitis) were similar to that in the whole population (including also patients with rhinitis alone, see Table 1). In those patients with moderate to severe persistent asthma, i.e., in those patients for whom allergy testing is recommended, the ImmunoCAP® Rapid test had a sensitivity of 100% (95% CI: 88–100%) and a specificity of 100% (95% CI: 69–100%) (Table 2). Performing an allergy work-up might also be envisaged in selected

Table 1. ImmunoCAP® Rapid results compared to doctor's conclusions

Doctor's conclusion*		ImmunoCAP® Rapid†		Total
		Pos	Neg	
Pos	n	136	12	148
	%	91.9	8.1	100
Neg	n	1	36	37
	%	2.7	97.3	100
Total		137	48	185

*Pos, at least one major triggering allergen identified; Neg, no major triggering allergens found.

†Pos, at least one positive allergen; Neg, all allergens negative.

Table 2. ImmunoCAP® Rapid compared to doctor's conclusions according to disease severity (GINA) for asthma (including patients with asthma alone or asthma & rhinitis)

Doctor's conclusion*		Severity of asthma											
		Intermittent			Mild persistent			Moderate-to-severe persistent			Total		
		ImmunoCAP® Rapid†			ImmunoCAP® Rapid†			ImmunoCAP® Rapid†			ImmunoCAP® Rapid†		
		Pos	Neg	Total	Pos	Neg	Total	Pos	Neg	Total	Pos	Neg	Total
Pos	n	20	4	24	33	4	37	29	–	29	82	8	90
	%	83.3	16.7	100	89.2	10.8	100	100	–	100	91.1	8.9	100
Neg	n	–	9	9	1	9	10	–	10	10	1	28	29
	%	–	100	100	10.0	90.0	100	–	100	100	3.4	96.6	100
Total	n	20	13	33	34	13	47	29	10	39	83	36	119

*Pos, at least one major triggering allergen identified, Neg, no major triggering allergens found.

†Pos, at least one positive allergen, Neg, all allergens negative.

patients with mild persistent asthma. In this subgroup of patients the sensitivity was 89% (95% CI: 75–97%) and the specificity 90% (95% CI: 55–100%). When results by disease severity were analyzed in patients with asthma moderate to severe asthma without rhinitis, the sensitivity and the specificity of the test were similar (both 100%) to those in patients with asthma and rhinitis.

A similar analysis was performed to assess the helpfulness of the ImmunoCAP® Rapid test in patients suffering from different degree of rhinitis severity according to the ARIA classification (5). In the group with moderate to severe rhinitis, the sensitivity of the ImmunoCAP® Rapid test for detecting the presence of allergic disease was 93% (95% CI: 86–97%) and the specificity 100% (95% CI: 79–100%) (Table 3). The sensitivity/specificity of the test, when applied in patients

with rhinitis regardless of the severity of the disease was 92% (95% CI: 85–96%) /100% (95% CI: 81–100%), and in the group of patients with mild rhinitis 85% (95% CI: 55–98%) /100% (95% CI: 16–100%), was similar to the general population. The ImmunoCAP® Rapid test was as reliable in patients with rhinitis alone (specificity 93%, sensitivity 100%) as in patients with rhinitis and asthma.

ImmunoCAP® Rapid test results according to age

Next, we analyzed the accuracy of the test in different age groups by dividing the patients into two age groups, 0–7 yr and 7–16 yr of age. All 23 children < 7 yr of age in whom the investigators diagnosed 'no major triggering allergen identified' had a negative ImmunoCAP® Rapid test result; this gave a calculated 100% specificity of the test (95% CI: 85–100%) (Table 4). In

Table 3. ImmunoCAP® Rapid compared to doctor's conclusions according to disease severity (ARIA) for rhinitis (including patients with rhinitis alone or asthma & rhinitis)

Doctor's conclusion*		Severity of rhinitis								
		Mild			Moderate to severe			Total		
		ImmunoCAP® Rapid†			ImmunoCAP® Rapid†			ImmunoCAP® Rapid†		
		Pos	Neg	Total	Pos	Neg	Total	Pos	Neg	Total
Pos	n	11	2	13	98	8	106	109	10	119
	%	84.6	15.4	100	92.5	7.5	100	91.6	8.4	100
Neg	n	–	2	2	–	16	16	–	18	18
	%	–	100	100	–	100	100	–	100	100
Total	n	11	4	15	98	24	122	109	28	137

*Pos, at least one major triggering allergen identified; Neg, no major triggering allergens found.

†Pos, at least one positive allergen; Neg, all allergens negative.

Table 4. ImmunoCAP® Rapid compared to doctor's conclusions according to age

Doctor's conclusion*		Age					
		<7 yr			≥7 yr		
		ImmunoCAP® Rapid†			ImmunoCAP® Rapid†		
		Pos	Neg	Total	Pos	Neg	Total
Pos	n	42	5	47	94	7	101
	%	89.4	10.6	100	93.1	6.9	100
Neg	n	–	23	23	1	13	14
	%	–	100	100	7.1	92.9	100
Total	n	42	28	70	95	20	115

*Pos, at least one major triggering allergen identified; Neg, no major triggering allergens found.

†Pos, at least one positive allergen; Neg, all allergens negative.

addition, the test was found to be very reliable with regard to sensitivity in the younger age group, 89% (95% CI: 77–97%) but also in the older age group, 93% (95% CI: 86–97%). Overall, false positive tests (only one out of the total of 37 patients with ‘no allergy’ tested) do not diminish the reliability of the ImmunoCAP® Rapid test.

Reliability of the different allergen tested

Analysis of results at this point gave global results with regard to the overall reliability of the ImmunoCAP® Rapid for the diagnosis of allergy. However, the test also provides individual non-quantitative results for ten common allergens. Variable results were found with sensitivity above 75% for IgE to house dust mites 82% (95% CI: 69–91%), timothy 80% (95% CI: 71–87%), and cat 76% (95% CI: 60–89%) (Table 5). Low number of patients for wall pellitory, olive tree, dog and mugwort hamper a proper interpretation of the results. Specificity was overall very high with numbers above 85% for most allergens. With regard to the two food antigens tested (egg white and milk) the investigators’ diagnoses were negative in all patients; the test was positive (denoting sensitivity in absence of clinical allergy) in only four patients

for egg white, specificity 98% (95% CI: 95–99%), and one patient for milk, specificity 99% (95% CI: 97–100%).

ImmunoCAP® Rapid test compared to ImmunoCAP® specific IgE

With regard to cat, birch, timothy, house dust mite separately and for all 10 allergens together we then assessed the sensitivity and specificity for the diagnosis of a clinically relevant allergy as indicated by the results of the ImmunoCAP® Rapid in comparison to the levels of allergen-specific IgE, as tested by ImmunoCAP® Specific IgE by using different cut-off levels. Except for birch, a sensitivity above 80% was found for all cut-off levels (>0.35 kU A/L, 1.0 kU A/L and 2.0 kU A/L). A high specificity of above 90% was found for all allergens (Fig. 1).

Discussion

Children often suffer from respiratory symptoms which are possibly allergy-related. It is a major task for primary healthcare physicians to rule out or have definite arguments for further allergy assessment by a specialist. A reliable allergy diagnostic tool for use in a primary healthcare

Table 5. ImmunoCAP® Rapid compared to doctor’s conclusions for specific allergens

Doctor’s conclusion*		Allergen														
		Cat			Birch			Mugwort			Timothy			Dog		
		ImmunoCAP® Rapid			ImmunoCAP® Rapid			ImmunoCAP® Rapid			ImmunoCAP® Rapid			ImmunoCAP® Rapid		
		Pos	Neg	Tot	Pos	Neg	Tot	Pos	Neg	Tot	Pos	Neg	Tot	Pos	Neg	Tot
Pos	n	29	9	38	44	16	60	1	8	9	89	22	111	3	2	5
	%	76.3	23.7	100	73.3	26.7	100	11.1	88.9	100	80.2	19.8	100	60.0	40.0	100
Neg	n	20	127	147	16	109	125	11	164	175	9	65	74	7	173	180
	%	13.6	86.4	100	12.8	87.2	100	6.3	93.7	100	12.2	87.8	100	3.9	96.1	100
Total	n	49	136	185	60	125	185	12	172	184	98	87	185	10	175	185

Doctor’s conclusion*		Allergen														
		Olive tree			Wall pellitory			House dust mite			Egg white			Milk		
		ImmunoCAP® Rapid			ImmunoCAP® Rapid			ImmunoCAP® Rapid			ImmunoCAP® Rapid			ImmunoCAP® Rapid		
		Pos	Neg	Tot	Pos	Neg	Tot	Pos	Neg	Tot	Pos	Neg	Tot	Pos	Neg	Tot
Pos	n	3	4	7	1	0	1	41	9	50	0	0	0	0	0	0
	%	42.9	57.1	100	100	–	100	82.0	18.0	100	–	–	100	–	–	100
Neg	n	61	117	178	17	167	184	10	125	135	4	181	185	1	184	185
	%	34.3	65.7	100	9.2	90.8	100	7.4	92.6	100	2.2	97.8	100	0.5	99.5	100
Total	n	64	121	185	18	167	185	51	134	185	4	181	185	1	184	185

*Pos, allergen concluded a major triggering allergen; Neg, allergen not considered a major triggering allergen.

Table 6. ImmunoCAP Rapid compared to doctor's conclusions according to indication to test, Host et al. (4)

Doctor's conclusion*		Indication to test								
		No			Yes			Total		
		ImmunoCAP® Rapid†			ImmunoCAP® Rapid†			ImmunoCAP® Rapid†		
		Pos	Neg	Total	Pos	Neg	Total	Pos	Neg	Total
Pos	n	2	2	4	8	—	8	10	2	12
	%	50.0	50.0	100	100	—	100	83.3	16.7	100
Neg	n	—	1	1	—	12	12	—	13	13
	%	—	100	100	—	100	100	—	100	100
Total	n	2	3	5	8	12	20	10	15	25

*Pos, at least one major triggering allergen identified; Neg, no major triggering allergens found.

†Pos, at least one positive allergen; Neg, all allergens negative.

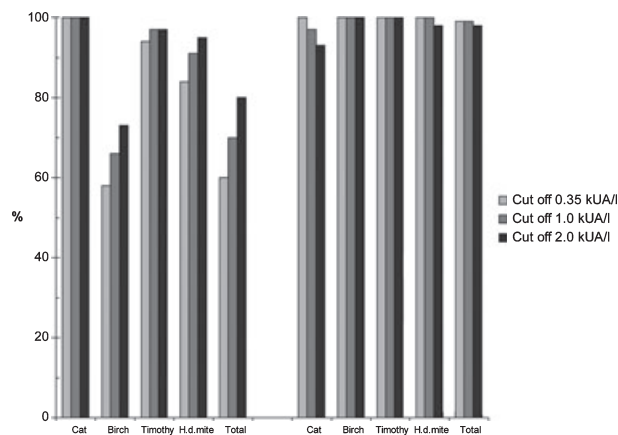


Fig. 1. Concordance of ImmunoCAP® Rapid compared to ImmunoCAP®-specific IgE (with various cut-off values for positivity) for four specific allergens and for all 10 allergens together.

setting is essential. In this study, we assessed the usefulness of such a diagnostic tool for respiratory allergy, the ImmunoCAP® Rapid, for detecting clinically relevant allergy. We have shown that this test, a near-patient assay for the qualitative determination of allergen-specific IgE antibodies in capillary whole blood, has an excellent specificity and sensitivity for revealing whether or not allergy is the underlying cause of the patients' symptoms.

The study was performed in a clinical setting corresponding to primary healthcare, i.e., in offices of pediatricians seeing children presenting for common respiratory symptoms for the first time. The gold standard for diagnosis was the investigators' conclusion on the implication of a major triggering allergen. To achieve this stan-

dard of diagnosis, we selected investigators who were trained and board-certified in allergy and clinical immunology. The investigator's conclusions, based on the history as well as on IgE tests, as to whether or not clinically relevant allergies were underlying the children's symptoms were then compared with the results of the ImmunoCAP® Rapid test. When interpreting a positive result for at least one of the ten allergens on the ImmunoCAP® Rapid as indicating a clinically relevant allergy without drawing conclusions on which allergen was causing the diseases, the sensitivity of the test was 92% and the specificity 97%. Thus, the ImmunoCAP® Rapid fulfilled the primary aim of this investigation, i.e., to provide to primary care a primary allergy evaluation tool allowing confirmation or exclusion of allergy in the pathogenesis of common, non-infectious, respiratory symptoms in children (Table 6).

An efficient and cost-effective allergy work-up in primary health care is based on allergy diagnosis according to disease severity. A group of experts specialized in pediatric allergy together with primary healthcare physicians recently presented guidelines based on evidence-based medicine for the diagnosis of allergy in childhood (4). According to these guidelines, children with persisting and long-lasting lower respiratory symptoms or treatment-resistant rhinitis should be investigated for allergy. This level of disease severity corresponds to moderate-to-severe rhinitis according to ARIA guidelines (5) or to moderate-to-severe persistent asthma according to GINA guidelines (7). Consequently, it is important that the ImmunoCAP® Rapid test yields accurate results in these patient groups. Indeed, in patients with moderate-to-severe rhinitis the specificity was 100% and the sensitivity 93%. Similarly, in patients with moderate-to-severe persistent asthma specificity (100%) as well as sensitivity (100%) was excellent. In addition, with a rate of positive doctor's conclusions of 80% (148/185), we have a similar number for allergy in patients with rhinitis and/or asthma as in other general populations (9).

Allergy diagnosis, in particular in the primary care setting, is hampered by false-positive tests reflecting sensitivity to a common allergen in the absence of symptoms triggered by this allergen, i.e., clinically relevant allergy. Providing an allergy test to primary care with a high specificity is therefore especially important. In addition, in order not to introduce an interpretation bias by the pre-test probability of allergen positivity, we avoided to calculate predictive values, and provided numbers for sensitivity and specificity. The ImmunoCAP® Rapid test, analyzed either for

the whole population, or in the different subgroups according to disease severity or age, always provided a very high specificity. Providing good specificity is particularly important in the case of young children. In these patients, positive tests often denote exclusively of sensitization in the absence of clinical allergy and can be wrongly over-interpreted. Thus, the risk of patients wrongly diagnosed as allergic only due to a positive test remains low. The sensitivity of the ImmunoCAP[®] Rapid was compared to ImmunoCAP[®] Specific IgE, which is considered as the standard. Although there were variations between specific allergens, ImmunoCAP[®] Rapid was found to be slightly less sensitive than ImmunoCAP[®] Specific IgE. However the ImmunoCAP[®] Rapid test is designed to be an evaluation test for the primary care setting and the slightly lower sensitivity to the common allergens tested is contra-balanced by the very good specificity. In any case, a patient with a negative test but a history suggestive for allergy should be referred by the primary care physician to an allergist for further diagnostic work-up.

Allergy testing for the diagnosis of respiratory disease is usually performed by skin prick tests and/or by *in vitro* IgE testing (10). Accurate skin prick testing relies on standardized methods as well as the use of proper extracts (11). In addition, accurate skin prick testing is dependent on the personal experience of the investigator and is directly related to the number of tests performed. These prerequisites are not usually reached in a primary care setting, leading primary care to favor *in vitro* IgE testing. It has been demonstrated in primary care that the determination of specific IgE antibodies improves the management of patients with symptoms possibly related to allergy (12). *In vitro* evaluation tests, such as the Phadiatop[®] (Phadia, Uppsala Sweden), have been utilized for many years, also in assessing sensitization in young infants. They have been found to be a reliable alternative to skin prick tests for detecting relevant IgE-sensitization in children at two years of age (13). They have also been tested for their effectiveness in predicting the development of atopic disease during childhood. However, a limited sensitivity of these tests has also been reported (14). Phadiatop[®] Infant has also been investigated with regard to predicting the diagnosis of wheezing or eczema in children younger than 4 yr of age (15). In this specific study, which has similarities to ours, but performed in patients referred by primary care physicians to allergists, the accuracy of the Phadiatop Infant[®] was evaluated in a blinded manner against the allergologists' final diagnosis.

The sensitivity of the test was found to be 92% and specificity 82%. According to these results, 18 of 100 children would be wrongly diagnosed as allergic, based on a false-positive test only denoting sensitivity. In comparison, the ImmunoCAP[®] Rapid which demonstrated in our study to have a better specificity, is more accurate in the primary care setting where specificity is of high importance.

Conclusions

In conclusion, due to the high prevalence of allergic diseases, close cooperation between primary care and specialized physicians is essential. Very often, the initial evaluation for allergy is performed by primary care physicians. Thus, primary care needs reliable diagnostic tests, in particular with regard to specificity. In this study, we have demonstrated that the ImmunoCAP[®] Rapid test is a reliable diagnostic tool for the evaluation of children with respiratory disease. In addition, it might be recommended for the evaluation of allergic diseases in the children with respiratory diseases according to current guidelines which suggest performing tests according to the disease severity.

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Relevant conflict of interest disclosure

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