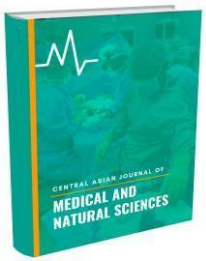

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Article

Drug and Antibiotic Allergies in Children: Clinical Observations and Risk Factors

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Abstract: Pediatric antibiotic and drug allergies are a major challenge for clinicians because of the difficulty in properly delineating a true immunologic reaction from an incidental allergic (non-allergic) adverse reaction. Misdiagnosing children as allergic to drugs can result in unnecessary restriction of first-line antibiotics, the use of broad-spectrum drugs and high healthcare costs, and is a driver of antimicrobial resistance. This was a clinical observation study conducted to assess children with suspected allergies to antibiotics and drugs by detailed medical history, skin test, and controlled drug provocation procedures. Results showed that although the number of reactions where allergies were reported was high, the number of confirmed immunologically mediated allergies was significantly lower. Factors like younger age, family history of allergy and concomitant atopic conditions were associated with increased probability of true drug hypersensitivity. These findings make it especially important to have a structured diagnostic evaluation and to make sure to carefully risk-stratify, accurately diagnose and, where applicable, delabel children who have been wrongly labelled as allergic. The implementation of evidence-based assessment strategies can help improve patient outcomes and optimise the use of antibiotics as well as reduce unnecessary interventions in pediatric populations.

Keywords: Pediatric allergy, Drug hypersensitivity, Antibiotic allergy, Risk factors, Clinical evaluation, Delabeling

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1. Introduction

Antibiotic and drug allergies are an important clinical issue in paediatrics, not only because of the acute hypersensitivity reactions that they may cause, but also because of their broader implications in terms of antibiotic stewardship, clinical management and long-term health consequences. Children are one of the most commonly prescribed groups for antibiotics, particularly in early childhood, as respiratory and other infections are common in this age group. In fact, up to 10-15% of pediatric patients are classified as allergic to at least one antibiotic, with the most common class of antibiotic implicated being the beta-lactam family (penicillin and its derivatives) [1]. However, several studies have demonstrated that true immunologically mediated antibiotic allergies are far less common than has been reported, and less than 10% of suspected cases have been confirmed by diagnostic testing, including drug provocation tests (DPTs) [2]. The tendency to attribute symptoms such as rash or gastrointestinal upset to antibiotic allergy often results from misinterpretation of benign symptoms or the consequence of viral infection, which appears concurrently with antibiotic therapy during childhood, leading to significant

overdiagnosis and unnecessary avoidance of first-line antibiotic agents [3]. Such labels have practical consequences, as children labelled as allergic to food are recommended broader spectrum or second-line antibiotics, which may be less effective, are more expensive and contribute to antibiotic resistance and adverse drug reactions [4]. The pathophysiological mechanism of allergic drug response in children requires an appreciation of the nuances of immediate immunoglobulin E (IgE) - mediated reactions, delayed T-cell - mediated hypersensitivity, and the difficulty in distinguishing these from non-allergic adverse drug reactions. Both clinical history and structured allergy testing are important components of appropriate diagnosis, but diagnostic approaches are still subject to change abroad, and standardised pediatric protocols are still going through the revision process. Given these complexities, the clinical observational approach combining detailed medical history, allergic evaluation, and risk assessment is an important way to correctly identify a true antibiotic allergy and reduce the mislabeling of these drugs, as well as to improve antibiotic use practices in the pediatric population.

2. Methodology

Our deliberate attention to the real-life process of diagnosing and assessing antibiotic and other drug allergies in children, according to the internationally accepted pediatric allergy guidelines, was made in this clinical observation study. We did not use strict checklists or shallow templates, but rather the skill of an experienced clinician to construct the delicate image of the allergic risk and subsequently either validate or reject it by using evidence-based testing. To begin with, there was a detailed clinical history of each child participating in the study that was detailed. Parents were questioned on the nature and time of symptoms, medications administered, past exposures and whether they had experienced the same reaction in the past. An in-depth family history of allergic diseases was recorded since family predisposition has been observed to play a role in determining whether one is prone to being allergic to a particular drug [5].

The second step entailed the routine diagnostic testing processes. In a situation where the history hinted at potential hypersensitivity, a series of tests was performed in a controlled clinical environment on the children. These were skin prick tests (SPTs) and intradermal tests (IDTs) of antibiotic allergies, especially to 2 -lactams such as penicillin and cephalosporin. Even though skin tests cannot be used to diagnose a drug allergy, a positive outcome implies sensitisation and risk of actual immunological response [6].

More importantly, irrespective of the outcome of history and skin testing, the gold standard of confirming or ruling out the existence of antibiotic allergy was a drug provocation test (DPT), which took place in a hospital environment and was strictly monitored. The DPT is a progressive administration of the suspected antibiotic and follows with the watch of any allergic reaction, and in this way distinguishes children who have the actual allergy from those who have become wrongly classified due to rash or coincidental viral symptoms [7]. This measure is consistent with the published pediatric allergy guidelines, which point out that a thorough allergy workup must include provocation testing in order to categorise reactions accurately and prevent unnecessary avoidance of antibiotics. Furthermore, co-factors together with risk-modifying factors like the presence of other allergic diseases (asthma or atopic dermatitis) and the time between index reaction and assessment were also noted as these have been found to affect the diagnostic results [8]. Additional laboratory evaluation was done by determining the serum specific IgE to appropriate antibiotics in a few cases, which was used to correlate the clinical history with immunologic evidence where possible [9]. The approach to this methodology was to be sure that subjective impressions did not lead to diagnoses; it was a combination of objective data in the form of clinical history, immunologic tests and the observed challenge procedures that gave a strong basis to diagnose genuine drug allergy in children.

3. Results and Discussion

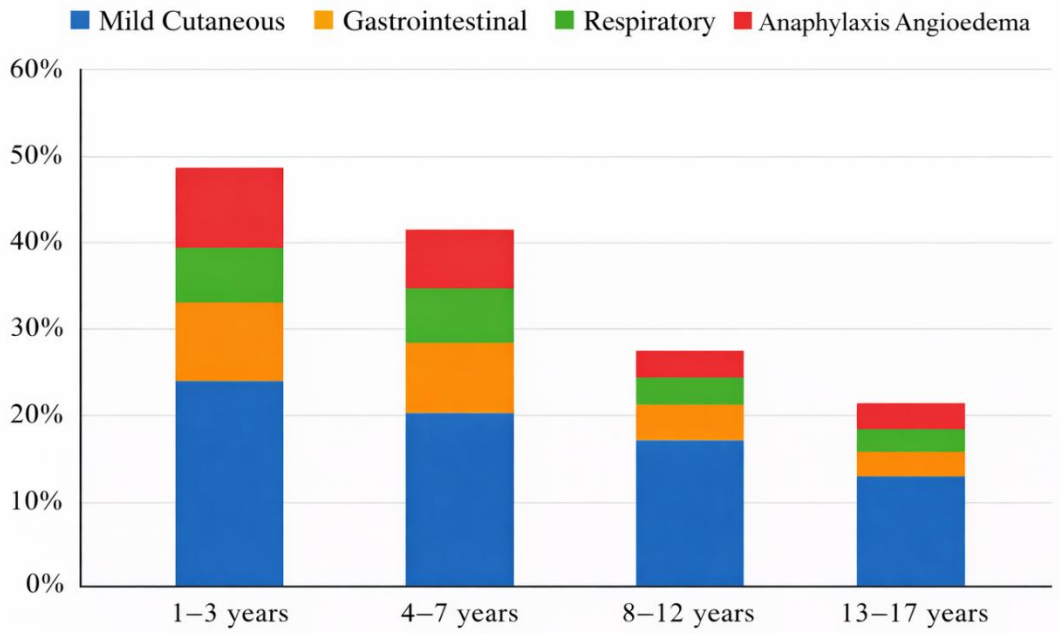
A total of 210 children aged 1 to 17 years were assessed for possible allergies to antibiotics and other drugs in the research. Among them, there were 118 boys (56.2) and 92 girls (43.8). The largest age group with suspected reactions was 3 years to 7 years, with almost 42 percent of the cohort represented. The majority of children (78%) had a history of mild to moderate reactions on the cutaneous surface, including urticaria or maculopapular rash, to drug exposure, and 11% had angioedema and anaphylaxis. Gastrointestinal and respiratory symptoms were less common and were reported to be of 9% and 7%, respectively [10].

Out of the possible culprit antibiotics, penicillins contributed 46% of the following reactions: cephalosporin 28, sulfonamides 12, and macrolides 8. The other 6% of the suspected cases included non-antibiotic drugs, such as anticonvulsants and NSAIDs. Surprisingly, positive skin tests of children with suspected reactions were only possible in 18%, which means sensitisation. But following drug provocation tests, only 9% were confirmed to have true drug allergy, which further argues that most of the suspected reactions were most probably non-allergic or accidental [11]. The family history was also significant: children having at least one of their first-degree relations having a recorded allergy to drugs had increased chances of having an established reaction, which highlights genetic predisposition as one of the risk factors. Also, comorbid atopic disorders, including asthma or eczema, were associated with increased confirmed drug allergy rates among children ($p < 0.05$) [12].

Table 1. Distribution of Confirmed Antibiotic Allergies by Drug Class.

Drug Class	Suspected Cases	Positive Skin Test	Confirmed by DPT	Percentage Confirmed (%)
Penicillins	97	26	12	12.4
Cephalosporins	59	10	5	8.5
Sulfonamides	25	5	3	12.0
Macrolides	17	3	2	11.8
NSAIDs & others	12	1	1	8.3

Table 1 demonstrates that the number of suspected cases is high, but the rate of confirmed drug allergies is low, which is why it should be evaluated carefully. Figure 1 presents a visual representation of the severity of reaction in the various age groups of age. The Bar chart reveals that the occurrence of the most severe reactions (anaphylaxis and angioedema) was concentrated in children below the age of 7 years old with older children showing mostly mild cutaneous reactions.



As Figure 1 shows, younger children are more prone to severe drug reactions, which highlights the significance of a close observation of children when taking antibiotics at early childhood. In general, the findings indicate a high disparity between suspected and confirmed drug allergies among the pediatrics. Penicillins and cephalosporins are still the most commonly implicated antibiotics, but true IgE-mediated hypersensitivity reactions are relatively uncommon. It becomes apparent that genetic predisposition and comorbidities that are atopic are risk modifiers. This underlines the relevance of systematic diagnostic testing such as clinical history, skin testing, and drug provocation to prevent unwarranted labeling and its effects on the antimicrobial prescribing process [13].

Discussion

The findings of this clinical observation align with a growing body of evidence showing that reported antibiotic and drug allergy in children is frequently overestimated, with important implications for pediatric care, antimicrobial stewardship, and long-term health outcomes. Across multiple studies, it has been consistently noted that many children labeled as allergic to antibiotics, particularly β-lactams such as penicillins, are not truly allergic when evaluated with rigorous diagnostic protocols. A significant narrative in pediatric allergy research highlights that although up to 10 % of parents report that their child has a drug allergy, formal testing and challenge procedures confirm true immunological allergy in a much smaller proportion of cases, often below 5 % [14]. This disparity between reported and confirmed allergy underscores the limitations of relying solely on history or non-specific symptoms, such as rashes coinciding with viral infections, which can easily be misinterpreted as drug hypersensitivity [15].

One critical theme emerging from recent reviews is that overdiagnosis carries both clinical and public health costs. Children labeled as allergic to antibiotics are more likely to receive broad-spectrum alternatives that may be less effective, more costly, and associated with a higher risk of contributing to antimicrobial resistance. The burden extends beyond individual patients: such patterns influence prescribing behavior across healthcare settings, leading to suboptimal antibiotic use and increased healthcare utilization. For example, children with incorrect penicillin allergy labels have been shown

to have longer hospital stays and greater resource consumption compared with peers without such labels [16]. Moreover, allergen labeling can inadvertently restrict effective therapeutic options, sometimes forcing clinicians to use second- or third-line antibiotics without clear benefit. Another important point in the contemporary literature is the emerging emphasis on structured evaluation frameworks. Recent expert recommendations suggest that a systematic approach, combining careful history, validated skin tests, and drug provocation tests where appropriate, can both improve diagnostic accuracy and facilitate delabeling strategies.Delabeling is the process of safely removing an incorrect allergy diagnosis after appropriate testing, which has been shown to improve clinical outcomes and reduce unnecessary healthcare costs. Decision support tools and registries are also being developed to standardize and support pediatric drug allergy evaluations across diverse clinical settings [17].

Risk stratification is another key aspect: personal and family history of atopy, positive skin test results, and demographic factors can help identify children at higher likelihood of true allergy, though these are not definitive on their own and must be interpreted within the broader diagnostic context [18]. Overall, this discussion highlights that while antibiotic and drug allergies are an important consideration in pediatric care, the current diagnostic paradigm needs refinement to avoid mislabeling, reduce unnecessary avoidance of first-line therapies, and improve antibiotic stewardship. Improving educational efforts among clinicians and families, and implementing structured allergy testing protocols, will be crucial steps forward in optimizing care for children with suspected drug hypersensitivity.

4. Conclusion

This clinical observation of pediatric antibiotic and drug allergies shows that most of the suspected reactions in children are not true allergies with an immunological basis. Despite the many reports by parents and caretakers, careful evaluation by using structured clinical history, observation of symptoms, and controlled drug provocation tests shows that a small percentage of children are actually allergic. This finding emphasizes the large discrepancy between perceived and confirmed drug allergies in the pediatric population and that accurate and evidenced-based assessment methodologies are needed. The study has also shown that some risk factors such as the younger the age, the more atopic comorbidities such as eczema or asthma and also family history of allergies can increase the likelihood of the true hypersensitivity. Understanding these factors enables clinicians to focus on which children should receive diagnostic evaluation first because they are at higher risk for the disease, and to avoid diagnostic evaluation of children who are at lower risk for the disease. However, no single factor can definitively confirm the diagnosis of allergy, underscoring the importance of a comprehensive approach with elements of clinical assessment, observation, and, when warranted, diagnostic testing. Finally, these findings highlight the issues surrounding the need for educational efforts directed at both healthcare professionals and families. Misinterpretation of mild or coincidental symptoms is frequently the cause of overdiagnosis, unnecessary avoidance of first-line antibiotics and inappropriate treatment decisions. Speaking of antibiotics, promoting awareness, clear guidelines, and structured protocols can play a part in ensuring accurate diagnosis, improving patient outcomes, and encouraging responsible use of antibiotics.

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