

Diagnosis of penicillin, amoxicillin, and cephalosporin allergy: Reliability of examination assessed by skin testing and oral challenge

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The specificity of pediatrician-diagnosed allergy reactions to penicillin, amoxicillin, and oral cephalosporins, which was based on contemporaneous examination of the patient, was evaluated by an elective skin testing program. Children and adolescents ($n = 247$) experiencing an adverse reaction to penicillin, amoxicillin, and/or an oral cephalosporin sufficient to lead to the recommendation to avoid further use were enrolled. Skin testing with penicillin G, commercial benzylpenicilloyl phosphate, penicillin minor determinant mixture, ampicillin, cefazolin, cefuroxime, and ceftriaxone was performed according to the suspected drug allergy followed by an oral challenge, repeat testing, and prospective follow-up if no reactions were observed. Overall, 84 (34.0%) of 247 patients had an IgE-type reaction on skin testing or oral challenge. Twenty-seven (32%) of 85 suspected penicillin reactions, 53 (34%) of 156 suspected amoxicillin reactions, and 13 (50%) of 26 suspected cephalosporin reactions were shown to be IgE mediated. Positive skin tests were observed in 20 patients with non-IgE-type clinical adverse reactions, including 15 patients with only a pruritic polymorphous rash. No reactions to oral challenge were severe after negative skin testing. One hundred sixty-three patients received multiple treatment courses with beta-lactam antibiotics after a negative skin testing procedure and three (1.8%) had adverse IgE reactions, all of which were mild. Physician-diagnosed allergic reactions to beta-lactam antibiotics based on patient examination at the time of the reaction is more accurate than patient history alone but still overestimates the rate of possible true allergy in 66% of patients. Elective penicillin, amoxicillin, and cephalosporin skin testing and oral challenge protocols are necessary to identify patients not at risk. (*J Pediatr* 1998;132:137-43)

Withholding indicated penicillin and cephalosporin antibiotic therapy in the patients who carry histories of "allergy" to these drugs can have adverse clinical conse-

quences, including treatment failures, increased toxicity of alternative agents, and costs. Because withholding antibiotic therapy is otherwise the most effective measure in preventing an allergic reaction, routine elective skin testing in pediatrics has been advocated. Mendelson et al.¹ skin tested 240 children and adolescents with a history of penicillin or amoxicillin allergy and found only 8.75% to be truly allergic to these antibiotics. This study was performed to (1) assess the reliability of pediatrician-diagnosed allergy reactions to penicillin, amoxicillin, and the oral cephalosporins based on examination at the time of the reaction fol-

lowed by elective skin testing and oral challenge; (2) evaluate polymorphous rash as a possible IgE-mediated reaction of clinical consequence; (3) detect cephalosporin hypersensitivity through skin testing and oral challenge; and (4) monitor prospectively the predictive value of negative skin testing for subsequent reactions to antibiotics administered.

EPG	Elmwood Pediatric Group
MDM	Minor determinant mixture

METHODS

Patients

Consecutive patients referred for evaluation of possible penicillin, amoxicillin, or cephalosporin allergy from 1988 to 1996 were considered for inclusion in the study. All of the patients were from the Elmwood Pediatric Group, which had adopted the recommendation of Mendelson et al.¹ to request elective skin testing on patients suspected of antibiotic allergy. All members of EPG were board-certified pediatricians in general practice; they did not receive special education on the recognition of drug rashes in association with the study. All patients were well and had no need of antibiotics at the time of evaluation (testing and oral challenge). For every patient, the EPG medical record was reviewed. Patients were included in this study only if they had a physician examination at the time of the suspected adverse reaction, and the observed reaction led the physician to label the patient as antibiotic allergic (i.e., suspected of having IgE immunologically-mediated reaction) with admonition not

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Table I. Clinical manifestations of adverse antibiotic reactions

Adverse reaction	No. of patients with reaction*
Urticaria	149
Polymorphous rash†	96
Erythema multiforme	6
Pruritus alone	4
Angioedema and urticaria	4
Angioedema	4
Serum sickness	4
Arthralgia	3
Laryngeal edema	2
Bronchospasm	1
Abdominal pain	1
Purpura	1
Emesis	1

*Twenty-nine patients had multiple manifestations of a reaction to a single antibiotic exposure.

†Maculopapular, erythematous, and usually associated with a history of pruritus or observed scratching but not a typical, nonspecific amoxicillin rash.

to administer any further antibiotic in the beta-lactam class. Consent was obtained from the parents and the patients after the possible risks of the penicillin skin testing and oral challenge procedures were explained.

Skin Testing Reagents

The reagents used for skin tests were as follows: (1) normal saline and histamine phosphate (1 mg/ml histamine, Eli Lilly Co.) to serve as negative and positive controls, respectively; (2) benzylpenicilloyl polylysine solution (Pre-pen, Kremers-Urban, Milwaukee, Wisc.) at a concentration of 6×10^{-5} M, with a single-dose ampule used for each testing session; (3) potassium benzylpenicillin (Pen G, Eli Lilly Co.), 16.9 mmol/L, of which a stock solution, 10^6 U/ml in normal saline, was made up fresh for each testing session; (4) penicillin minor determinant mixture consisting of sodium benzylpenicilloate and sodium benzylpenilloate, each at 10 mmol/L prepared according to the procedure of Van Dellen et al.²; (5) ampicillin (Bristol-Myers Squibb) at 10 mg/ml for prick testing and 1 mg/ml for intradermal testing; (6) cefazolin (Bristol-Myers Squibb) at 10 mg/ml for prick testing and

Table II. Results of elective skin testing protocol for physician-diagnosed adverse reaction to penicillin, amoxicillin, or cephalosporins

Testing protocol*	No. of patients	Initial skin test positive	Oral challenge positive†	Repeat skin test positive†	Negative
1	117	35 (29.9%)	2 (1.7%)	10 (8.5%)	70 (59.8%)
2	130	18 (13.8%)	3 (2.3%)	16 (12.3%)	93 (71.5%)
Totals	247	53 (21.5%)	5 (2.0%)	26 (10.5%)	163 (66.0%)
Grand total		84 (34.0%) positive patients			

*Protocol 1 testing reagents were penicillin G, Pre-pen, and MDM for suspected penicillin- or amoxicillin-allergic patients. Protocol 2 testing reagents were penicillin G, Pre-pen, MDM, ampicillin, and various cephalosporins for suspected penicillin-, amoxicillin-, and cephalosporin-allergic patients.

†Patients who were initially skin test negative received an oral challenge and those who were initially skin test negative and oral challenge negative underwent repeat skin testing. The percentages are calculated with 117 patients (protocol 1) and 130 patients (protocol 2) as the denominator.

1 mg/ml for intradermal testing; (7) cefuroxime (Glaxo Wellcome) at 10 mg/ml for prick testing and 1 mg/ml for intradermal testing; and (8) ceftriaxone (Roche) at 10 mg/ml for prick testing and 1 mg/ml for intradermal testing.

Procedures for Skin Test and Antibiotic Challenge

Patients avoided all antihistamines for 2 to 4 weeks before testing; the longer interval was recommended for antihistamines with longer half-lives. Patients were skin tested on the forearm by the prick (puncture) technique. If at 20 minutes both the erythema and wheal response to the testing materials was greater than 5×5 mm (>25 mm²), the patient was considered to be allergic to the antibiotic and no further testing was done. If the prick test was negative (<25 mm²), 0.02 ml of the testing material was injected intradermally into the volar aspect of the forearm. After 15 minutes, the intradermal test was read. Erythema and wheal at injection site greater than 5×5 mm was considered to be positive and the patient was considered to be allergic to the antibiotic. A reaction greater than 3×3 mm (>9 mm²) but less than 5×5 mm (<25 mm²) was considered borderline positive. Two testing protocols were used during the time course of the study. In the first skin testing protocol for 51 patients with suspected penicillin allergy and the first 68 patients with suspected amoxicillin or amoxicillin/clavulanate allergy, reagents used were Pen G, Pre-pen, and MDM (total $n = 117$ patients; 2 patients were

suspected of allergy to both antibiotics). In the second testing protocol for 34 suspected of penicillin allergy, 93 suspected of amoxicillin or amoxicillin/clavulanate allergy, and 26 children suspected of cephalosporin allergy, reagents used included Pen G, Pre-pen, MDM, ampicillin, cefazolin, cefuroxime, and ceftriaxone (total $n = 130$ patients; 22 patients were suspected of multiple beta-lactam antibiotic allergy). All skin tests were performed and read by trained technicians.

If the intradermal skin test was negative, the patient was then given a penicillin oral challenge (crushed penicillin VK tablet 125 mg [<40 lb] or 250 mg [≥ 40 lb], Eli Lilly Co.) and observed for 30 minutes to determine whether there was an immediate reaction. If there was no reaction, a 5- to 10-day challenge with the beta-lactam antibiotic that previously elicited an adverse reaction was administered in the home setting with diphenhydramine on hand in case of an adverse event. If a patient had experienced an adverse reaction to a single antibiotic, that antibiotic was administered according to a standard schedule for 10 days. If the patient experienced an adverse reaction to two antibiotics, the patient received a 5-day course with the first (generally crushed penicillin or amoxicillin), followed by 3 days (washout period) with no antibiotic, and then a 5-day course with the second antibiotic of concern in crushed tablet or capsule form. The patient was told to discontinue the antibiotic and contact the physician immediately if any reaction was experienced during the

Table III. Case history

Reactions to oral challenge after initial skin testing was negative					
Patients	Suspected drug allergy	Initial skin testing	Challenge drug/dose	Reaction*	Onset after challenge
1	Penicillin	All negative	Penicillin VK 250 mg tid for 10 days	Hives, serum sickness and joint swelling	3 days after challenge
2	Amoxicillin	All negative	Penicillin VK 250 mg tid for 10 days	Itchy eyes and periorbital edema	Fifth day of oral challenge
3	Cefprozil	All negative including cefuroxime	Penicillin VK 250 mg bid for 5 days, then cefprozil 250 mg for 5 days	Hives and angioedema	Tolerated penicillin then third day of cefprozil
4	Penicillin	3 × 3 mm intradermal reaction to MDM and negative to remainder	Penicillin VK 250 mg tid for 10 days	Giant hives and pruritus	Felt itchy in office after one dose; next dose in morning had reaction
5	Amoxicillin	4 × 4 mm intradermal reaction to MDM and negative to remainder	Penicillin VK 250 mg tid for 10 days	Hives	Second day of penicillin

*Reactions occurred to the oral challenge antibiotic after patients were skin test negative. Follow-up skin tests were not performed.

testing period. All patients who reported a reaction were examined to document the reaction. After completing the course of antibiotic(s), the patient returned 3 to 4 weeks later to be skin tested again using penicillin, amoxicillin, and the cephalosporin products as appropriate in a manner identical to the initial evaluations. If the oral challenge dose of antibiotic was tolerated and the repeat skin test was negative, the patient/parent was told that they could resume receiving that antibiotic and others in the beta-lactam antibiotic class. If the patient's oral challenge or skin test was positive to penicillin or amoxicillin, they were told to avoid these antibiotics but were told they could receive oral cephalosporins with the first dose administered under physician supervision and with diphenhydramine kept in the home in case of a late developing adverse reaction. For positive oral challenges or skin tests to cephalosporins, patients were told to avoid that specific class of antibiotics.

Prospective Follow-up

At the completion of the skin testing regimen, patient records were monitored prospectively for a period of 6 months to 8 years (average = 5.4 years), depending on when the initial testing was performed,

to ascertain whether oral antibiotics were subsequently administered from the beta-lactam class and whether any adverse reactions occurred. Because these children received all their general pediatric care from the physicians of EPG, virtually all antibiotic courses administered to the patients were captured in this analysis.

Statistics

Chi square was used to compare the frequency of a family history of adverse reactions to antibiotics and atopy and a personal history of allergy. A *p* value < 0.05 was considered significant.

RESULTS

Two hundred forty-seven patients with an examination-confirmed adverse reaction to amoxicillin, penicillin, and/or a cephalosporin were included in the study; the patients ranged in age from 6 months to 18 years. The most common clinical manifestations of an adverse antibiotic reaction were urticaria and polymorphous rash (Table I).

A positive family history of adverse reactions to antibiotics and a personal history of allergy was reported in 7.1% of the

skin test- or oral challenge-positive patients and 22.6% reported a personal allergy history compared with 4.9% and 18%, respectively, of those who were skin test and oral challenge negative (*p* = NS). A family history of atopy was positive in 21.4% of our skin test- and oral challenge-positive patients, and 13.5% of our skin test- and oral challenge-negative patients had a similar history (*p* = NS). Fifty-four percent of the skin test- and oral challenge-positive patients were male compared with 57% of the skin test- and oral challenge-negative patients.

Fifty-three (21.5%) of the 247 skin tested children had an initial positive reaction (Table II). One hundred ninety-four children who were initially skin test negative were given a 10-day oral challenge with one antibiotic (10 days) or two antibiotics (sequential 5-day courses) to which they had previously reacted. Five (2%) of the 247 children were thus identified as antibiotic allergic (Table III). After completion of the oral challenge, children returned for repeat skin testing; 26 (10.5%) of the 247 patients included in this study were positive. In total, 163 (66%) of the 247 evaluated children were thus negative according to our testing protocol and were permitted thereafter to receive an-

Table IV. Results of skin testing and oral challenge for patients with pruritic polymorphous rash ($n = 68$)

Positive reaction	Rash associated with		
	Penicillin	Amoxicillin	Cephalosporins*
Initial skin test	3/21 (14.3%)	4/43 (9.3%)	2/4 (50%)
Oral challenge	0/21 (0.0%)	1/43 (2.3%)	0/4 (0.0%)
Repeat skin test	1/21 (4.8%)	4/43 (9.3%)	0/4 (0.0%)

Same testing protocols and derivations of percentages as Table II.
*Cephalosporins were cefaclor, cephalexin, cefixime, and cefuroxime.

Table V. Results of elective skin testing after examination-confirmed adverse reactions to penicillin, amoxicillin, or cephalosporin

Suspected drug	Skin testing performed	Positive skin tests or oral challenge
Amoxicillin	156	53
Penicillin	85	27
Amoxicillin/ clavulanate	5	1
Cephalexin	8	6
Cefadroxil	5	2
Cefaclor	4	2
Loracarbef	1	1
Cefprozil	4	1
Cefuroxime	2	1
Cefixime	1	0
Cefpodoxime	1	0
Total*	272	94

*Twenty-four patients had suspected allergy to more than one antibiotic, and 10 patients had positive skin tests to more than one antibiotic.

tibiotic therapy with agents in the beta-lactam class. Eighty-four (34%) of the 247 evaluated children who were positive reactors to our skin testing protocol challenge were advised to continue to avoid penicillin and amoxicillin (for those who were skin test or oral challenge reactors to those drugs) or to avoid penicillin, amoxicillin, and the cephalosporins (for those who were skin test or oral challenge positive to those antibiotics).

The number of beta-lactam antibiotic courses before the experienced adverse reaction in skin test–negative patients was compared with skin test–positive patients; and exposures were similar (1043 courses in 163 skin test–negative patients and 531 courses in 84 skin test–positive patients). The use of beta-lactam antibiotics in skin test–negative and positive patients was similar for the penicillins (penicillin,

amoxicillin, and amoxicillin/clavulanate) and the cephalosporins.

The time elapsed since the clinical reaction was analyzed in relationship to skin test positivity. No indication was found that a positive skin test was more likely soon after the adverse reaction compared with a longer time interval. We analyzed this in 3-month increments and divided the patients according to type of reaction (urticaria versus polymorphous rash versus other reactions) and could not detect any differences (data not shown).

In 68 children the adverse reaction was a polymorphous rash with pruritus (Table IV); 15 (22%) of the 68 patients were positive on skin testing or oral challenge.

Of 156 children suspected of amoxicillin allergy, 53 had an initially positive or retest positive skin test, 27 (32%) of 85 suspected penicillin-allergic and 13 (50%)

of 26 suspected cephalosporin-allergic children were skin test positive (Table V). Twenty-four patients had suspected allergy to more than one antibiotic, and 10 patients had positive skin tests to more than one antibiotic.

Of the 14 patients positive on initial skin testing to penicillin, 11 (79%) were positive to a single skin test reagent, including 1 (7%) who was only positive to MDM. Of the 30 patients positive on initial skin testing who had previously experienced an adverse reaction to amoxicillin, 56% were skin test positive to a single reagent, including 1 (3%) to MDM only and 1 (3%) to ampicillin only. Of the five positive skin test or oral challenge reactors with histories of a cephalosporin-adverse drug reaction and the eight positive skin test reactors who had adverse reactions to a cephalosporin and penicillin and/or amoxicillin, two were skin test positive on initial testing with a cefazolin skin test reagent only. One patient suspected of cefuroxime allergy who was skin test negative to all reagents initially was skin test positive to cefuroxime on retesting after a negative cefuroxime axetil oral challenge.

Based on the examination at the time of the adverse reaction, the patients were divided into a group for whom the reaction was classically IgE mediated (hives, pruritus, angioedema, bronchospasm, or laryngeal edema) and a group for whom the reaction was considered likely not to be IgE mediated (polymorphous rash, erythema multiforme, arthralgia, abdominal pain, serum sickness, emesis, purpura). The results of skin testing in relation to the patient's age and the type of previous reaction to penicillin, amoxicillin, and the cephalosporins suggest that this categorization was sometimes inaccurate. Five (19%) of 27 penicillin reactors had positive skin tests or oral challenge even though their preceding history and examination suggested a non-IgE-mediated adverse event. Similarly, 15 (28%) of 54 amoxicillin reactors and 2 (15%) of 13 cephalosporin reactors who had non-IgE-type adverse events nevertheless were positive on skin testing or oral challenge.

Of the 247 patients with examination-documented adverse reaction to a beta-lactam antibiotic that were skin tested, 3

(1%) experienced an IgE-mediated reaction in association with the initial skin testing procedure. Two patients had pruritus develop and one patient had several hives on the trunk and neck develop; each was given diphenhydramine and the symptoms resolved.

Multiple courses of penicillins and cephalosporins were administered to skin test–negative patients during a 6-month to 8-year follow-up (mean = 5.4 years). Of 163 patients receiving 513 treatment courses with the beta-lactam antibiotic class after skin testing and oral challenge, only 3 (1.8%) children experienced adverse IgE-type reactions, all of which were mild.

Eighty-four patients who experienced a positive skin test or oral challenge with penicillins were advised that they could receive cephalosporin antibiotics; 43 treatment courses with cephalosporins were subsequently administered and two children experienced a mild IgE-type-mediated reaction. One patient who had a reaction to cefaclor subsequently had a positive skin test with cefuroxime. Both of the patients who reacted to a cephalosporin had positive reactions to prick or intradermal skin testing to more than one penicillin reagent. During follow-up, one patient who had been borderline positive on skin testing with MDM and cefazolin received a course of penicillin VK with no observed adverse reaction.

DISCUSSION

In this study we found that pediatrician-diagnosed significant adverse reactions to penicillin, amoxicillin, and various oral cephalosporins based on examination of the patient at the time of the reaction accurately predicted IgE sensitivity in 84 (34%) of 247 children. We modeled our skin testing and oral challenge protocol after that described by Mendelson et al.,¹ who found that 21 (8.8%) of 240 children and adolescents demonstrated positive IgE sensitivity when the diagnosis of antibiotic allergy was by patient history only. The rate of positivity at each testing phase of the current study was higher than that observed by Mendelson et al.¹

Five of our patients had positive oral challenges versus three of their patients, and 26 of our patients had positive reactions on repeat skin testing versus 2 of their patients. Our skin testing and oral challenge protocol also confirmed that 13 (50%) of 26 suspected cephalosporin-allergic children displayed hypersensitivity.

Early observations suggested that a personal history of atopy increased the likelihood of penicillin allergy.³ We did not find an increase in beta-lactam antibiotic allergy in patients with a personal history of atopy. The incidence of cutaneous drug reactions is reportedly 35% higher in females.⁴ We did not find an increased prevalence of females in our skin test–positive reactors. A family history of adverse reactions to antibiotics or a family history of atopy has not been associated with an increased risk of allergic reaction to beta-lactam drugs⁵; we found neither association in our study population.

Young and middle-aged adults between the ages of 20 and 49 seem to have the greatest risk of acute allergic reactions to antibiotics.⁶ It has been suggested that the reduced risk of reactions in children may be due to a lower cumulative penicillin exposure in children⁷ or a more frequent and faster loss of sensitivity.⁸ We failed to detect a difference in IgE-mediated adverse reactions in the pediatric age group.

Finke et al.⁹ found that the time between the suspected penicillin reaction and the performance of skin testing was an important variable in the percent of positive reactors. Others found that a history of a documented penicillin reaction within 1 year was more likely to result in a positive skin test.^{10,11} This time-dependent decline in the rate of positive skin test in both adults and children was not observed by Mendelson et al.¹ or in our study. However, in our study, the longest interval between observed reaction to skin testing was 8 years, whereas in earlier work, the most impressive decline in skin test reactivity occurred when the interval between reaction and skin testing exceeded 10 years.^{11,12}

In the case of beta-lactam antibiotic IgE sensitivity, frequent intermittent courses of therapy rather than prolonged treatment without drug-free intervals has been associated with greater drug sensitiza-

tion.¹³ We found no difference in the frequency of prior antibiotic administrations with penicillin and amoxicillin or with the cephalosporin class in test-positive versus test-negative patients. Beta-lactam antibiotic exposure was considerable in our study population before the study, with skin test–positive patients having received an average of 6.4 treatment courses/patient and skin test–negative patients 6.3 treatment courses/patient.

The type of adverse reaction after beta-lactam therapy is thought to be predictive of the likelihood of positive skin test reactions. We found positive skin test reactions in patients with polymorphous rash as did Mendelson et al.¹ Notably, our patient population did not include individuals with the classical idiosyncratic rash associated with amoxicillin administration. Thus a polymorphous rash during beta-lactam antibiotic administration, which was of concern to experienced pediatricians, was associated with IgE sensitivity in 22% of patients evaluated in our study. Whether polymorphous rash is an indication to recommend skin testing before subsequent prescription of this antibiotic class cannot be determined from our study because we did not rechallenge skin test–positive children with oral antibiotic.

It is important to select an appropriate skin testing panel of reagents because some patients respond with positive reactions to just one reagent. We confirmed the previously established value of including MDM and ampicillin in identifying patients at higher risk for serious IgE-mediated reactions.^{1,3,14–17} Skin testing without oral challenge would fail to identify non-IgE-immunologic and non-IgE-idiosyncratic reproducible reactions. It is important to classify adverse reactions to a beta lactam as immunologically versus not immunologically mediated, and IgE versus non-IgE mediated.^{7,12,18,19} Therefore a testing protocol that includes skin testing to a full battery of reagents, followed by an oral challenge, and then by repeat skin testing is valuable. Six patients in the study with erythema multiforme and four with serum sickness (including rash) completed our skin testing and oral challenge protocol without a recurrence.

We have confirmed the safety of testing for penicillin allergy with Pen G, Pre-pen,

and MDM, as well as with cephalosporin skin testing reagents.^{1,3,8,20,21} After negative skin testing, use of an oral route of challenge is the safest method of drug administration.²² The last component of our testing protocol (i.e., repeat skin test) alleviates concern that a patient could successfully tolerate an oral challenge but become resensitized through expansion of memory B-cell clones expressing IgE.

A concern of pediatricians is the potential for allergic cross-reactivity in children who are considered penicillin or cephalosporin allergic.²³⁻²⁶ On the basis of the chemical structure and degradation of the penicillins and cephalosporins, differing conclusions regarding the likelihood of cross-sensitivity might be reached.²⁷⁻³² We found that addition of cephalosporin skin testing reagents detected positive reactions in three children who otherwise would have been missed.

Three studies involving small numbers of penicillin skin test-positive patients treated with cephalosporins revealed no adverse consequences.³³ We identified one patient who had a positive skin test with penicillin determinants who received cefaclor 3 months later and experienced an urticarial reaction.

A potential for increased hypersensitivity to first-generation cephalosporins exists in those patients who have histories of penicillin allergy.^{24,28,34} However, the history of penicillin allergy was not confirmed by skin tests in those studies, and many of the cephalosporin reactions may not have been immunologically mediated. Second- and third-generation cephalosporins have a lower incidence of allergic reactions.^{18,33,35}

Previous investigators have concluded that nearly all patients with previous reactions to penicillin can subsequently receive the drug safely if they have negative skin tests to the major and minor determinants.^{1,10} The reliability of a negative skin test with the major determinant alone has been reported to be as high as 97%, whereas the addition of Pen G and MDM may bring the reliability to 99%.^{7,12,18,20} In outpatients the risk of conversion from a negative to a positive skin test after a skin testing procedure is considered to be negligible. However, this conclusion has been reached after short follow-up¹ and

may not be applicable to patients receiving intravenous penicillin.³⁶

In our study the predictive accuracy of elective beta-lactam antibiotic testing was assessed in 163 patients during 513 subsequent treatment courses after negative testing and oral challenge. We observed only three (1.8%) cases of adverse IgE reactions, all of which were mild. Although skin testing reagents for cephalosporin allergy were selected empirically, support for broader interpretation of the results comes from the 100 treatment courses of oral cephalosporins subsequently rendered without adverse reaction.

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