Evaluation of the Impact of Pharmacist-Led Penicillin Allergy Assessments on Antibiotic Utilization in a Large Community Teaching Hospital

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Abstract (252 words)

Rationale: Penicillins are the most common cause of allergic drug reactions with a prevalence of up to 20% in hospitalized patients. To date, there are limited Canadian publications describing pharmacist involvement in penicillin skin-testing. The purpose of this study is to evaluate the impact of a pharmacist-led initiative at Hôpital Montfort on de-labelling penicillin allergies and reducing the use of two broad spectrum antibiotics, meropenem and vancomycin.

Objectives: To determine the proportion of patients in whom an antibiotic change was made as a result of a penicillin allergy assessment and identify barriers for not de-escalating therapy in patients deemed non penicillin allergic. Potentially drug cost savings were also examined for skin-tested patients.

Methods: This is an observational cohort study conducted at Hôpital Montfort between October 1st 2016 and May 31st 2017, following the implementation of a policy allowing pharmacists to refer patients to an inpatient allergist for skin testing.

Results: Pharmacists recommended a penicillin skin test (PST) for 15 of 32 identified patients (46.9%) with a penicillin allergy who were prescribed meropenem or vancomycin. Nine of 15 eligible patients (60%) underwent a PST, with five patients having their antimicrobial therapy de-escalated to a penicillin or cephalosporin antibiotic. Four patients had their therapy modified based only on the pharmacist assessment. De-escalation of therapy subsequent to a PST led to a range of cost saving between -$81.04 to $390.34.

Conclusion: A minimal-cost, pharmacist-led initiative to reduce broad-spectrum antibiotic use in penicillin allergic patients resulted in antimicrobial de-escalation in nine patients, demonstrating another opportunity for pharmacist involvement in antimicrobial stewardship.
Introduction

Among antimicrobials, penicillins are the most common cause of allergic drug reactions with a prevalence of 1-10% in the general population.\(^1\,^2\) This number is increased two-fold in hospitalized patients.\(^2\,^4\) This can be quite misleading, since 90-98% of these patients with a reported penicillin allergy lack a true IgE mediated hypersensitivity and would actually tolerate penicillins.\(^5\) A recent systematic review estimated the actual prevalence of immediate penicillin allergy among adults who reported a beta-lactam allergy as 7.79%.\(^6\) Two theories regarding the over-reporting of penicillin allergies include the possibility of an inaccurate initial classification of the allergy and the dissipation of the IgE-mediated reaction over time.\(^5\) The accurate diagnosis of penicillin allergies is critical since false labeling carries the risk of many negative consequences.\(^6\,^7\)

The use of unnecessary broad spectrum agents in patients reporting a penicillin allergy can lead to increased cost, less efficacious therapy, toxicity to the patient, and an increased risk of infection or colonization with multidrug resistant pathogens.\(^5\) Findings from a matched cohort study revealed that patients with a penicillin “allergy” that were treated with alternate antibiotics had a longer length of hospital stay, were 23.4% more likely to acquire a \textit{Clostridium difficile} infection, and had a 30.1% and 14.1% greater likelihood of being colonized with vancomycin-resistant \textit{enterococcus} and methicillin resistant \textit{Staphylococcus aureus}, respectively, than their controls.\(^8\) In addition to these clinical ramifications, the unnecessary use of broader spectrum agents in patients with unverified penicillin allergies has financial implications for the health care institution. One study estimated the mean antibiotic cost for
penicillin allergic patients to be 63% higher than for patients who were not allergic to penicillin while another study estimated an increase in cost of about $520 per penicillin-allergic patient based on analysis of peripherally inserted central catheter placement and removal, dressing changes, drug level testing, laboratory technician time, and drug costs.\textsuperscript{9,10}

One method to prevent unnecessary prescribing of second line, broader spectrum agents is through the use of a penicillin skin test (PST), which is highly accurate for detecting a penicillin allergy.\textsuperscript{1,2} The PST is a two-step process comprised of a skin prick or puncture test followed 15 minutes later by an intradermal test for those patients who test negative for the first step.\textsuperscript{12} If performed accurately, the PST has a negative predictive value of 99% and a positive predictive value of 50%, making it highly accurate for ruling out a true allergy.\textsuperscript{12} The PST has the advantage of being the most rapid, sensitive, and cost-effective method of determining a true Ig-E mediated reaction to penicillin.\textsuperscript{9} Additionally, the results of a PST allow for more appropriate antibiotic choices without negatively impacting patient safety. For instance, patients with a negative PST result have the same risk of experiencing an adverse event from a penicillin antibiotic as the general population, with a risk of anaphylaxis ranging from 0.0015\% to 0.002\%.\textsuperscript{12,13} Rare hypersensitivity reactions caused by the PST have been reported but were attributed to improper technique and overdosing with the testing reagent.\textsuperscript{2}

Many previous studies have demonstrated that penicillin skin testing decreases the use of broad-spectrum antibiotics and potentially the cost of therapy.\textsuperscript{9,14-16} The impact of penicillin skin testing on antimicrobial stewardship has been validated in various settings such as
ambulatory clinics, preoperative clinics, inpatient wards, intensive care units, and emergency departments. Successful implementation of a penicillin skin testing guideline in these areas has shown a significant reduction in the use of many second line, broad-spectrum agents like vancomycin, fluoroquinolones, clindamycin, and third generation cephalosporins, and an accompanying return to the use of first line Beta-lactams in the majority of patients who reported an allergy but tested negative.

While most studies of this nature have been conducted on the basis of physicians performing the allergy assessment and referring patients for a PST if necessary, the involvement of pharmacists in such an initiative is a relatively novel idea. To date, there are limited American studies describing pharmacist involvement in identifying patients for penicillin skin testing in both inpatient and outpatient settings despite success in the few that are known. In one hospital, a pharmacist-operated PST program under the guidance of an allergist led to the reduction of unnecessary use of vancomycin and fluoroquinolones. A recent study has also proven the value of non-specialized pharmacists, pharmacy residents, and students in the implementation of antimicrobial stewardship programs. As such, the value of the pharmacist in the thorough assessment of penicillin allergies cannot be understated. Unlike certain studies that have limited the implementation of a penicillin skin testing initiative to one clinical area or hospital unit, this study will evaluate the hospital-wide impact of an allergy assessment policy (all inpatients on all units may undergo an allergy assessment). Additionally, this study is amongst the first Canadian examples of a pharmacist-led allergy intervention, demonstrating the value of pharmacists in antimicrobial stewardship initiatives.
Hôpital Montfort is a 289 bed community teaching hospital in Ontario. Since November 1st 2016, a collaborative initiative between pharmacists and allergists was approved and implemented with the goal of better evaluating inpatients reporting a penicillin allergy (Appendix A). The purpose of this study is to evaluate the impact of this initiative over an eight-month period on the usage of two specific broad-spectrum antibiotics, vancomycin and meropenem, after its implementation. The primary objectives of this study include identifying the proportion of patients in whom an antibiotic de-escalation was made as a result of the policy and to identify reasons why broad-spectrum therapy was not de-escalated in patients found to be non-penicillin allergic. Secondary objectives include describing the true prevalence of penicillin allergies at our institution, the uptake of the program by pharmacists in the department, screening for development of allergic drug reaction after de-escalation as a result of a negative PST, and to conduct a preliminary cost analysis of the policy.

Methods

Project Setting

Hôpital Montfort, a 289 bed Franco Ontarian community teaching hospital, employs a single in-hospital allergist that is available Monday to Thursday for in-patient consultation. Since November 1st 2016, a collaborative initiative has been in place between pharmacists and the in-hospital allergist at our institution. The Penicillin Allergy Evaluation Policy allows pharmacists to identify and directly refer patients who may benefit from penicillin allergy skin testing to the allergist for an in-patient PST. Based on the results of the test, the clinical pharmacist is then
able to suggest a de-escalation of antimicrobial therapy to the most responsible physician. As determined in the policy, penicillin allergic patients admitted to the day-surgery clinic were also excluded due to time constraints. The details of the referral process, including evaluation tools and algorithms, are outlined in the PHARMA XXX policy in Appendix A.

Pharmacist training and education on this initiative took place under the direction of the in-hospital allergist during the integration phase of the policy (October 1st 2016 to October 31st 2016). Staff meetings, visual reminders in the department, and e-mail reminders were also employed throughout the study period to ensure that pharmacists were continuing to identify these patients whenever possible.

Study Design
This study was conducted as a single-center, observational, retrospective cohort study. The integration phase of the Penicillin Allergy Evaluation Policy (PHARMA 060) took place from October 1st 2016 to October 31st 2016 and was dedicated to pharmacist education and training. The retrospective study period took place between November 1st 2016 to May 31st 2017. Penicillin allergy assessments and PST results from both the integration and study phases were included in data collection. A seven-month study period after the policy implementation was chosen to coincide with the timeline for the completion of the pharmacy residency program. Ethics approval for this study was obtained from the Hôpital Montfort Research Ethics Board.

Objectives
The purpose of this study is to evaluate the impact of this initiative on the usage of two highly monitored broad-spectrum antibiotics at our institution, vancomycin and meropenem. While the PHARMA 060 policy highlights other indications for a PST including multiple antibiotic allergies or patients with frequent or recurrent infections, this project focuses on the subset of penicillin allergic patients who were prescribed either vancomycin or meropenem during their admission.

**Primary Objectives**

1. Proportion of patients in whom an antibiotic change was made (e.g. return to beta-lactam) as a result of the Penicillin Allergy Evaluation Policy.

2. Proportion of patients deemed non penicillin-allergic in whom an antibiotic change was not made (vancomycin or meropenem continued) and the barriers for not de-escalating antimicrobial therapy.

**Secondary Outcomes**

1. Cost analysis comparing the total cost of therapy of vancomycin or meropenem to beta-lactam antibiotics once patients have been assessed using the Penicillin Allergy Evaluation Policy and had their therapy modified.

2. The efficiency of the Penicillin Allergy Evaluation Policy at capturing all patients eligible for pharmacist assessment. This will be defined as the total number of patients assessed compared to the total number of eligible patients throughout the study period.
3. Development of an allergic drug reaction to a beta-lactam antibiotic in patients who were deemed non-allergic and had their therapy modified to include a beta-lactam antibiotic.

4. The prevalence of reported penicillin allergies at Hôpital Montfort during the whole study period (Nov 1st 2016 to May 31st 2017).

Data Collection and Analysis

Data collection was done by the primary investigator using a pre-established, standardized data collection tool (Appendix 2). The two primary resources used for data collection included the electronic medical chart available through the MediTech computer program and Microsoft SQL Server Management Studio, which extracts population data from the MediTech program.

No sample size calculation was required for this study as all identified allergy assessments during the study period were included. All data was analyzed using descriptive statistics in Microsoft Excel 2011.

Results

In total, 113 penicillin allergic patients were prescribed either vancomycin or meropenem at Môntfort Hospital between October 1st 2016 and May 31st 2017. However, 61 of these patients were excluded from the study based on conditions set out a priori in the Penicillin Allergy Evaluation Policy due to time and personnel constraints. These exclusions included patients
prescribed up to two doses of vancomycin or meropenem for pre-operative prophylaxis. Therefore, 53 potentially eligible inpatients were identified during the study period.

**Primary Outcomes**

A sequential breakdown of patient recruitment during this study is outlined in Figure 1. Of the 53 potentially eligible patient identified, 32 (60.4%) were identified by a dispensing pharmacist who left a follow-up intervention (entered into MediTech using the code M.PEN) for the clinical pharmacist on the admitting unit. Of these 32 patients, the clinical pharmacists recommended a PST for 15 patients (46.9%). The remaining patients were not referred for various reasons including discharge (n=4), a change from meropenem or vancomycin to a fluoroquinolone (n=3), a true indication for the targeted broad-spectrum antibiotics (n=4), a contraindication to skin testing (n=1), cessation of antibiotics (n=2), or de-escalation to beta-lactams based on prior tolerance identified by either the staff physician (n=3) or the pharmacist (n=2). While clinical pharmacists had recommended PSTs for 15 patients, only nine patients (60%) underwent skin testing. Barriers to skin testing upon examination included patients leaving against medical advice (n=1), the treating physician not agreeing to consult the allergist (n=2), allergist unavailability (n=2), and the patient tolerating a penicillin test dose, negating the need for the PST (n=1). Encouragingly, all nine patients who were skin tested had negative skin test results leading to penicillin allergy de-labelling in 100% of skin tested patients. Broad spectrum antimicrobial therapy was promptly de-escalated in five cases (55.5%). De-escalation did not occur despite a negative skin test in the remaining four patients due to cessation of antibiotics (n=2), a chronic complicated diverticulitis requirement meropenem as per physician...
documentation (n=1), and a diabetic foot infection that was revealed to be infected with MRSA (n=1).

**Secondary Outcomes**

A preliminary cost-analysis was conducted on the nine patients who underwent a penicillin skin test. The analysis included the cost of the PST, which was estimated at $80, and the difference in antibiotic drug cost for the duration of treatment. While a more complete analysis would have included nursing and pharmacist time, central line placements, infection from intravenous line use, or re-admissions for development of toxicity or *Clostridium difficile* infection; this was not within the scope of the present study. As outlined in Table 1, the cost-saving based on the five patients who had their therapy de-escalated ranged between -$81.04 to $390.34 per patient.

The efficiency of pharmacists at identifying all potentially eligible patients for further assessment was also evaluated. Dispensing pharmacists identified 32 of 53 (60.4%) potentially eligible patients by entering a follow-up intervention for the clinical pharmacist on the admitting unit. Interestingly, the number of penicillin allergic patients identified by dispensing pharmacists as well as the referrals made by the clinical pharmacists increased over time as seen in Figure 2.

The safety outcome pertaining to the reliability of the PST results demonstrated that all patients who were determined to be non-penicillin allergic and had their antimicrobial therapy
de-escalated to a beta-lactam antibiotic tolerated their therapy without adverse effects. Lastly, the prevalence rate of reported penicillin allergies at Hôpital Montfort was found to be 10.6%, which coincided with existing literature.\textsuperscript{1-2}

**Discussion**

The main objective of this study was to determine if a reduction in the usage of meropenem and vancomycin could be made through the implementation of a pharmacist-led penicillin skin testing program. After a seven-month study, clinical pharmacists assessed 32 of 53 (60.4%) patients who met the inclusion criteria of having a reported penicillin allergy and being prescribed either vancomycin or meropenem. Clinical pharmacists referred 15 (46.9%) of these patients directly to the in-hospital allergist for skin-testing. Of these 15 patients, nine patients (60%) were skin tested and found to be non-penicillin allergic. Five of the nine skin-tested patients had their antimicrobial therapy de-escalated to a beta-lactam based on the result of the PST. Interestingly, clinical pharmacists were also able to successfully de-escalate four patients (7.5%) to beta-lactam antibiotics during the study period based solely on their assessment of the penicillin allergy and without consulting the allergist. In total, clinical pharmacists at our community teaching hospital were able to de-escalate therapy from meropenem or vancomycin to a beta-lactam agent in nine cases over a short period of seven months. While the number of patients in whom a change was made was modest compared to previously published studies in multi-site tertiary care centers, this model holds promise considering it was implemented in a single center community teaching hospital using existing resources.
As a new initiative, areas for improvement have been identified to maximize the impact of the program at our institution. One such example would be to extend the reach of the program to the pre-operative clinic, an area which was initially excluded. Other methods would be to address the barriers identified during the study that prevented the skin-testing of penicillin allergic patients. The first barrier was the incomplete identification of all potentially eligible patients by dispensing pharmacists. This was identified during the study period and addressed through more frequent visual reminders in the department, electronic reminders, as well as semi-regular staff meetings. It is possible that these interventions led to the higher number of patients identified and referred for skin testing the latter half of the study (Figure 2). For a program such as this to continue to be successful, reinforcement and continuous education for the pharmacists involved would be a necessary step.

The second barrier occurred when patients identified by the dispensing pharmacists were not referred by the clinical pharmacist to the allergist for a PST. While some of the reasons documented in Figure 1 are valid, such as the cessation of antibiotics or an indication necessitating meropenem or vancomycin, there remains one possible future target for expanding the number of patient PST referrals. In three cases, a referral was not made because the patient’s antibiotic had been changed to a fluoroquinolone. While fluoroquinolones were not a targeted antibiotic in the Penicillin Allergy Evaluation Policy, they are still considered broad-spectrum antibiotics and have been associated with several adverse drug effects. For
this reason, it would be beneficial to expand the targeted antibiotic from meropenem and vancomycin alone, to also include fluoroquinolones.

The third barrier in the process occurred when patients referred for a PST were not tested prior to their discharge. While some reasons are impossible to address, such as discharge against medical advice, there remains two groups of patients for whom a PST could have been done. In two cases, the patient did not receive a PST because the most responsible physician was not in agreement with the referral. As the risks of a PST are minimal to none, this demonstrated an opportunity to familiarize physicians at our institution with this new initiative and the advantages it presents. This could be done by disseminating the Penicillin Allergy Evaluation Policy to physician groups and providing presentations for residents and staff physicians on the policy and its benefits in hopes of increasing the number of referrals. The patients were not skin tested due to the in-hospital allergist’s unavailability. As a single center, we are fortunate to have an inpatient allergist. However, in his absence, there remains no other personnel qualified or trained to administer and interpret the test. In addition, the average time between the referral and the PST being performed was five days. For this reason, a group of physicians at our institution have expressed an interested in acquiring the necessary training to perform skin testing at the bedside. We believe this will lead to a greater number of patient being skin tested and in a timelier manner. However, the expertise of the in-hospital allergist cannot be understated and referrals will continue to be necessary in complex situations.
The final barrier to de-escalation of therapy occurred in patients proven to be non-penicillin allergic through a PST, yet remained on meropenem or vancomycin. Two such cases are described in this study where the patients had serious infections requiring the use of meropenem or vancomycin. In these instances, as de-escalation is not clinically appropriate, we believe these patients did not benefit from the PST and the referral should not have been made. In fact, skin testing these patients without the possibility of antimicrobial de-escalation had a negative impact on the overall cost-savings of the program. To address this issue, more education to the referring clinical pharmacists should be provided, as highlighted earlier.

The Penicillin Allergy Evaluation Policy implemented at Môntfort Hospital proved to be a cost-effective initiative based on a preliminary analysis based on drug and PST cost (Table 1). These results are very encouraging and support the continuation of this program. Cost effectiveness may even be extended to future re-admissions for patients who were skin-tested during the study, but a longer observation period would be required to confirm this. We suspect that with improved identification of eligible patients and more timely skin testing, the cost savings would grow. While previous models have incorporated other factors such as central line placement, time cost, and recurrent admissions due to subsequent Clostridium difficile infection, an in-depth cost analysis was a secondary outcome for the study and beyond the scope of the evaluation conducted.

**Conclusion**
We evaluated a feasible model for inpatient penicillin skin testing led by pharmacists. A decrease in drug cost was also documented in patients who were skin tested. If implemented in similar institutions with access to an allergist, this pharmacist-led program could reduce broad-spectrum antibiotic use in penicillin allergic patients and reinforce the role for pharmacists in antimicrobial stewardship.
References


Tables and figures

Figure 1: Patient Recruitment Algorithm

1. Total potentially eligible patients \( n = 53 \)
   - Patients identified by distribution pharmacist (M.PEN intervention entered) \( n = 32 \) (60.4%)
   - PST recommended by pharmacist \( n = 15 \) (46.9%)
   - PST performed for \( n = 9 \) (60%) Negative result leading to allergy de-labeling \( n = 9 \) (100%)
   - Antimicrobial therapy de-escalated \( n = 5 \) (55.5%)

2. Barrier #1: M.PEN not entered by distribution pharmacist \( n = 21 \) (39.6%)

3. Barrier #2: PST not recommended for \( n = 17 \) (53.1%)
   - Documented Rationale
     - Patient discharged: 4
     - Antibiotics changed to fluoroquinolone: 3
     - Broad-spectrum required
       - Severe sepsis: 1
       - Febrile neutropenia: 1
       - MRSA osteomyelitis: 1
       - Methicillin resistant CoNS infective endocarditis: 1
     - De-escalated to cephalosporin based on prior tolerance
       - Change made by MD: 3
       - Change made by evaluating pharmacist: 2
     - Contraindications to PST (anaphylaxis < 10 years ago): 2
     - Antibiotics stopped: 2

   *Patients may have had multiple reasons for not undergoing a PST.
   CoNS = coagulase negative staphylococcus; MRSA = methicillin resistant s. aureus

4. Barrier #3: PST not performed for \( n = 6 \) (37.5%)
   - Documented Rationale
     - Patient left against medical advice: 1
     - MD not in agreement: 2
     - Allergist unavailable: 2
     - Tolerated penicillin test doses, negating need for PST: 1

5. Barrier #4: No change in antimicrobial therapy for \( n = 4 \) (44.4%)
   - Documented Rationale
     - Antibiotics stopped: 2
     - Chronic complicated diverticulitis requiring meropenem: 1
     - MRSA diabetic foot infection requiring vancomycin: 1

MRSA = methicillin resistant s. aureus
Table 1: Cost-Analysis of Penicillin Skin testing in De-escalated Patients

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Reported Reaction</th>
<th>Type of Infection</th>
<th>Initial Antibiotic</th>
<th>De-escalated Antibiotic</th>
<th>Duration of Therapy</th>
<th>Net Difference*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'</td>
<td>Rash and blue nails</td>
<td>Perioperative prophylaxis</td>
<td>Vancomycin</td>
<td>Cefazolin</td>
<td>1 day</td>
<td>-$61.95</td>
</tr>
<tr>
<td>2</td>
<td>Anaphylaxis 40 years ago</td>
<td>Pneumonia and cellulitis</td>
<td>Meropenem clindamycin</td>
<td>Cefazolin</td>
<td>6 weeks</td>
<td>$390.34</td>
</tr>
<tr>
<td>3</td>
<td>Rash</td>
<td>Endometriosis</td>
<td>Vancomycin</td>
<td>Amox/Clav</td>
<td>7 days</td>
<td>$76.60</td>
</tr>
<tr>
<td>4</td>
<td>Positive test 20 years ago.</td>
<td>Ulcer</td>
<td>Meropenem</td>
<td>Cefazolin</td>
<td>6 weeks</td>
<td>$336.46</td>
</tr>
<tr>
<td>5†</td>
<td>Rash, nausea, &amp; vomiting</td>
<td>Urinary tract infection</td>
<td>Ciprofloxacin</td>
<td>Cephalexin</td>
<td>7 days</td>
<td>-$81.04</td>
</tr>
</tbody>
</table>

AVG = $137.89

*Calculated as difference in drug cost after deducting PST cost. ¹Later treated for a urinary tract infection using ceftazidime and avoided quinolone exposure. †Initially prescribed vancomycin preoperatively; PST done after vancomycin complete. AVG = average per patient.
Figure 2: Rate of Patient Recruitment During Study Period

- **M.PEN only**
- **PST Complete**

Oct (pilot)  | Nov  | Dec  | Jan  | Feb  | Mar  | Apr  | May  |
0          | 1    | 1    | 3    | 2    | 6    | 5    | 8    |
0          | 1    | 1    | 3    | 2    | 6    | 5    | 8    |
## Évaluation des allergies à la pénicilline

**Titre:**
ÉVALUATION DES ALLERGIES À LA PÉNICILLINE

**En vigueur le:**
Mai 2017

**Dernière révision:**

**Catégorie:**
INTRA SERVICE – PHARMACIE

**Source:**
PHARMACIE

**Autres références:**
Directrice, Services diagnostiques, pharmacie et accueil (24/05/2017)

### 1. Politique

1.1 L'Hôpital Montfort adopte une politique afin d'améliorer l'évaluation et la documentation des allergies à la pénicilline, conformément aux meilleures pratiques, et tel que recommandé comme stratégie de gestion des antimicrobiens par la Santé publique Ontario (SPO) et tel qu'encouragé par la campagne « Choisir avec soin Canada ».

1.2 Cette politique a pour but d'évaluer et de documenter de façon systématique les allergies à la pénicilline afin d'optimiser la sélection des antimicrobiens et ainsi de répondre au mandat du programme de gestion des antimicrobiens (PGA) en ce qui a trait à l'implantation d'initiatives visant à utiliser judicieusement des antibiotiques à larges spectres.

1.3 Il existe de nombreuses conséquences bien documentées aux allergies à la pénicilline, notamment un taux élevé d'infections à Clostridium difficile (risque jusqu'à 34 % plus élevé) et l'augmentation globale du coût de l'hospitalisation.

1.4 Cette politique standardise l'évaluation des allergies à la pénicilline en donnant un outil aux pharmaciens. Suivant l'évaluation, le pharmacien peut suggérer une consultation en allergie, en obtenant l'accord du médecin traitant et remplissant le formulaire de demande de consultation en allergie.

1.5 Le résultat des tests cutanés doit être documenté sur une ordonnance.

### 2. Définitions

2.1 Allergie à la pénicilline : Mention au dossier ou par le patient d'une réaction à la pénicilline :

2.1.1 Environ 10-20 % des patients admis signalent une allergie à la pénicilline.
2.1.2 Environ 90 % des patients qui déclarent être allergiques à la pénicilline sont capables de tolérer les pénicillines et seulement 1-10 % des patients qui déclarent une allergie à la pénicilline testent positivement lors des tests cutanés.

2.1.3 Environ 80 % des patients ayant une véritable allergie à la pénicilline perdent leur réponse immunogène dans les 10 ans.

2.2 Caractéristiques de la réaction : Description de la réaction du patient

2.2.1 Les réactions sont non allergiques (intolérances telles que nausée, vomissement, intolérance gastro-intestinale, maux de tête) ou allergiques.

2.2.2 Il existe quatre types d'allergies à la pénicilline, chacun avec différents mécanismes immunologiques et des impacts cliniques différents.

2.2.3 Tableau 1 : Caractéristiques des réactions allergiques à la pénicilline

<table>
<thead>
<tr>
<th>Type</th>
<th>Réaction immunologique</th>
<th>Réaction clinique</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>IgE</td>
<td>Angioedème, dyspnée, bronchospasme, urticaire, anaphylaxie</td>
</tr>
<tr>
<td></td>
<td>Immédiate/rapide : minutes ou heures suivant l'exposition</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>IgG – Réactions cytoxiques</td>
<td>Troubles sanguins, Cytopénie</td>
</tr>
<tr>
<td></td>
<td>Rapide/modérée : plus de 72 heures suivant l'exposition</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>IgG ou IgM – Complexes immuns Retardée : 10-21 jours suivant l'exposition</td>
<td>Maladie sérique (fièvre, urticaire, arthralgie, lymphadénopathie) (Serum sickness)</td>
</tr>
<tr>
<td>IV (SJS, TEN)</td>
<td>Cellules T</td>
<td>P. ex., réaction cutanée sévère, dermatite, morbilliforme ou éruption maculo-papuleuse, DRESS, Syndrome de Stevens Johnson (SJS), TEN (Syndrome d'épidermolyse toxique nécrosante)</td>
</tr>
<tr>
<td></td>
<td>Modérée/retardée : de 2-4 jours allant à 2-4 semaines suivant l'exposition</td>
<td></td>
</tr>
</tbody>
</table>

3. INDICATIONS/CONTRE-INDICATIONS

3.1 Indications

3.1.1 Patient ayant une allergie à une pénicilline et ayant une infection active pour laquelle un traitement de première ligne est un antibiotique bêta-lactame.

3.1.2 Patient ayant une allergie à la pénicilline et nécessitant un traitement antimicrobien pour une infection active, mais le patient ne connaît pas la nature de leur réaction.
3.1.3 Patient ayant de multiples « allergies aux antibiotiques » et ayant une infection nécessitant un traitement antimicrobien.

3.2 Contre-indications aux tests cutanés

3.2.1 Patient ayant une intolérance aux pénicillines, car il n’a pas besoin de tests cutanés.

3.2.2 Patient ayant eu une réaction anaphylactique aux pénicillines au cours des 10 dernières années.

3.2.3 Patients ayant subi une réaction anaphylactique (peu importe la source) au cours des quatre semaines précédentes.

3.2.4 Patient ayant eu une réaction de type III (symptômes compatibles avec une IgG ou IgM), car les tests cutanés sont peu efficaces ; par contre, une consultation en allergie pourrait être utile.

3.2.5 Patient ayant eu une réaction de type IV (Stevens Johnson (SJS) ou syndrome d’épidermolyse toxique nécrosante (TEN) secondaire à une pénicilline (ces patients ne doivent pas recevoir de pénicilline sous aucune forme).

3.2.6 Patient ayant des antécédents d’allergie aux pénicillines, mais qui a depuis toléré une pénicilline (les tests cutanés sont inutiles, car ces patients ne sont pas allergiques).

3.2.7 Patient atteint de choc ou d’instabilité hémodynamique ou recevant des vasopresseurs.

4. PROCÉDURE

4.1 Évaluation

4.1.1 Tableau 2 : Outils pour évaluation des allergies à la pénicilline

<table>
<thead>
<tr>
<th>Questions</th>
<th>Réponse du patient/Patient response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. À quel médicament le patient a-t-il réagi ? (nom et description si possible)</td>
<td></td>
</tr>
<tr>
<td>What drug did the patient react to? (name and description if possible)</td>
<td></td>
</tr>
<tr>
<td>2. Est-ce que la réaction a été vue/documentée par quelqu’un ? (par un membre de la famille, par le médecin de famille ou dans un autre hôpital)</td>
<td></td>
</tr>
<tr>
<td>Was the reaction witnessed or documented? (by family member, family physician, by another hospital)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
| 3. | **Quand la réaction a-t-elle eu lieu ?** (il y a combien d’années, de mois ou de semaines ?)  
  **How long ago did the reaction occur?** *(how many years, months or weeks ago?)* |
| 4. | **Combien de temps après avoir pris le médicament est-ce que la réaction a eu lieu ?** (combien de minutes, heures, jours ou semaines ?)  
  **How soon after taking the drug did the reaction occur?** *(how many minutes, hours, days or weeks?)* |
| 5. | **Quelle était la nature de la réaction ?**  
  Quels étaient les symptômes ?  
  Besoins médicaux ? *(hospitalisé, évaluation par Md ?)*  
  **What was the nature of the reaction?**  
  **What were the symptoms?**  
  **Medical care received?** *(hospitalized, Md consulted?)* |
| 6. | **Combien de temps s’est écoulé avant que la réaction ne soit résolue ?**  
  **How long did it take for the reaction to resolve?** |
| 7. | **Est-ce que le patient reçoit des médicaments pouvant interférer avec les tests cutanés à la pénicilline ? Si oui, les bénéfices du test cutané surpassent-ils les risques de l’arrêt des médicaments ?**  
  **Is the patient taking any drugs that may interfere with penicillin skin-testing? If so, benefits outweigh risks of holding medication?**  
  - Antidépresseurs tricycliques (retenir pendant 4 demi-vies si possible)  
  - Antihistaminiques (anti-H2, H1RAs) (retenir pendant 2 jours si possible)  
  - Antihistaminiques topiques/hasardés (retenir pendant 1 jour, si possible)  
  - Benzodiazépines (retenir pendant 24 h)  
  - Bêta-bloquants ou bloqueurs des canaux calciques non-dihydropyridine (retenir pendant 4 demi-vies si possible)  
  - Corticostéroïdes systémiques  
  - Corticostéroïdes topiques au site du test *(choisir autres sites)* |

**5. RÉFÉRENCES ET RÈGLEMENTS CONNEXES**


Annexe A
Algorithme décisionnel – Évaluation des allergies à la pénicilline

Patient avec une « allergie » à la pénicilline et pouvant bénéficier d'une pénicilline ou béta lactame

Évaluation de la réaction (questionnaire)

Allergie de Type I (Voir tableau 1)
(urticaire, angioedème, dyspnée, ou réaction inconnue)

Réaction il y a moins de 10 ans
Présence de contre-indication au test cutané
ÉVITER Pénicillines et béta lactames PAS de tests cutanés
Tests cutanés possible Consultation en allergie
ÉVITER Pénicillines et béta lactames PAS de tests cutanés
Considérer consultation en allergie

Réaction il y a plus de 10 ans ou réaction inconnue
Pas de contre-indication au test cutané
ÉVITER Pénicillines et béta lactames OK Pas besoin de test cutané

Allergie de type II, III, IV (Voir tableau 1)
P. ex., Serum Sickness, TEN, SJS, néphrite, cytopenie, vasculite

Réaction non-allergique Intolérance
(nausée, vomissement, diarrhée, maux de tête)
### Appendix 2 – Data Collection Tool

<table>
<thead>
<tr>
<th>PATIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>STUDY CODE # ___________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date (dd/mm/yyyy): <em><strong>/</strong></em>/______</td>
</tr>
<tr>
<td>Age (years): _______</td>
</tr>
<tr>
<td>Reason for admission: ________________________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISCHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date (dd/mm/yyyy): <em><strong>/</strong></em>/_____</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PENICILLIN ALLERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific agent: ___________________</td>
</tr>
<tr>
<td>Reaction consistent with:</td>
</tr>
<tr>
<td>☐ Type I</td>
</tr>
<tr>
<td>Description of the reaction: ________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASSESSMENT AND REFERRAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST recommended by pharmacist:</td>
</tr>
<tr>
<td>☐ Yes</td>
</tr>
<tr>
<td>If performed, result of PST:</td>
</tr>
<tr>
<td>☐ Positive</td>
</tr>
<tr>
<td>Reason why referral was or was not sent: (Indications/Contraindications):</td>
</tr>
<tr>
<td>______________________________________________________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INDICATION FOR ANTIBIOTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection: ___________________________________________________________________</td>
</tr>
</tbody>
</table>
### ANTIBIOTIC HISTORY

#### Initial Antibiotic Regimen
(start date: ____/____/____, end date: ____/____/____)

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose</th>
<th>Frequency</th>
<th>Route</th>
<th>Duration</th>
</tr>
</thead>
</table>

**Daily Cost** *(mero = $4.15/500 mg, vanco = $10.44/1 g)*

**Total presumed cost for entire duration:**

#### Post-Assessment Antibiotic Regimen
(start date: ____/____/____, end date: ____/____/____) OR No change made

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose</th>
<th>Frequency</th>
<th>Route</th>
<th>Duration</th>
</tr>
</thead>
</table>

Evidence of allergic reaction to B-lactam as per progress notes:

**Daily cost:**

**Total cost for remaining days of therapy:**

### MICROBIOLOGY (IF APPLICABLE)

A. Pathogen identified: ________________________
B. Culture source: ____________________________
C. ☐ MRSA colonized OR ☐ ESBL colonized
D. Susceptibility: