

Nutrition in Clinical Practice

<http://ncp.sagepub.com/>

Nationwide Survey of Hospital Practices When Compounding Parenteral Nutrition Solutions in Latex-Allergic Patients

Samia Abd El-Atti, Barbara Martinelli, Bryan Yourich, Kelley Wasicek and Robert Weber

Nutr Clin Pract 2006 21: 513

DOI: 10.1177/0115426506021005513

The online version of this article can be found at:

<http://ncp.sagepub.com/content/21/5/513>

Published by:



<http://www.sagepublications.com>

On behalf of:



[The American Society for Parenteral & Enteral Nutrition](#)

Additional services and information for *Nutrition in Clinical Practice* can be found at:

Email Alerts: <http://ncp.sagepub.com/cgi/alerts>

Subscriptions: <http://ncp.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

Nationwide Survey of Hospital Practices When Compounding Parenteral Nutrition Solutions in Latex-Allergic Patients

Samia Abd El-Atti, RPh, PhD, BCNSP; Barbara Martinelli, PharmD, MBA, BCNSP; Bryan Yourich, PharmD; Kelley Wasicek, RPh; and Robert Weber, MS, FASHP
University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania

ABSTRACT: We surveyed 100 institutions in 50 states, varying in size from 50 to 1000 beds. The purpose of this survey was to examine the policies and techniques hospitals used in confirming latex allergy (LA) in patients and preparing parenteral nutrition (PN) for LA patients.

Our survey indicated that within the institutions in our study, many inpatient pharmacists do not use any defined method for confirming LA other than what is documented in the patient profile upon admission. Most inpatient pharmacies are not aware of any institutional policy concerning parenteral medications in LA patients, and some do not identify the importance of LA in preparing PN.

It is apparent from the results of this survey that uniform guidelines or practice standards for this important issue should be developed. Although the publications on LA are numerous, they mostly deal with the exposure to latex gloves or latex devices. Knowledge of preparing parenteral medications for LA patients in the literature is minimal. It is also clear that awareness and knowledge of pharmacy personnel should be enhanced. Finally, we are hoping that this survey will send a clear message to pharmacy organizations to develop guidelines or pharmacy practice standards for this issue, and for health institutions to develop policies and make them available to their personnel.

Natural rubber latex allergy (LA) emerged in the 1980s as a recognized public health concern.¹ As a result, many institutions started removing vial closures to eliminate the possibility of allergic reactions by LA patients in spite of the risk of contamination.

Correspondence: Samia Abd El-Atti, RPh, PhD, BCNSP, University of Pittsburgh Medical Center, 200 Lathrop Street, Suite G119, Pittsburgh, PA 15213. Electronic mail may be sent to abdelattis@upmc.edu.

0884-5336/06/2105-0513\$03.00/0

Nutrition in Clinical Practice 21:513-517, October 2006

Copyright © 2006 American Society for Parenteral and Enteral Nutrition

To reduce allergic reaction to natural rubber, vial closure manufacturers started reducing the natural rubber content of vial closures. Currently, vial closures used on pharmaceutical medications are typically made up of either synthetic rubber or a mixture of dry natural rubber and synthetic rubber, at ratios ranging from mid-20% to <1% (0.9%) dry natural rubber (E. Clinii, verbal communication, September 2004 and November 2004).

Despite the dramatic reduction in natural rubber content of vial closures, many institutions still remove the vial rubber closures before drawing up the parenteral medications and parenteral nutrition (PN) for LA patients.

We surveyed 100 institutions to determine their current policies and techniques for preparing PN for LA patients. We also studied PN components to find out their latex contents.

Methods

Our survey included 100 institutions in 50 states, 2 institutions per state, varying in size from 50 to 1000 beds, preparing an average of 1607 PN bags per day. Details are as follows:

- Seven institutions had 50–250 patient beds and prepared an average of 36 PN bags per day.
- Thirty-six institutions had 250–500 patient beds and prepared an average of 417 PN bags per day.
- Fifty-one institutions had 500–750 patient beds and prepared an average of 961 PN bags per day.
- Six institutions had 750–1000 beds and prepared an average of 193 PN bags per day.

The purpose of the survey was to study:

1. the process of confirming LA in patients;
2. the policies for compounding PN for LA patients; and
3. the procedures for compounding PN for LA patients.

The survey design used a random hospital selection with open-ended questions in telephone interviews during business hours.

The survey topics were patient population size, percentage of patients receiving PN, PN admixture

technique, and procedure for handling LA patients. We mainly surveyed academic medical centers, teaching hospitals, and community hospitals (20 institutions were either children's hospitals or had pediatric departments). Our survey excluded home infusion facilities and institutions that outsourced PN. We also studied the latex allergen contents in rubber closures for the components that might be a part of PN. Because most of the surveyed institutions used PN compounders that are known to have latex-free tubing, we assumed that the only source of latex was from the rubber vial closures.

This study was supported by University of Pittsburgh Medical Center (UPMC) inpatient pharmacy to assist in revision of the LA policy of the institution.

Results

The survey results showed that a majority (84%) of pharmacies use only the information collected in the patient admission profile to confirm LA in patients. Twelve percent of the pharmacies contact the patient's nurse to verify the LA, and only 4% of pharmacies contact the physician.

In reference to policies for compounding PN and parenteral medications for LA patients, 72% of surveyed pharmacies reported not knowing of an institutional policy regarding parenteral medications for LA patients. Eleven percent of institutions reported having no formal policy for LA patients. Ten percent of institutions have a policy to remove vial closures, and 6% of institutions surveyed have a policy to allow vial closure penetration (5 institutions allow 1 puncture through vial closures; 1 institution allows 20 punctures). Finally, only 1% of institutions have a policy to enforce the use of a 5- μ m filter needle.

There was a variety of responses regarding the procedure of compounding PN for LA patients. Seventy-nine percent (79 of 100) of institutions use standard aseptic techniques (swabbing the vial top with 70% isopropyl alcohol before withdrawing the solution). Of those, 60 institutions acknowledge that removing the rubber closures will not affect the allergen content of the solution. Six institutions limit vial penetration (5 allow 1 penetration; 1 allows 20 penetrations). However, 54 institutions do not discourage vial penetration, and 1 institution uses a 5- μ m filter needle for LA patients. In fact, 19 institutions do not identify the importance of LA in preparing PN. On the other hand, 21% (21 of 100) remove rubber vial closures; 11 of those institutions reported that removing vial closures is their standard technique, without a policy in place, and 10 institutions follow a written policy.

In order to establish a possible relationship between LA and PN, we studied the dried natural rubber contents of PN components by contacting the manufacturers. The results are presented in Table 1.

Discussion

Products made from natural rubber are manufactured using 2 commonly used processes. The natural rubber latex manufacturing process uses liquid natural rubber in a concentrated suspension, and dipping, extruding, or coating forms the products. Examples of the products made from this process include medical gloves, catheters, tracheostomy tubes, and condoms. The dried natural rubber process uses coagulated natural latex in the form of dried sheets. Products are formed from dried natural rubber by compression molding, extruding, or by converting sheets into solution for dipping. Examples of products made from dried natural rubber include syringe plungers, vial closures, and injection ports on IV tubing (Novo Nordisk Pharmaceutical Inc and Eli Lilly and Company, written communication, August 2004). The distinction between these 2 types of manufacturing processes is critical to antigenicity. Dried natural rubber products do not leach antigen to any applicable extent, whereas natural rubber latex leaches antigen in considerable amounts.^{2,3}

Prevalence of latex allergic sensitization in the general population is quite low; several studies of young adults demonstrate rates of results that are <1%⁴ (approximately 0.8% of the general population is latex sensitive⁵).

We reviewed many publications from the past 2 decades, searching for the best practice recommended for compounding PN and parenteral medications for LA patients. The main interest of this survey was PN preparation because it is composed of multiple medications, but the same argument applies to all parenteral medications. Most of the literature we reviewed dealt with latex-related allergy in professional settings, especially the effect of rubber gloves on patients and healthcare workers.^{2-4,6-13} Very little literature dealt with handling parenteral preparation for LA patients. Controversy around the best practice occurs in these publications. What follows are the 3 most important publications concerning this issue.

A study published by Primeau et al¹⁴ demonstrated that natural rubber pharmaceutical vial closures release latex allergens that produce skin reactions. In their study, 5 pharmaceutical vial closures (2 natural rubber and 3 synthetic) were coded, inserted into vials containing phenol-saline human serum albumin, and stored in an inverted position before use. Twelve volunteers with LA and 11 volunteers without LA underwent skin testing with solutions from each of the 5 vials. The vials were either unpunctured (0p) or punctured 40 times (40p) with a 21-gauge needle 12-24 hours before testing. All intradermal skin test responses in the group without LA were negative. Two and 5 of the 12 subjects with LA had positive intradermal skin reactions to 0p and 40p solutions, respectively, from vials containing rubber closures.

Table 1
Dried natural rubber (DNR) content of parenteral nutrition components

Ingredient	Manufacturer	Pharmaceutical form	DNR in closure	Percentage of DNR in closure
Travasol	Baxter	Bag	N/A	
Novamine	Baxter	Bottle	Y*	
HepatAmine	B. Braun	Bottle	N	
Dextrose	Baxter	Bag	N/A	
Water	Baxter	Bag	N/A	
Sodium acetate	Abbott	Bottle	N	
Potassium acetate	Abbott	Bottle	N	
Sodium phosphate	Abbott	Bottle	N	
Potassium phosphate	American Reagent Inc.	Bottle	Y	15.9
Sodium chloride	Abbott	Bottle	Y	~14
Potassium chloride	Abbott	Bottle	Y	~14
Multivitamin vial 1	Baxter	Vial	N	
Multivitamins vial 2	Baxter	Vial	N	
Zinc chloride	Abbott	Vial	N	
Adult trace elements	American Reagent Inc.	Vial	Y	15.9
Calcium gluconate	American Reagent Inc.	Vial	Y	0.09
Pepcid	Ben Venue for Bedford	Vial	N	
Chromium	Abbott	Vial	N	
Vitamin K	Abbott	Ampule	N/A	
Copper	Abbott	Vial	N	
Manganese	Abbott	Vial	N	
Thiamine	American Pharmaceutical	Vial	Y	15.9
Heparin	Elkins-Sinn	Vial	Y	13.9
Selenium	American Reagent Inc.	Vial	Y	15.9
Ascorbic acid	American Reagent Inc.	Vial	N	
Folic acid	Ben Venae for Bedford	Vial	N	
Levocarnitine	Bedford	Vial	N	
Octreotide	Novartis	Ampule	N/A	
Insulin R	Lilly	Vial	Y*	
Magnesium sulfate	Abbott	Vial	N	

The above table was not intended to include every manufacturer for every product because more than 1 manufacturer can produce equivalent products. It includes all the products that are used by our institution (UPMC) and their manufacturers. The components in this table are the most commonly added to PN. The purpose behind this table is to draw a picture of the latex contents that might be present in the PN.

DNR, dried natural rubber; PN, parenteral nutrition; N/A, not available.

*The manufacturers of those 2 products did not cooperate in giving us a precise percentage of the latex content of the closures.

In spite of the controversy in their results, they concluded that pharmaceutical vial closures release latex allergens and recommended a "1-stick rule" in which a single puncture was permitted through any vial closure before drug administration to an individual with LA.¹⁴

On the other hand, a study published by Thomsen and Burke¹⁵ demonstrated a lack of latex allergen contamination in solutions withdrawn from vials with natural rubber closures. Their study consisted of 3 parts: (1) preparation of 20 samples from vials with latex-containing closures in accordance with conventional guidelines, (2) preparation of 20 samples in accordance with LA precaution guidelines, and (3) preparation of 5 latex-free samples and 1 latex-contaminated sample as negative and positive control, respectively. The conventional method involved swabbing the vial top with an alcohol preparation pad, puncturing the dried natural rubber closures with an 18-gauge needle attached to a latex-free syringe, and withdrawing the contents of the vial into the syringe. The latex-allergy precau-

tion preparation was similar, except that the closure was removed before the vial contents were withdrawn. They conclude that removal of the dried natural rubber closures from vials did not yield less latex allergen solutions than solutions prepared according to conventional guidelines.

Jones et al¹⁶ studied the latex allergen levels of injectable collagen stored in syringes with rubber plungers. They studied extracts of syringe plungers and collagen solutions before and after storage in syringes with dried natural rubber plungers for latex protein allergen. They concluded that the level of latex allergen in injectable collagen is very low. As a result, hypersensitive reactions of latex contamination would be unlikely.

A related survey published in 1997 demonstrated that 26 out of 45 hospitals (58%) removed vial closures before preparing parenteral medications for LA patients, and 11 out of 45 hospitals (24%) filter all medications.¹⁷ Although filtering PN is a common practice in the infusion process by nurses, it is

not recommended or a proven method for removing latex contents from medications.

Following this study, Hamilton et al¹⁸ published an article to emphasize that the risk of vial closure removal outweighs the benefits because this practice involves the technical difficulties of vial closure removal. In addition, removing the vial closures could possibly lead to microbial contamination and improper dosing. This practice also does not consider the latex allergens that might leach to the medications during storage and manufacturing. Hamilton highly recommended the "1-stick rule," which has been used by the Johns Hopkins Hospital in Baltimore, MD, for >5 years. In this practice, a single puncture is permitted in any vial closure for all patients. The advantage of this practice is to minimize the latex distribution in the medication while still using a closed-vial system. Furthermore, it eliminates the need to determine the nature of the rubber closure before parenteral medication preparation. Although this practice does not address the risk of the latex that might leach from the rubber closure to the medication during manufacturing and storage, and it is not cost-effective if it applies to all patients, it is still the best available option and has been applied by our institution in preparing parenteral medications for LA patients.

In 2 interviews with professional personnel from West Pharmaceutical Services, one of the largest companies for producing vial closures, it was stated that although many recipes are available for manufacturing vial closures, only few are widely used. The vial closures used for human products are typically made up of synthetic rubber or a mixture of dried natural rubber and synthetic rubber, at ratios ranging from mid-20% to <1% (0.9%) dried natural rubber (E. Clinii, verbal communication, September 2004 and November 2004).

This survey revealed that 21% of surveyed institutions still remove the vial closures before drawing up the parenteral medications in preparing PN for LA patients in spite of the risk of contamination. Studying Table 1 allows us to determine that two-thirds (20/30) of PN components are latex-free, whereas only one-third (10/30) have closures which contain natural rubber.

Yuill et al¹⁹ surveyed 269 departments of anesthesia in England and Wales for the provision for patients with LA. Their study suggested suboptimal management of LA patients. Staff members, especially during off hours, have difficulties dealing with LA patients because there are no established guidelines. They suggested the need for national guidelines and timely LA protocol.

No guidelines have been published concerning this issue by any of the known pharmaceutical organizations such as the American College of Clinical Pharmacy (ACCP), the American Pharmaceutical Association (APHA), and the American Society of Health-System Pharmacist (ASHP). Latex guidelines have been published by nursing organizations

such as the Association of Perioperative Registered Nurses²⁰ and the Society of Gastroenterology Nurses and Associates²¹; however, they do not deal with preparing parenteral medications. ASHP published a chapter in their recent publication, *Compounding Sterile Preparations*, on dealing with LA. The recommendation was to not remove the rubber closures.²²

The unawareness of institutional policies in 72% of surveyed institutions does not mean the absence of latex policies in those institutions. Realistically, we believe that there is a communication gap between the operation and administration of those institutions that might increase their liability with regard to latex exposure in latex-allergic patients.

Finally, the introduction of West Pharmaceutical Services²³ Fluro Tec Barrier Film techniques in 2003 eliminates the exposure of the vial content to the rubber. The barrier protection properties can help reduce leachable extractable particulate resulting from interaction between the closure and the drug. This technique is not yet widely used in the United States.

Recommendations

According to the findings of this survey, the authors have 7 recommendations:

- Each health institution should develop its own policy for compounding parenteral medications in LA patients.
- LA policies should be updated to reflect recent studies and publications.
- LA policies should be known and available to pharmacy personnel.
- Each institution should develop a precise method to identify LA patients upon admission, which might include multiple questions.
- The "1-stick rule" appears to be the best available practice despite its limitations.
- Multiple-needle penetration should be discouraged to reduce any chances of intradermal response in LA patients.
- A defined set of rules should be used to increase the awareness and education of pharmacy personnel. Institutions should also introduce a practice of educational in-services and periodic competency tests.

Acknowledgments

We thank Sue Skelder for her assistance in this project and Laurie Rack for her assistance in changing UPMC's policy regarding latex allergy. We would also like to thank all the clinical pharmacists who took the time to answer our questions.

References

1. Hamilton RG. Diagnosis of natural rubber latex allergy. *Methods*. 2002;27:22-31.

2. Sumana R. Latex allergy. *Am Fam Physician*. 1998;57:93–100.
3. Yunginger JW, Jones RT, Fransway AF, et al. Extractable latex allergens and proteins in disposable medical gloves and other rubber products. *J Allergy Clin Immunol*. 1994;93:836–842.
4. Charous BL, Blanco C, Tarlo S, et al. Natural rubber latex allergy after 12 years: recommendations and perspectives. *J Allergy Clin Immunol*. 2002;109:31–34.
5. American Association of Nurse Anesthetists latex allergy protocol. *J Am Assoc Nurse Anesth*. 1993;61:223–224.
6. Bollinger ME, Mudd K, Keible LA, Hess BL, Bascom R, Hamilton RG. A hospital-based screening program for natural rubber latex allergy. *Ann Allergy Asthma Immunol*. 2002;88:541–542.
7. Poulos LM, O'Meara JJ, Hamilton RG, Tovey ER. Inhaled latex allergy. *J Allergy Clin Immunol*. 2002;109:701–706.
8. Patriarca G, Nucera E, Buonomo A, et al. New insights on latex allergy diagnostics and treatment. *J Invest Allergol Clin Immunol*. 2002;12:169–176.
9. Brown RH, Hamilton RG, McAllister MA; Johns Hopkins Latex Task Force. How health care organization can establish and conduct a program for a latex free environment. *Jt Comm J Qual Saf*. 2003;29:113–123.
10. Kurtz KM, Hamilton RG, Adkinson NF Jr. Role and application of provocation in the diagnosis of occupational latex allergy. *Ann Allergy Asthma Immunol*. 1999;83:634–639.
11. Brown RH, Schauble JF, Hamilton RG. Prevalence of latex allergy among anesthesiologists: identification of sensitized but asymptomatic individuals. *Anesthesiology*. 1998;89:292–299.
12. Hamilton RG, Adkinson NF Jr. Validation of the latex gloves provocation procedure in latex-allergic subjects. *Ann Allergy Asthma Immunol*. 1997;79:266–272.
13. Hamilton RG, Adkinson NF Jr. Natural rubber latex skin testing reagents: safety and diagnostic accuracy of non-ammoniated latex, ammoniated latex, and latex rubber gloves extracts. *J Allergy Clin Immunol*. 1996;98:872–873.
14. Primeau M-N, Adkinson NF Jr., Hamilton RG. Natural rubber pharmaceutical vial closures release latex allergens that produce skin reactions. *J Allergy Clin Immunol*. 2002;107:958–962.
15. Thomsen DJ, Burke TG. Lack of latex allergen contamination of solutions withdrawn from vials with natural rubber stoppers. *Am J Health Syst Pharm*. 2000;57:44–47.
16. Jones JM, Sussman GL, Beezhold DH. Latex allergen levels of injectable collagen stored in syringes with rubber plungers. *Urology*. 1996;47:898–902.
17. The ASHP council bibliography. Procedure for preparing injectable medications for latex-sensitive patients. *Am J Health Syst Pharm*. 1997;54:2516–2517.
18. Hamilton RG, Brown RH, Veltri MA, et al. Administering pharmaceuticals to latex-allergic patients from vials containing natural rubber latex closures. *Am J Health Syst Pharm*. 2005;62:1822–1827.
19. Yuill GM, Saroya D, Yuill SL. A national survey of the provision for patients with latex allergy. *Anesthesia*. 2003;58:775–803.
20. Association of Perioperative Registered Nurses. AORN latex guidelines. *AORN J*. 2004;79:653–672.
21. Society of Gastroenterology Nurses and Associates, Inc. Guidelines for preventing sensitivity and allergic reactions to natural rubber latex in the workplace. *Gastroenterol Nurs*. 2004;27:191–197.
22. Hetey S. Dealing with latex allergy. In: Buchanan EC, Schneider PJ, eds. *Compounding Sterile Preparations*. 2nd ed. Bethesda, Md: American Society of Health-System Pharmacists; 2004:207–213.
23. West Pharmaceutical Services. *Strength, Character, Performance: 2003 Annual Report*. Available at: http://www.westpharma.com/annual_reports/default.asp. Accessed September 6, 2004.