

Case Report of Latex Aerosolization from a Transesophageal Echocardiogram Machine

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ABSTRACT

Aerosolized natural rubber latex proteins produce latex sensitization and can cause acute allergic reactions in susceptible individuals. The objective of this study is to describe measures that should be taken to ensure a latex-safe hospital environment. A case of latex-induced anaphylaxis prompted a survey of air quality in acute care areas of a major tertiary health care center that had eliminated the use of powder-free latex gloves years earlier. Six air samples were collected using pre- and postcalibrated sampling pumps operating at 2.7 L/minute. Samples were collected in duplicate on three-piece 37-mm Teflon filters in open-faced cassettes and tested for latex allergen by inhibition immunoassay. All samples had less than the detection limit $> 5 \text{ ng/m}^3$ for aerosolized latex except for the echocardiogram suite where the transesophageal echocardiogram machine was located. After thorough cleaning of the suite and echocardiogram machine, subsequent air sampling showed no detectable latex aerosolization particles. Follow-up investigation to discover the source of contamination revealed that the department performing routine maintenance on the echocardiogram equipment used powdered latex gloves obtained outside the hospital. Employees who are latex allergic may experience symptoms even in an environment of powder-free, nonlatex gloves. The site was a contaminated transesophageal echocardiogram machine. Institutional policies should be in place to monitor employee complaints and address allergic reactions to latex. (Allergy and Asthma Proc 25:191–194, 2004)

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INTRODUCTION

Aerosolized natural rubber latex powder particles are associated with immunoglobulin E (IgE) latex sensitization and production of allergy symptoms in health care workers and patients.^{1,2} Current recommendations by the American Academy of Allergy, Asthma, and Immunology and American College of Allergy, Asthma, and Immunology advocate use of low-allergen, powder-free gloves by health care providers in meeting universal precautions.³ Residual latex particles might remain in acute care areas on stationary objects or within medical equipment because use of powdered latex gloves was once a common practice for protection of health care workers. Inadvertent exposure to latex particles contaminating medical equipment has the potential to produce acute allergic symptoms, possibly resulting in anaphylaxis, in susceptible employees or health care workers.

The University of Iowa Hospitals and Clinics, a major tertiary health care center in the midwest, implemented a hospital-wide policy in 1996 to ensure a latex-safe environment for all patients and health care workers. A Latex Allergy Committee was organized to assist in the development and oversight of policies and procedures regarding latex products. Areas of responsibility included purchase and use of latex products in the hospital, development and implementation of uniform safety standards, and regular monitoring of the hospital environment for compliance. As part of this initiative, the purchase of powdered latex gloves was prohibited.

Our study confirms that the monitoring of acute care areas and performing periodic air samplings are justified in

maintaining a latex-safe environment. Moreover, continual review of hospital practices may uncover situations in which latex powdered gloves have been indiscriminately used in nonmedical departments within the institution.

CASE REPORT

On September 4, 2001, an attending cardiologist with previously diagnosed latex allergy was called to perform a transesophageal echocardiogram using a portable echocardiogram machine. The echocardiogram machine's light source uses a fan system located posteriorly on the unit. The cardiologist stood immediately behind the unit while performing the procedure wearing nitrile gloves. Allergic symptoms occurred within 5–10 minutes of initiating the echocardiogram procedure. She experienced sudden onset of chest tightness associated with shortness of breath combined with itchiness and puffiness of the periorbital area. She also described a "catching" sensation within her upper airway. No latex balloons or plants were in or near the unit, and she did not ingest or come in contact with any chestnuts, avocados, kiwi, bananas, or peaches before the event. The gloves used in the echocardiogram suite were nonpowdered, low-allergen, additive-free latex gloves or nitrile exam gloves. Symptoms spontaneously resolved within 20–30 minutes after the cardiologist left the area, used three puffs of an albuterol inhaler metered dose inhaler, and took a 60-mg tablet of fexofenadine.

The cardiologist's history revealed that she was diagnosed with an IgE-mediated latex allergy confirmed by a radioallergosorbent test CAP RAST (Pharmacia) of 4163 IgE counts (IgE range, 3600–8000; Allergy Testing Laboratory, Gainesville, FL) in December 1995. In the past, she had recurrent mild nasal and intermittent respiratory allergic symptoms after exposure to powdered latex gloves and assorted latex products in the hospital environment. She had no history of sensitivity to cross-reactive foods such as chestnut, avocado, or kiwi.⁵ On one occasion, symptoms were triggered by talking on the telephone after another employee handled the phone wearing powdered latex gloves. On another occasion, she developed acute gastrointestinal cramping followed by sudden sharp pleuritic chest tightness with chest pain, lip swelling, dizziness, and shortness of breath after eating a piece of cake packaged by a food handler wearing powdered latex gloves. During another episode a few years later, she developed generalized pruritus and shortness of breath after unknowingly donning a pair of latex gloves before a procedure. She never had allergy symptoms related to performing echocardiography in the past. Episodes resolved with epinephrine, steroids, and antihistamine therapy. Generally, her latex allergy symptoms have remained under control because powdered latex gloves are no longer permitted in the hospital environment.

MATERIALS AND METHODS

Worksafes Iowa, an industrial hygiene consultation group within the University of Iowa College of Public Health assessed six different locations in the hospital for occupational health and safety hazards, specifically the level of aerosolized latex allergens. On September 13, 2001, Worksafes Iowa collected six air samples from designated areas using pre- and postcalibrated personal sampling pumps. All samples were collected at a height equivalent to the breathing zone in employee work areas. Samples were collected on three-piece 37-mm Teflon filters in open-face cassettes. Filters were attached to sampling pumps operated at 2.7 L/minute.

After extraction, the samples were sent to Mark Swanson, Mayo Clinic (Allergic Diseases Research, Rochester, MN) to be analyzed for latex allergen content by inhibition immunoassay. The samples were tested in duplicate and collected on 2 distinct sampling days with workload and type of procedures performed representative of a normal work day. The results were expressed in nanograms per cubic meter of air. Table I lists the six samples and their corresponding latex allergen content results. Testing revealed that a latex aeroallergen level of 20 ng/m³ was detected in the Echocardiography Suite while the echocardiogram machine was running. The sample analysis from the echocardiogram area was the only detectable sample and was retested with the second batch of samples to confirm reported results. Samples in all other medical/surgical acute care areas tested revealed latex aeroallergen levels below detection limits.

DISCUSSION

Subsequent investigation of the acute care area where the cardiologist performed the echocardiogram yielded no clues as to a possible hidden source of latex allergen. Air samples collected in the Cardiovascular Intensive Care Unit and the Cardiology step-down unit were below detection for latex allergens. The only gloves used in the area were either nitrile or powder-free, low-allergen, additive-free latex gloves. However, the light source fan on the echocardiogram unit was suspect as a potential source of latex antigen. Therefore, air sampling was performed in the Echocardiogram Suite with the echocardiogram machine in operation. In addition, air sampling also was performed in other acute care areas where the cardiologist was likely to provide future consultation.

Investigation of an isolated acute allergic reaction in an IgE-sensitized individual uncovered a significant quantity of aerosolized latex in the Echocardiography Suite while the echocardiogram machine was in use. Worksafes Iowa proposed that residual quantities of latex protein collected on the light source fan of the echocardiogram machine produced enough antigen to be detected at the moderate level by air-sampling detection standards. Because all powdered gloves (exam, procedural, surgical, and chemotherapy gloves) had been removed from this area of the hospital in 1996, pursuit of an explanation for a likely source of latex

TABLE I

Latex Aerosolization Testing Results

Sample	Location	Flow Rate (1 pm)	Time (min)	Latex Allergen Level
September 13, 2001*				
1	4JCE Medical/Surgical Unit	2.7	514	Less than detection limit <5 ng/m ³
2	4JCW Medical/Surgical Unit	2.7	512	Less than detection limit <5 ng/m ³
3	4RC Medical/Surgical Unit	2.7	497	Less than detection limit <5 ng/m ³
4	4 Echo Echocardiogram Suite	2.7	489	Original sample retested 20 ng/m ³
5	01014 JPP Nonclinical Area	2.7	483	Less than detection limit <5 ng/m ³
6	Control Site	—	—	Less than detection limit <5 ng/m ³
October 3, 2001#				
1	4 Echo Echocardiogram Suite	2.7	509	Less than detection limit <2 ng/m ³
2	Control Site	—	—	Less than detection limit <2 ng/m ³

Key: <10 ng/m³ = low; 10–50 ng/m³ = moderate; >50 ng/m³ = high.

*September 13, 2001 detection limit, 5 ng/m³.

#October 3, 2001 detection limit, 2 ng/m³.

Source = Ref. 7.

contamination resulted in a thorough investigation of the acute care units, ventilation systems, medical-surgical supplies, and medical equipment stored at several acute care locations within the hospital.

Final analysis concluded that routine maintenance of the transesophageal echocardiogram machine used in the Echocardiography Suite had been performed in the past by personnel from the Bioengineering Department. While performing their maintenance duties, staff wore powdered latex gloves causing a residual buildup of latex antigen on the inner mechanics of the echocardiogram machine. Consequently, bioengineering personnel inadvertently contributed to a buildup of residual latex protein within medical equipment used in the Echocardiography Suite.

Staff from multiple departments within the health care center worked collaboratively to remove promptly all suspect allergens from the Echocardiography Suite. The machine was cleaned and the filter was replaced by bioengineering personnel wearing latex-free gloves. Ventilation filters were replaced, curtains in the room were laundered, and environmental surfaces were cleaned. Subsequent air sampling in the Echocardiography Suite with the echocardiogram machine operating was performed. The results confirmed that decontamination measures taken were successful in reducing latex aeroallergen levels to below detectable levels.

Prior studies have concluded that extremely minute quantities of latex aeroallergens (≥ 0.5 ng/m³) are associated

with production of allergy symptoms in sensitized individuals.^{2,4,5} For this reason, purchasing of latex gloves and surveillance of the environment at the University of Iowa Hospitals and Clinics is overseen by the Latex Allergy Committee with select representatives from hospital administration to ensure that high-quality, powder-free, latex gloves with the lowest latex allergen and additive content are used in the medical center.

CONCLUSION

Continuous monitoring of the hospital environment and of the purchasing practices of latex gloves is prudent to ensure a safe working environment. Inspection of acute care areas and periodic air samplings also are beneficial in assuring a latex-safe environment.⁶ Inadvertent exposure to natural rubber latex is possible despite careful inspection and adherence to institutional policies regarding latex avoidance. Continuous review of hospital practices may uncover situations in which latex powdered gloves are indiscriminately used in nonmedical departments within the institution. Air sampling can assist in detecting hidden sources of latex allergen including residual buildup from prior use of powdered latex gloves or use of latex gloves that do not meet the highest safety standards. Health care providers and hospital staff should be instructed regarding the potential risks of latex allergy and an institution-wide safety program regarding the use of latex gloves and equip-

ment in all areas of the hospital should be implemented. In addition, institutional policies to manage reported cases of latex-allergic reactions in the workplace and to monitor employees with latex allergy should be developed and enforced. Ensuring a latex-safe environment is a high priority in a hospital environment where inadvertent exposure to latex by a sensitized individual could lead to a severe, life-threatening, allergic reaction.

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