ORIGINAL ARTICLE

Analysis of Environmental Conditions in the Operating Room for Latex-Allergic Patients' Safety

Cati Méndez, BSN, Eva Martínez, BS, Eva Lopez, BS, Inma Garçon, BSN, Carmen Carrión, BSN, Núria Prats, BSN, Blanca Baldellou, BSN

Purpose: *Most current protocols agree that latex-sensitive patients should be scheduled for elective surgery as the first case of the day with a 12-hour activity-free interval before surgically treating latex-allergic patients.*
Design: *To understand the kinetics of decontamination of airborne particles in the operating room (OR) after a surgical procedure to determine the activity-free interval necessary between surgeries for latex-allergic patients.*
Methods: *This observational study included 12 ORs in four hospitals. Baseline levels of airborne particles were established before surgery.*
Findings: *Mean recovery time of ORs was 18.9 ± 6.5 minutes. To guarantee an efficacy of 99.9%, two standard deviations were added to the maximum time (28 minutes). Total recovery time: 32 minutes.*
Conclusions: *ORs that complied with the requirements of our study before performing surgery on latex-allergic patients obtained the same environmental conditions as first thing in the morning after thorough cleaning of the OR and a 32-minute activity-free interval and staff traffic restriction.*

Keywords: *allergic patients, latex, operating room, anaphylaxis, kinetics of particles.*

MOST CURRENT PROTOCOLS in surgical areas recommend a 12-hour activity-free interval before surgically treating patients who are hypersensitive to latex.[1-3] The interest for air quality in the operating room (OR) to avoid infections started at the beginning of the 20th century. The first studies on this issue published in 1946 are attributed to Bourdillon-Colebrook, who recommended improved ventilation systems because surgical rooms were only equipped with exhaust fans, but no clean air inlet. Such improvements achieved adequate environmental conditions but did not prevent ingress of contaminated air into the operating theater from other contaminated areas. Recommendations regarding the assurance of air quality, the control of airborne particles in different procedures and spaces, and the number of air renovations (between 20 and 30 per hour) were later incorporated. It was not until 1960 that Blowers and Crew established the principles of an effective ventilation system for operating theaters.[4]

Cati Méndez, BSN, operating room head nurse, Terrassa Hospital, Barcelona, Spain; Eva Martínez, BS, technician in occupational risk prevention, La Mancomunitat Sanitària de Prevenció, Barcelona, Spain; Eva Lopez, BS, technician in occupational risk prevention, La Mancomunitat Sanitària de Prevenció, Barcelona, Spain; Inma Garçon, BSN, operating room head nurse, Moises Broggi Hospital, Barcelona, Spain; Carmen Carrión, BSN, operating room head nurse, Badalona Municipal Hospital, Barcelona, Spain; Núria Prats, BSN, operating room head nurse, Igualada Hospital, Barcelona, Spain; and Blanca Baldellou, BSN, technician, Occupational Risk Prevention, Terrassa Hospital, Barcelona, Spain.

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Address correspondence to Cati Méndez, Hospital de Terrassa, Carretera Torrebonica s/n, 08227 Terrassa, Barcelona, Spain; e-mail address: cmendez.cati@gmail.com.

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Latex is the substance obtained from the sap of the *Hevea brasiliensis* tree. Its protein content is between 1% and 1.8% and 13 allergens have been identified. These proteins can also be found in some foods, and cross-reactions may occur between latex-allergic individuals and the ingestion of such food items.[5] References about hypersensitivity to latex were found in 1927 and later in 1979, but the number of individuals with latex hypersensitivity rose in the 1990s. This increase was the result of the greatly increased use of latex gloves and products made of raw latex, following international guidelines that recommend the use of gloves since the appearance of the human immunodeficiency virus as a measure for preventing the propagation of infectious diseases.[6,7]

In the past years, latex allergy has become a major health concern that affects health care workers[8-10] and the general population. Other risk groups include individuals allergic to tropical fruit (eg, banana, kiwi) or other types of fresh or dried fruits, patients diagnosed of atopy, dermatitis, asthma, allergies, and exposed workers such as kitchen and cleaning staff.

Latex allergen (latex proteins) contact and/or exposure may occur via cutaneous, percutaneous, mucosal, or parenteral routes. Inhalation of latex particles occurs when the proteins combine with the powder from the gloves and form aerosolized particles that become airborne. Reactions caused by hypersensitivity to latex can range from contact urticaria, angioedema, rhinoconjunctivitis, bronchial asthma, and even anaphylactic shock.

The prevalence of latex allergy according to a report by the Catalan Society of Allergy and Clinical Immunology is estimated at 1% for the general population. This figure increases in risk groups: 3% to 11% in health care professionals, 8% to 10% in surgical staff and dentists, and 30% to 50% in patients with urogenital disorders and with multiple surgery.[5,11]

Latex is used to manufacture medical gloves, material, equipment, and devices. As gloves are the first barrier used by health care professionals, their use is indispensable in surgical areas and is closely correlated with the high levels of airborne allergens. The studies performed on the use of powdered and powder-free gloves have shown that latex protein concentrations are lower when powder-free gloves are used.[12]

Several studies have demonstrated that the risk of developing hypersensitivity to latex is higher when powdered gloves are used.[9,13] Related factors are glove protein and lubricating powder. A number of investigations have shown that the concentrations of airborne allergens range between 8 and 974 ng/m^3 in areas where powdered latex gloves are used and between 0.3 and 1.8 ng/m^3 where powder-free latex gloves are used.[14,15]

The OR is an area of great activity, subject to constant changes (surgical techniques, physical structure, equipment, furniture, materials, and drugs) and is considered a high-risk area. It is therefore important to know the components of the materials used in the manufacture of all devices and materials and identify and verify their correct functioning. Maintenance of the parameters of the ventilation system should be established according to the legislation in force.[16,17]

Installations should ensure a clean airflow to allow dilution of the contamination generated by surgical equipment and individuals in the surgical room. The air pressure should ensure an airflow path from clean to less clean areas and an airflow pattern that shifts contaminated air in areas that require special protection (surgical area and instrument tables) to minimize the level of airborne contamination.[18,19]

Experience has shown that ORs at risk for a higher presence of bacteria and potential for contamination should be equipped with fans at 2,400 m/hour when equipped with mixed air systems and include a minimum of 20 air changes/hour.[20]

Particles are solid or liquid matter shed into the air. Particle concentration is an indicator of the air quality in the OR. Depending on the type of premises, several stages of filtration are required to eliminate particulate pollutants.

The criterion established to operate on latex-allergic patients in the sites participating in the present study is to schedule them for elective surgery as the first case of the day. This measure is taken as airborne latex-laden particles are presumed to be at their minimum levels at that time, because there has been no activity since the previous day. Reproduction of this "first case of the day" environment would allow modifying the present protocols that require a 12-hour interval between