American Latex Allergy Association

In-use barrier integrity of gloves: latex and nitrile superior to vinyl.

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BACKGROUND: Although gloves manufactured with different materials have comparable barrier properties when removed directly from the box and tested, their actual on-the-job barrier performance may be extremely different. Although effective in static, pre-use conditions, barrier properties may be compromised once challenged by the rigorous hand and finger movements associated with many health care procedures. Gloves are meant to act as barriers, protecting persons by reducing the risk of exposure to bloodborne pathogens. Ineffective barriers or barriers that are easily breached during risk-associated procedures have the potential to place health care professionals at risk. Multiple studies attesting to the barrier attributes of vinyl and latex gloves during varied controlled clinical situations are available. Studies are available that address the permeation characteristics of nitrile, but no studies document the effectiveness of nitrile as a barrier to bloodborne pathogens or compare the barrier effectiveness of nitrile to gloves made of other materials during simulated use or clinical situations.

OBJECTIVE: This study was undertaken to compare the barrier integrity of latex, vinyl, and nitrile gloves during controlled, simulated clinical use conditions that were specifically designed to mimic patient care activities. This study compares the performance of gloves made of natural rubber latex, long considered the gold standard; polyvinyl chloride (vinyl), a synthetic copolymer; and nitrile (acrylonitrile butadiene), a recently available synthetic for use in the health care environment.

METHODS: A total of 2000 gloves (800 latex gloves, 800 vinyl gloves, and 400 nitrile gloves) were evaluated for baseline determinations in unused gloves and for failure rates after specific simulated use conditions. Potential bias was avoided through strict control of all actions and manipulations. Gloves were graded on a pass or fail system for leaks as defined by American Society for Testing and Materials D5151, Standard Test Method for Detection of Holes in Medical Gloves. To more fully characterize the gloves evaluated, individual products were also tested for physical dimensions (finger and palm thickness), powder levels, total protein (Modified Lowry), and antigenic protein (Latex ELISA [enzyme-linked immunosorbent assay] for Antigenic Proteins).

RESULTS: With the exception of one vinyl glove brand with a 12% failure rate, no significant differences in failure rates were detected among the 3 types of gloves when tested directly out of the box with no manipulation. However, after manipulation intended to simulate in-use conditions, vinyl gloves failed 12% to 61% of the time. Latex and nitrile performed significantly better, with failure rates of only 0% to 4% and 1% to 3%, respectively. All latex gloves, with one exception, tested at less than 50 microg/g of total water extractable protein. The antigenic

protein levels, with one exception, tested from less than 0.2 microg/g to 5.5 microg/g. The one latex product that fell outside these values had 154 microg/g of total protein and 105.7 microg/g of antigenic protein.

CONCLUSIONS: This study indicates that the latex and nitrile gloves evaluated were comparable in terms of barrier performance characteristics both unused and during manipulations mimicking patient care procedures. Whereas stretch vinyl exhibited lower failure rates than standard vinyl, the higher in-use leakage rates associated with all vinyl gloves tested indicate decreased durability and, potentially, compromised barrier protection when this synthetic is used. Careful consideration to the degree of barrier effectiveness should be given before glove selection when the potential exposure to bloodborne pathogens or biohazard risks is a concern.

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