

Advantages and Disadvantages of Non-latex Surgical Gloves

a report by

Dr Denise M Korniewicz

Professor and Executive Dean, University of Miami, School of Nursing



Dr Denise M Korniewicz is currently Professor, Executive Dean and Associate Dean for Research at the University of Miami, School of Nursing & Professor, Department of Epidemiology, School of Medicine. She has been a registered nurse for over 30 years with experience in emergency and critical care nursing.

Dr Korniewicz is a fellow in the American Association of Nursing and a member of the International Honor Society for nursing. She serves on the editorial board for the *American Journal of Infection Control* and provides editorial reviews for the Association of Critical Care Nurses. Dr Korniewicz has received numerous awards such as the Pinnacle Award for mentorship from Sigma Theta Tau International Society for Nursing and awards for Outstanding Faculty Research. She has been named in *Who's Who in Science and Engineering*, *Who's Who in Medicine & Health* and *Who's Who in the World*. Dr Korniewicz has been published in over 120 scientific journals, reviews and book chapters. She has delivered numerous lectures related to infection control and gloving. Dr Korniewicz has participated in a variety of national and international task forces designed to enhance healthcare employee safety.

Non-latex sterile surgical gloves have been introduced into the operating room as a solution to increased reports among healthcare workers (HCWs) and patients who describe allergies associated with latex.¹⁻⁴ Non-latex sterile surgical gloves have not been used routinely for surgical procedures and little has been documented about their barrier effectiveness with surgical use. Rego and Roley^{5,6} reported that non-latex nitrile medical gloves were comparable to latex when used for basic patient care. Similar findings related to the barrier quality of non-latex surgical gloves during routine surgical use were also reported.⁷ However, there are several advantages and disadvantages that have been reported consistently with the use of non-latex surgical gloves during routine surgery. As a result, HCWs remain concerned about risks associated with the barrier quality and overall safety of non-latex surgical glove use.

Advantages of Non-latex Surgical Gloves

Although non-latex surgical gloves have been available for years, it is only recently that they have been used exclusively in some healthcare institutions that have changed to a totally latex-free surgical environment. There are three documented advantages for their use. Firstly, one of the most widely recognised advantages of non-latex surgical gloves is their ability to provide an alternative hand protection for HCWs who are allergic to latex, or who provide care to patients with a known latex allergy.

Secondly, many of these synthetic materials (nitrile, neoprene and polyisoprene) have provided satisfactory hand protection and there has been limited evidence of problems with clinical use. Thirdly, non-latex surgical gloves may be safer during surgery because they can readily alert the surgeon when they become breached. The majority of reports have demonstrated that when surgeons use non-latex surgical gloves they are easily able to see a hole produced from a surgical instrument or a sharp. The tensile strength of non-latex surgical gloves is less than surgical gloves, so

when holes appear the material tends to tear, allowing the surgeon to immediately change the glove. However, latex surgical gloves have more flexibility and often reseal – thus surgeons are not aware when a hole appears. The inability of the surgeon to recognise a break in the barrier protection provided by the non-latex surgical glove limits the ability to change them in a timely manner and reduce the risk of infection transfer between the surgeon and patient. This indirect advantage of non-latex surgical glove use may eventually impact on the decisions made in the selection of surgical gloves to ensure patient and healthcare employee safety.

Disadvantages of Non-latex Surgical Gloves

There are several reported disadvantages of non-latex surgical glove use. Firstly, non-latex surgical gloves appear to be more sensitive to conditions of use, with certain surgeries and types of HCWs at greater risk from glove failures. In a federally funded study to compare the failure rates of latex and non-latex surgical gloves following surgical procedures, non-latex gloves were found to have a significantly higher failure rate than latex surgical gloves (non-latex 8.4%, latex 6.0%, $n = 11,118$ gloves).⁸ In addition, the location on the defect on the glove was found to be different for non-latex and latex gloves. In latex gloves, the defects were found primarily in the fingers (43.8%) while in non-latex gloves the most frequent location was the top of the gloves (36.9%). This may purport to be initial data, supporting research into the durability of specific gloves and the testing of both formulation and glove design.

Secondly, specific types of HCWs are also associated with increased non-latex glove failure. Surgical technicians have a higher glove failure rate than any other surgical worker – including surgeons, despite wearing their gloves for shorter lengths of time during procedures and also changing their gloves more frequently. This finding is surprising and is not consistent with findings for other members of the surgical team.

Table 1: Selection Guide for Gloves Used in Healthcare Settings

| | Barrier Protection | Strength & Durability | Puncture Resistance | Fit & Comfort | Elasticity | Allergenicity |
|----------------------------|-------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------|
| Latex | Long-standing barrier qualities | Strong, natural rubber is durable | Has re-seal qualities | Provides comfortable fit | Natural ability due to elastic quality rubber | Contains protein & chemical allergens low powder is preferred |
| Neoprene (Chloroprene) | Good but tear resistance is marginal | Strong | Has some puncture resistant qualities | Provides a good fit, has some elastic ability that enhances fit | Close to latex and allows for flexibility | Contains no latex proteins but has some accelerator chemicals |
| Nitrile | Resistant to punctures & tears, flexes and does not develop holes | Strong has puncture resistant qualities | Has puncture resistant qualities | Slightly tighter fit | Less than latex over time tends to shape to wearer's hand | Contains no proteins but contains some accelerator chemicals |
| Vinyl | Easily breaks during use, baggy | Weak, breaks easily & punctures easily in use | Punctures with sharps | Fit limited baggy | Dexterity compromised | Contains no proteins but chemical accelerators |
| Polyurethane | Durable and high puncture resistance | Excellent tear puncture and abrasion resistance | Superior to latex for puncture resistance; mimics nitrile in performance | Good comfort and fit; has latex-like qualities | Elasticity is apparent | Contains no latex proteins & no chemical accelerators |
| Copolymer (block polymers) | Good resistance to tears | Stronger than vinyl; puncture resistance is fair | Easy to puncture | Latex like fit and comfortable | Elasticity superior to vinyl but below latex | Contains no latex proteins but some chemical accelerators |

Surgical residents were found to have the second highest defect rate and wore their gloves longer than surgical technicians.⁸

Thirdly, the type of surgical speciality is also related to the glove failure rate. Non-latex surgical gloves have been reported to have higher defect rates among surgeons who specialise in orthopaedic, plastics and cardiac services.⁹ Additionally, time or duration of use (length of time for operative procedure) has been a factor that has inhibited their widespread use. Latex gloves fail primarily due to length of use, whereas non-latex gloves are more sensitive to conditions of use (e.g. type of healthcare worker and surgery). Khoo¹⁰ noted that human factors such as skill of surgical personnel, operative difficulty, sharp exposure and types of surgical instruments that require fine hand motor movements inadvertently impact the incidence of glove defects.

Patient and HCW Safety

Since surgical gloves undergo a series of physical stresses such as twisting, pulling, stretching, exposure to bodily fluids or chemicals, it is not unusual for the barrier to become compromised.^{3,11–15} Surgical gloves act as a barrier to infection, therefore frequent changing of gloves and monitoring glove breaches from sharps or surgical instruments is imperative. Surgical gloves that are compromised by unnoticed

visible defects may be an indirect cause of surgical wound infection.^{16–18}

Research⁸ demonstrated that a majority of non-latex glove defects were not always visible to the naked eye and may inadvertently expose HCW to bloodborne pathogens. Eighty-three per cent of glove defects pass unnoticed, which may contribute to the risk of cross-contamination of bloodborne pathogens such as hepatitis or HIV among exposed HCWs or patients.^{19–21} Non-latex or latex surgical gloves that have unnoticed visible defects may be an indirect cause of surgical wound infection, especially non-latex surgical gloves that are coloured (pink, green and blue) and make it difficult for surgeons to distinguish a barrier breach.

Economic Considerations

Healthcare administrators prefer non-latex products; however, the demand and supply of these products remain inconsistent. The availability of non-latex gloves is dependent on the ability of synthetic manufacturers to supply the raw materials for production. The costs for non-latex gloves passed along to the healthcare industry can be two to three times that of latex surgical gloves. The demand for non-latex products and non-latex surgical gloves will need to increase tremendously before the price can be stabilised, therefore institutions may want to evaluate the costs

associated with a commitment to an all-non-latex environment.

General Surgical Practice Guidelines When Using Non-latex Surgical Gloves

Non-latex surgical gloves can be safely used as an alternate hand barrier even though they remain inferior to latex surgical gloves. Based on the advantages and disadvantages that have been reported, it is recommended that:

- non-latex surgical gloves should be changed immediately when the barrier is breached;
- HCWs (surgical technicians and residents) with less surgical experience may be at greater risk from exposure to bloodborne pathogens and therefore may require additional training when using non-latex surgical gloves, since they tend to break easily with use;
- HCWs who work in orthopaedic, oral, plastics and cardiac surgical suites need to adhere to the bloodborne pathogen regulations that require HCWs to frequently change their gloves, particularly when the barrier becomes compromised; and
- surgical personnel (surgeons and nurses) responsible for training surgical residents and scrub personnel need to emphasise frequent glove

changes, particularly amongst trainees.

Future Trends in Non-latex Surgical Glove Use

The quality of non-latex surgical gloves is dependent on the type of material (nitrile, neoprene or isoprene), glove manufacturer and stress during clinical use. Non-latex neoprene intact gloves are comparable to latex and can provide a safe alternative to latex among latex allergic patients and HCWs. Nitrile continues to be too rigid as a surgical glove and is poorly rated amongst surgical personnel. Other features – such as powder – continue to be omitted as a donning agent for non-latex gloves, since recent data supports the discontinuation of powder as it enhances allergic symptoms.

New non-latex gloves are continuously being developed to provide cost-effective quality barrier protection. Renewed emphasis about patient and HCW safety poses new challenges for manufacturers. Innovative methods are needed to develop new gloves with anti-microbial properties to reduce cross-contamination between and among HCWs.²² Gloves in the future may provide added needle stick or sharp protection with the use of puncture-free materials. These challenges will force the provision of strict standards for glove manufacturers and will move the market towards the survival of quality non-latex gloves. ■

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