Research Brief

Biogel®

Double Gloving and Safety

Key Points

- **99%**: The number of surgeons reporting in one survey having experienced needlestick injuries, yet only half had reported the injury.[i]
- **95%**: The volume of blood on a solid suture needle reduced when passing through two glove layers reducing viral load in the event of a contaminated percutaneous injury.[ii]
- **87%**: The rate of reduced exposure to patient's blood when double gloving is used.[iii]
- **50%**: Percent of operations in which patient blood makes contact with Operating Room (OR) personnel skin or mucous membranes.[iv]

Introduction

Personal protective equipment (PPE) is one of many areas covered by regulations for sharps injury prevention featured in the Needlestick Safety and Prevention Act. Using two sets of gloves during invasive surgical procedures is one of the Hierarchy of Controls by Occupational health and safety professionals as one of the most effective sharps safety controls.

Evidence based practice (EBP), Association of PeriOperative Registered Nurses (AORN) and American College of Surgeons (ASC)recommend double gloving for invasive procedures for sharps safety.

Evidence

Surgical Glove Best Practice using a Just Culture Model, Rachel Nolan, RN, BSN, CNOR, AORN Poster Presentation, 2020

The operating room conducted a skills fair and 2 week surgical glove trial to gain double gloving acceptance using a colored indicator glove, create a synthetic (no natural rubber latex) atmosphere and lower SKUs. Post implementation showed 100% double gloving compliance in all areas but the cardiac surgical team.

The OR consolidated SKUs, projected an approximate $40,000 cost reduction in glove spend and clinically benefitted from a no natural rubber latex atmosphere.

There was a 31% decrease in needlestick injuries during the first year following double gloving implementation

Visible glove perforation in total knee arthroplasty: Risk and consequences, Lee Qunn Jid, et al, Journal of Orthopedic Surgery 2017

This study reported an independent association of glove perforation with higher superficial SSIs in joint arthroplasty surgery.

Over 2 years, 1226 Total Knee Replacements (TKRs) were reviewed with 55 glove perforations noted and an operation perforation rate of 4.5%. Risk factors were identified including body mass index (BMI), bilateral surgery, operation time and non-trainee surgeons. The adjusted odds ratio for superficial SSI after glove perforation was 15.2 (independent of BMI and operation time)

Superficial SSI was significantly higher in the glove perforation group

Glove Failure in Elective Thyroid Surgery: a prospective randomized study, Dariusz Timler, et al, International Medicine and Environmental Health, 2015

The Department of Endocrinological and General Surgery of Medical University of Lodz sought to analyze perforation rate in sterile gloves used by surgeons in the operating room. The randomized controlled trial analyzed the incidents of tears in sterile surgical gloves used by surgeons during operations on 3 types of thyroid diseases. 972 pairs (sets) of gloves were collected from 321 surgical procedures.

Statistically relevant glove tears occurred more often in operator than the 1st assistant. This study proved that the role performed by the surgeon during the procedure (operator, 1st assistant) has significant influence on the risk of glove perforations.

Glove perforation was detected in 89 of 972 glove sets (9.2%)

Nearly 90% of glove perforations were unnoticed during surgery

Evidence *continued*

Bacterial migration through punctured surgical gloves under real surgical conditions, Nils-Olaf Hübner, et al, BMC Infectious Diseases 2010

Ernst-Moritz- Arndt University in Germany examined 194 Biogel surgical gloves during 20 consecutive elective and emergency surgical laparotomies to determine micro-perforations and bacterial migration.

Perforations were noticed in 10.2% of outer gloves and 1.04% of inner gloves. Authors concluded that undetected perforation of surgical gloves occurs frequently and bacterial migration through micro-perforations in surgical gloves does occur.

In 70% of cases, a perforation was noticed by a color change using the indicator-glove system. Bacterial migration was detected in over 50% of perforated gloves.

Single versus double-gloving for obstetric and gynecologic procedures, Lancaster C., Duff.P, Am J Obstet Gynecol. 2007 May

In this prospective cohort study, surgeons single or double-gloved for pelvic surgery procedures at their own discretion. Gloves were collected at the end of each procedure and evaluated for perforations.

1000 sets of gloves were tested: 675 double-glove sets and 325 single-glove sets. The highest rate of perforation (19%) occurred during major gynecologic procedures. Surgical nurses were the most likely member of the surgical team to sustain a glove injury. There was no significant difference in the total perforation rate between double and single glove sets (10% vs 11%). However, there was a significantly greater potential for blood-skin exposure in the single glove sets.

11% of single glove sets contained a perforation, whereas only 2% of double glove sets contained a corresponding defect in the inner and outer gloves.

Study of Blood Contact in Simulated Surgical Needlestick Injuries with Single or Double Latex Gloving, Andreas Wittmann, PhD, et al, Infection Control Hospital Epidemiology, 2009

The aim of this study was to measure the quantity of blood transferred at the point of a percutaneous injury by using radioactively labeled blood. To determine blood transfer volume under simulated intraoperative conditions, 3 mL of blood was applied to the outside of each test glove.

To simulate punctures with surgical suturing needles preloaded safety lancets were used to pierce the glove (s) at a depth of 2.4 mm through the applied blood. Single glove: 0.064 µl transferred; double glove: 0.011 µl transferred (141% difference in blood transfer amount).

To simulate injuries caused by sharp objects such as bone fragments and scissor tips ,glove(s) were pierced with an automatic blade shaped lancet to a depth of 1.8 mm with a blade-shaped needle. Single glove: 0.069 µl ; double gloving: 0.033 µl (70% difference in blood transfer amount).

Double gloving leads to a significant reduction in the quantity of blood transferred during needlestick injury. Punctures involving the double layer of gloves were clearly identifiable by the coloring of the puncture site.

Summary Points

1. There is higher likelihood of SSI in procedures in which gloves were perforated compared with interventions where gloves remained intact. Where no surgical antimicrobial prevention measures are put in place, perforation of gloves during surgical procedures increases the risk of SSIs. **(Surgical glove perforations and the risk of surgical site infection,** Misteli H et al. Archives of Surgery. 2009)
2. The consistency of current evidence as well as the relatively large effect size lead to the conclusion that there is no further need for more or better studies to confirm the enhanced protective effect of double-gloving. **(Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel,** Cochrane Database of Systematic Reviews 2014;(3):CD009573. Mischke C, Veerbeck JH, Saarto A, Lavoie M-C, Pahwa M, Ijaz S)
3. There is no statistical difference in the time to perform a microsurgical procedure with one pair vs two pairs of gloves. **(The Effects of Double Gloving on Microsurgical Skills,** Scott A. Hardison, MD, et al, Otolaryngology–Head and Neck Surgery 2017)

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i. Study of Blood Contact in Simulated Surgical Needlestick Injuries With Single or Double Latex Gloving , Andreas Wittmann, PhD, et al, Infection Control Hospital Epidemiology 2009 **ii**. AORN 2017 Guidelines for Perioperative Practice, Guideline for Sharps Safety. **iii**. Revised Statement on Sharps Safety, American College of Surgeons, 2016 **iv**. Moving the Sharps Safety in Healthcare Agenda Forward in the United States: 2020 Consensus Statement and Call to Action, 2020 International Safety Center

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