Commentary

# Occupational Exposure to Blood and Body Fluids in Operating Rooms and the Importance of Surgical Gloves in Minimizing Risks

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## Abstract

Daily, the surgical teams are at risk for injury and needle-sticking in the operating rooms. Despite the ubiquity of occupational hazards, exposure to blood and body fluids in operating rooms remains highly prevalent. Sharps injuries remain the most common among surgical teams in practice and the most frequent route of transmission of blood-borne pathogens. However, increased attention to occupational health has been developed throughout the years. Therefore, management and control of occupational infections require establishing protective barriers; such as wearing surgical gloves, avoidance of exposure risk by modification of techniques and deploying a constant awareness and vigilance towards sharp instruments in the operating room.

## Keywords

Occupational Exposure; Body Fluids; Operating Room; Gloving

## Problem Statement

Operating rooms are a high-risk environments where professionals are exposed directly to blood, body fluids, secretion and excretion [1–4]. This work-environment exposes the surgical team members to many diseases such as Human Immunodeficiency Virus (HIV), hepatitis C virus, and hepatitis B virus [5]. Actually, these blood-borne pathogens continue to be a source of occupational infection for operating room workers [6]. Concerning the hepatitis B virus, it is the infection that has the longest known role as a pathogen of occupational origin, but infection with this virus can be largely prevented by the use of the effective vaccine against hepatitis B. As for the Hepatitis C virus, it affects the largest number of people in the United States and there is no vaccine available for the prevention of this infection which increases its gravity for surgical team members and all operating room professionals. When it comes to HIV infection, it has not yet been associated with documented transmission in the operating

room environment, but six cases of probable occupational transmission have been reported [6].

Furthermore, under-reporting of incidents is a recognized shortcoming [7] . A study by Lazenby et al [8] in 2011 examined the incidence among surgeons and found that up to 70% of the incidents went unreported. The main reasons being cited were the overly complicated reporting procedures and the perceived low risk of transmission of viruses [8]. These findings go hand in hand with the results found by Winchester et al. [9] in a study conducted among 120 members of staff at a London hospital. They found that while up to 58% of respondents had reported all previous incidents, 38% had reported only some.

## The Importance of Adequate and Integrate Gloving in Minimizing Risks

Nevertheless, this risk may be reduced by implementing protective barriers, such as wearing surgical gloves. Indeed, Gloves are considered as a barrier that can prevent transmission of microorganisms from the practitioners to the patient and from patient to surgical team members and are of equal importance as surgical hand antisepsis [5,10]. However, as is the case for all protective measures, the use of surgical gloves does not completely eliminate the risk. In fact, tears and micro-perforations may occur exposing both patients and surgical team members to several complications [10–12]. Studies have reported that glove perforations can go up to 50% depending on the type of surgery [6,13]. This accident exposes in turn surgical team to many occupational hazards. Indeed, in case of glove perforation, germs find a passage to wearer's hands [10,11]. In 2010, Julian Camill Harnoß *et al.* reported that 15% of the surgical gloves tested were perforated and concluded that the perforation in the glove layer allow bacteria to pass from the surgical site to the surgeon's hand [14].

Gloves' perforation increases also the risk of surgical-site infection [5]. In their study, Lee Qunn Jid et al. [15] found a higher rate

of surgical site infection during procedures in which glove were defected. Nevertheless, most operating rooms' professionals tend to underestimate the risk and the damages that can be caused by glove perforation and the importance of double gloving in minimizing the rate of contamination [11]. Indeed, the operating room team members, especially surgeons, prefer not to wear double gloves as they ascribe this to a diminishing of sensitivity; they choose to work comfortably even though they are not protected enough [16].

More importantly, practitioners often fail to perceive these perforations [10] and many of the tears are not noticed until the end of the surgery when the gloves are removed especially when the surgery is urgent or when a complication occurs and rapidity is required [17,18]. This highly increases the risks to which operating rooms professionals are exposed [19].

For a better and more efficient use and maximum protection for operating room professionals of the different risks they may be exposed to as a result of perforation or improper gloving, several recommendations have been proposed. However, we can admit that we have not yet arrived at consensual recommendations at the international level. The latest World Health Organisation guidelines for safe surgery published in 2009 [20] recommend that the operating team should cover their hair and wear sterile gowns and sterile gloves during the operation, but without any indication on single-or double-gloving. As for the guidelines of the Society for Healthcare Epidemiology of America (SHEA)/Infectious Diseases Society of America (IDSA) [21], they recommend that all members of the operative team should double-glove and change gloves when perforation is noted. The modalities and frequency of the changing of gloves have not been included in any guidelines or recommendations [20–22].

A Cochrane Review [23] published in 2009 investigated whether additional glove protection reduces the number of surgical site infection or blood-borne infections in patients or the surgical team and the number of perforations to the innermost pair of surgical gloves.

## Factors Associated with Glove Perforation

Studies have shown that several factors can be associated with glove perforation including type and duration of surgery, instrumentation, function and experience of the wearer, and glove quality [11,18,24,25].

For example, the study conducted by Tlili et al. [3] found a perforation rate of 16.5% and that all perforations were unnoticed by the surgical team members. The majority of perforated gloves (61.7%) were collected after urology procedures (P = .00005), 77% of perforated gloves were detected when the duration of the procedure exceeded 90 minutes (P = .001), and 96% were from brand A, which were the thicker gloves (P = .015). As for de Oliveira et al study [10], it showed that of the 1090 gloves analyzed, 131 (12%) had a perforation detected post-surgery, 39 of which (37.5%) were recognized by users at the time of occurrence. The highest incidence of perforations occurred among surgeons (P = 0.033) in the index finger, followed by the thumb of the non-dominant hand; in outer gloves (76.9%) when double- gloving was used (P = 0.014); in open surgery (P = 0.019); and in surgeries lasting 150 minutes (P < 0.05). Martinez et al. [13] found that the overall incidence of glove perforation was 3.4% and was detectable only by the electroconductivity method; the other 2 methods did not detect any perforations. There was a statistically significantly higher rate (P < 0.001) of perforations in the 0.32-mm powdered gloves (6.8%) compared with the 0.24-mm powder-free gloves (0%). Perforation of the inner glove occurred 5.7 times more frequently than perforation of the outer glove.

Laine et al. [19] examined 1769 gloves from 349 operations; these represent all the gloves used by surgeons for a period of two months and found that perforations occurred in 18.5% of conventional and 5.8% of arthroscopic procedures. The risk of contamination from blood was 13 times higher when using single compared with double gloves. Surprisingly, the combination of two regular gloves was much less efficient than double indicator gloves when comparing the rate

of perforation of the inner glove when the outer had been damaged (24% vs 4.9%; p = 0.02).

On the whole, many factors can be associated with the rate of glove perforation and because of its importance, many studies worldwide have been interested in studying the problem of glove perforation and its risks since decades ago.

## Conclusion

In conclusion, prevention of occupational infection requires use of protective barriers, avoidance of exposure risk by modification of techniques, and a constant awareness of sharp instruments in the operating room. Blood exposure in the operating room carries risk of infection and should be avoided. It is likely that other infectious agents will emerge as operating room threats. Surgeons must maintain vigilance in avoiding blood exposure and percutaneous injury.

## References

1. Mallouli M, Tlili MA, Aouicha W, Ben Rejeb M, Zedini C, et al. Assessing patient safety culture in Tunisian operating rooms: A multicenter study. Int J Qual Health Care. 2017; 29: 176-182.
2. Makama JG, Okeme IM, Makama EJ, Ameh EA. Glove Perforation Rate in Surgery: A Randomized, Controlled Study To Evaluate the Efficacy of Double Gloving. Surg Infect. 2016; 17: 436–442.
3. Tlili MA, Belgacem A, Sridi H, Akouri M, Aouicha W, et al. Evaluation of surgical glove integrity and factors associated with glove defect. Am J Infect Control. 2018; 46: 30–33.
4. Tlili MA, Mallouli M, Aouicha W, Guedhami F, Ben Dhiab M. La check-list aux blocs opératoires, telle que perçue par les soignants tunisiens. Tunis Med. 2017; 95: 115–119.

5. Goldman AH, Haug E, Owen JR, Wayne JS, Golladay GJ. High Risk of Surgical Glove Perforation From Surgical Rotatory Instruments. Clin Orthop Relat Res. 2016; 474: 2513–2517.

6. Fry DE. Occupational risks of blood exposure in the operating room. Am Surg. 2007; 73: 637–646.

7. Leavy P, Siddique I, Mohammed-Ali R. Occupational exposure to bodily fluids in oral and maxillofacial surgery: an evaluation of reporting practices and attitudes among staff at a major teaching hospital in the UK. Br J Oral Maxillofac Surg. 2017; 55: e7–11.

8. Lazenby MG, Anderud J, Whitley SP. Blood-borne viruses: are we taking them seriously? A survey of UK oral and maxillofacial surgeons. Br J Oral Maxillofac Surg. 2011; 49: 400–403.

9. Winchester SA, Tomkins S, Cliffe S, Batty L, Ncube F, et al. Healthcare workers' perceptions of occupational exposure to blood-borne viruses and reporting barriers: a questionnaire-based study. J Hosp Infect. 2012; 82: 36–39.

10. De Oliveira AC, Gama CS. Evaluation of surgical glove integrity during surgery in a Brazilian teaching hospital. Am J Infect Control 2014; 42: 1093–1096.

11. Guo YP, Wong PM, Li Y, Or PPL. Is double-gloving really protective? A comparison between the glove perforation rate among perioperative nurses with single and double gloves during surgery. Am J Surg. 2012; 204: 210–215.

12. Beldame J, Lagrave B, Lievain L, Lefebvre B, Frebourg N, et al. Surgical glove bacterial contamination and perforation during total hip arthroplasty implantation: When gloves

should be changed. Orthop Traumatol Surg Res. 2012; 98: 432–440.

13. Martinez A, Han Y, Sardar ZM, Beckman L, Steffen T, et al. Risk of Glove Perforation With Arthroscopic Knot Tying Using Different Surgical Gloves and High–Tensile Strength Sutures. Arthrosc J Arthrosc Relat Surg. 2013; 29: 1552–1558.

14. Harnoß JC, Partecke LI, Heidecke CD, Hübner NO, Kramer A, et al. Concentration of bacteria passing through puncture holes in surgical gloves. Am J Infect Control. 2010; 38: 154–158.

15. Jid LQ, Ping MW, Chung WY, Leung WY. Visible glove perforation in total knee arthroplasty: Risk and consequences. J Orthop Surg. 2017; 25: 230949901769561.

16. Han CD, Kim J, Moon SH, Lee BH, Kwon HM, et al. A Randomized Prospective Study of Glove Perforation in Orthopaedic Surgery: Is a Thick Glove More Effective? J Arthroplasty. 2013; 28: 1878–1881.

17. Choi LY, Torres R, Syed S, Boyle S, Ata A, et al. Sharps and Needlestick Injuries Among Medical Students, Surgical Residents, Faculty, and Operating Room Staff at a Single Academic Institution. J Surg Educ. 2017; 74: 131–136.

18. Bekele A, Makonnen N, Tesfaye L, Taye M. Incidence and patterns of surgical glove perforations: experience from Addis Ababa, Ethiopia. BMC Surg. 2017; 17.

19. Laine T, Aarnio P. How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. Am J Surg. 2001; 181: 564–566.

20. Guidelines for safe surgery. Geneva: World Health Organization. 2009. Available Online At: http://apps.who.int/iris/bitstream/10665/44185/1/9789241598552_eng.pdf.

21. Anderson DJ, Podgorny K, Berríos-Torres SI, Bratzler DW, Dellinger EP, et al. Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. Infect Control Hosp Epidemiol. 2014; 35: 605–627.

22. Alexander JW, Solomkin JS, Edwards MJ. Updated Recommendations for Control of Surgical Site Infections: Ann Surg. 2011; 253: 1082–1093.

23. Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection. Cochrane Database Syst Rev. 2006: CD003087 n.d.

24. Korniewicz D, El-Masri M. Exploring the Benefits of Double Gloving During Surgery. AORN J. 2012; 95: 328–336.

25. Yinusa W, Li YH, Ho WY, Leong JCY, Chow W. Glove punctures in orthopaedic surgery. Int Orthop. 2004; 28: 36–39.