G40 - How many pairs of gloves should the surgical team wear during major orthopedic procedures?

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Response/Recommendation: With a high percentage of outer glove perforation during major orthopedic procedures, there is a clear need for an additional barrier, which is provided by the second pair of gloves.

Level of Evidence: Strong

Delegate Vote:

Rationale:

Surgical gloves serve as a barrier to protect both the patient and the surgical team from contamination with pathogens that can result in infection. Minimizing contamination is critical during major orthopedic surgeries, as infection is a devastating complication(1). Among surgeons, there are varying practices regarding the number of pairs of gloves worn during procedures. Although numerous studies have investigated the effectiveness of double gloving, the conclusions remain varied. Factors such as the complexity of the surgery, the potential for glove perforation, and the risk of contamination(2) contribute to the need for a deeper analysis and more consistent guidelines in practice.

In order to address the posed question, we conducted a comprehensive systematic review. Using the appropriate MeSH terms developed by librarians, and search of two databases, which included PubMed and Embase, a total of 421 publications were identified. After merging 83 duplicates, 338 records remained for screening based on titles and abstracts. Following the assessment of titles and abstracts for eligibility, 97 studies advanced to the full-text screening phase. However, the full-text review revealed substantial heterogeneity among the studies, rendering them ineligible for a pooled analysis. Furthermore, very few clinical studies specifically addressing this topic were identified. As a result, the assignment necessitated a narrative approach.

Most surgical gloves are made of latex, vinyl, nitrile, or neoprene. They can be either unpowdered or powdered. Latex surgical gloves are the most commonly used; however, their main disadvantage is that they often cause allergies. Some surgical gloves are made of woven materials, mostly cotton. Not all the articles we consulted compare the same types of surgical gloves.

Orthopedics is one of the surgical specialties where surgeons choose to wear two pairs of gloves most frequently(3), and most surgeons prefer to wear two pairs of gloves in hopes of reducing

infection(4), but also for self-protection. Very few surgeons wear a single pair of gloves during a major orthopedic surgery, these could be either conventional or the so-called orthopedics gloves. The obvious problem is that if the glove needs to be changed, becomes contaminated, or suffers a puncture, the surgeon's hands will be immediately exposed since there is no other barrier(4,5).

We found only one paper that studied punctures in a single glove system during major orthopedic surgery. The study found a 12% puncture rate during hip replacements, a significant risk, therefore the same study suggests using a double glove system to reduce the likelihood of perforation and contamination(6). The case could be made that orthopedic gloves offer a thicker barrier, and a higher resistance to abrasion when compared to conventional gloves. There are those who choose these gloves due to the enhanced protection that they offer, but it comes with a cost because of their reduced tactile sensitivity and hand fatigue. In contrast, the performance of double conventional gloves has been found to be similar to that of a single orthopedic glove(7).

It is crucial to prevent infection, even before the incision is made. Which is why many surgeons often double-glove to reduce the possibility of contamination during patient draping for joint replacement surgery, at this stage 15% of gloves become contaminated. This occurs more frequently in hip surgeries than in knee surgeries and tends to affect the dominant hand. This contamination could be recognized; it may be visible in the form of a tear or may go unnoticed(8).

In major orthopedic surgeries, such as joint replacement, it is common to encounter sharp bone edges and instruments that can easily puncture the gloves. In fact, between 18.4% and 59% of all outer gloves can be punctured, and 8.4% to 25% of all inner gloves(9–11). Often, a damaged glove is recognized immediately; however, as shown by Demircay et al.(10), only 14.4% of the outer glove perforations and 6.97% of the inner glove perforations were recognized during joint replacement surgery. Most of the time, the surgery proceeds without the realization of any glove perforations.

It has consistently been demonstrated that the member of the surgical team who needs to pay special attention to their gloves is the main surgeon, as they are statistically the person most prone to glove perforation(12)(13)(14). This may be because the main surgeon is the one performing active manual tasks, using instruments, and operating drills and saws, while the assistants tend to have a less dynamic role(15).

Special attention needs to be paid to the gloves when performing a revision joint replacement, as up to 57% of the cases in revision hip arthroplasty, as reported by Boyarov et al.(14), are punctured, which is 15% more than in primary hip arthroplasties. Similar trends have been reported by Enz et al.(16) and Carter et al.(12); however, these last two studies failed to break down the data and do not provide specifics on whether the revision surgeries were for hip or knee.

Very few studies have been able to establish an association between glove puncture and an increased risk of surgical site infection (SSI). Jid et al. (2) found that after a puncture of both the inner and outer gloves during a primary total knee replacement, the rate of SSI was 9.1%. In contrast, the rate of SSI was 0.5% in cases where no gloves were punctured.

Conclusion:

Surgical gloves provide a barrier that helps reduce infections in patients and also prevents the surgical team from coming into contact with infectious biological products, materials, or secretions. A single pair of gloves poses a high risk for contamination if the gloves were to fail. The likelihood of a glove puncture increases with the complexity of the case, meaning that in revision arthroplasties, punctures are more common than in primary joint replacements. Furthermore, the number of outer glove punctures differs significantly from the punctures in the inner gloves. Based on the current evidence, two pairs of gloves should be worn when performing a major orthopedic procedure.

References

1. Al-Maiyah M, Bajwa A, Mackenney P, Port A, Gregg PJ, Hill D, et al. Glove perforation and contamination in primary total hip arthroplasty. J Bone Joint Surg Br. 2005 Apr;87(4):556–9. DOI: 10.1302/0301-620X.87B4.15744

2. Jid LQ, Ping MW, Chung WY, Leung WY. Visible glove perforation in total knee arthroplasty. J Orthop Surg (Hong Kong). 2017 Jan;25(1):2309499017695610. DOI: 10.1177/2309499017695610

3. Johanet H, Tarantola A, Bouvet E. [Protection methods in the operating room and risks of blood exposure. Results of a national survey]. Ann Chir. 2000 May;125(4):385–90. DOI: 10.1016/s0003-3944(00)00212-1

4. Ward WG Sr, Cooper JM, Lippert D, Kablawi RO, Neiberg RH, Sherertz RJ. Glove and gown effects on intraoperative bacterial contamination. Ann Surg. 2014 Mar;259(3):591–7. DOI: 10.1097/SLA.0b013e3182a6f2d9

5. Thanni LOA, Yinusa W. Incidence of glove failure during orthopedic operations and the protective effect of double gloves. J Natl Med Assoc. 2003 Dec;95(12):1184–8. PMID: 14717474

6. Tao LX, Basnet DK. Study of Glove Perforation during Hip Replacement Arthroplasty: Its Frequency, Location, and Timing. Int Sch Res Notices. 2014 Oct 29;2014:129561. PMID: 27350965

7. Jackson EM, Neal JG, Williams FM, Stern CA, Suber F, Thacker JG, et al. Biomechanical performance of orthopedic gloves. J Biomed Mater Res. 1999;48(2):193–8. DOI: 10.1002/(sici)1097-4636(1999)48:2<193::aid-jbm14>3.0.co;2-k

8. Makki D, Deierl K, Pandit A, Trakru S. A prospective study on the risk of glove fingertip contamination during draping in joint replacement surgery. Ann R Coll Surg Engl. 2014 Sep;96(6):434–6. DOI: 10.1308/003588414X13946184902046

9. Kumar D, Shantanu K, Kumar M, Kumar A, Sharma V. A Cross-sectional Analysis of Glove Perforation in Primary and Revision Total Hip Arthroplasty. Malays Orthop J. 2016 Nov;10(3):31–5. DOI: 10.5704/MOJ.1611.010

10. Demircay E, Unay K, Bilgili MG, Alataca G. Glove perforation in hip and knee arthroplasty. J Orthop Sci. 2010 Nov;15(6):790–4. DOI: 10.1007/s00776-010-1547-0

11. Enz A, Kostuj T, Warnke P, Osmanski-Zenk K, Mittelmeier W, Klinder A. Intraoperative damage to surgical gloves during various operations on the musculoskeletal system: a multicenter study. Arch Orthop Trauma Surg. 2022 Jan;142(1):57–65. DOI: 10.1007/s00402-020-03594-1

12. Carter AH, Casper DS, Parvizi J, Austin MS. A prospective analysis of glove perforation in primary and revision total hip and total knee arthroplasty. J Arthroplasty. 2012 Aug;27(7):1271–5. DOI: 10.1016/j.arth.2012.01.021

13. Lee SW, Cho MR, Lee HH, Choi WK, Lee JH. Perforation of Surgical Gloves during Lower Extremity Fracture Surgery and Hip Joint Replacement Surgery. Hip Pelvis. 2015 Mar;27(1):17–22. DOI: 10.5371/hp.2015.27.1.17

14. Boyrov A.A. , Tikhilov R.M. , Shubnyakov I.I. , Midaev A.A. Glove damage in total hip arthroplasty. Pediatric Traumatology, Orthopaedics and Reconstructive Surgery. 2019 Oct 2;7(3):55–62. DOI: 10.17816/PTORS7355-62

15. Kaya I, Uğraş A, Sungur I, Yilmaz M, Korkmaz M, Cetinus E. Glove perforation time and frequency in total hip arthroplasty procedures. Acta Orthop Traumatol Turc. 2012;46(1):57–60. DOI: 10.3944/aott.2012.2660

16. Enz A, Klinder A, Mittelmeier H, Kundt G, Mittelmeier W, Zaatreh S. Damages with High Consequences: Analysis of Perforations in Surgical Latex Operation Gloves from Orthopedic Surgeries. Eur J Microbiol Immunol. 2018 Dec 23;8(4):159–62. DOI: 10.1556/1886.2018.00028