ORIGINAL ARTICLE

Glove Perforation In Orthopedic Trauma Surgery

Sanaullah, Muhammad Inam, Zahid Wazir, Mohammad Arif Khan, Awal Hakeem

ABSTRACT

Objective: To evaluate the frequency of glove perforation during the lower limb fracture fixation procedures.

Material and methods: This prospective study was conducted at orthopedic and spine surgery unit Hayatabad medical complex Peshawar from may 2014 to November 2014. Data was collected from a total of 85 lower limb fracture fixation surgeries. A total of 85 surgeons, 85 first assistants and 85 scrub assistants were included in the study. Double gloves were used by all of them. Gloves were changed for perforation during surgery or due to excessive soakage or contamination. Gloves used in all surgeries were from the same company.

Results: In total 85 operations operative perforation rate was 49% (42/85) and the overall glove perforation rate was 16% (193/1195). Of 193 perforated gloves outer gloves were perforated 85 %(164/193) and inner 15 %(29/193). Out of 29 inner gloves perforation 22 inner gloves perforation accompanied outer gloves perforations at the same site and only on 7 occasions' inner gloves were perforated without outer glove perforation. Only 24 %(46/193) of the perforated gloves were identified during surgery and 76 %(147/193) of the perforations were detected by water loading test. Of 85 total operations 17 were emergency surgeries while 68 were elective surgeries. Operative perforation rate was 70 %(12/17) and glove perforation rate was 27 %(59/219) in emergency surgeries, which is significantly more than elective procedures. Among the elective surgeries the highest glove perforation was noticed for Ilizarov procedure, operative perforation rate was 90 %(8/9) and glove perforation rate was 40 %(53/134). Left hand was involved in 75% perforations. Commonly perforated site was left index finger (36%) followed by left thumb (31%).

Conclusion: The incidence of glove perforation is high in orthopedic trauma procedures. Double gloving can provide better protection for surgical team as well as patient.

Keywords: Double gloves, perforation, infection, orthopedic surgery.

INTRODUCTION

Surgical gloves are in use for more than 250 years. For the first time surgical gloves were used by German doctor Johann walbaum in 1758. The role of surgical glove in preventing post-operative surgical site infections is now well established.[1, 2] Studies have reported positive culture results in up to 10 percent of perforated gloves.[3] Perforations in gloves are a recognized pathway through which surgeons and assistants could be exposed to secretions and blood of the patients. Infected blood can transmit infection to surgical team members.[4] There is no vaccination available until now to protect against human immunodeficiency virus (HIV) and hepatitis C. Though vaccination against hepatitis B virus is now available but only 60% of surgeons are reported to be immunized against it.[5] Orthopedic surgeons are considered to be at more risk.[6] In orthopedic and trauma surgery the risk has been calculated to be more than other branches of surgeries.[7] The frequent use of penetrating devices such as screws, nails, wires, saws or needles during orthopedic procedures increases the risk for transmission of blood borne infections like Hepatitis B, Hepatitis C and HIV.[8,9] Literature has shown the highest rates of glove perforation in emergency trauma surgeries. Literature in other specialties have reported an incidence of gloves perforation ranging from 10% in ophthalmic surgery to 50% in general surgery.[10] In orthopedic surgery, the incidence ranges from 14% during pediatric orthopedic surgeries to 57% during hip fracture surgeries.[11] Surgical gloves perforation has direct proportion with duration of

Department of Orthopaedics and Spine Surgery, Hayatabad Medical Complex, Peshawar
Correspondence: Dr Sanaullah
Email: dr.sanaullah2009@gmail.com

surgery.[12] Surgeons and other healthcare professionals may be aware of glove perforation and its consequences but double gloving during surgeries have still not reached universal acceptance.[13] Regular use of simple double or indicator double gloves, changing gloves at regular intervals and adherence to surgical principles are some of the methods that can be used to reduce surgical glove perforation and hence its adverse consequences.[14] Double gloves are also protective in specific surgeries using penetrating instruments such as Ilizarov surgery, hip arthroplasty and other major orthopedic surgeries. Wearing two pairs of gloves significantly reduces the number of perforations to the inner glove and thereby reducing adverse consequences. However, unnoticed perforation remains a problem and may only be discovered upon later inspection of the gloves or by filling it with water .[15] Using double gloves may be protective for the surgical team, especially during surgical procedures in patients with Hepatitis B, Hepatitis C and HIV.[16] In indicator double gloves special green inner glove turns dark green when punctured with consequent contact with body fluid. The discoloration is seen under the skin colored outer glove and hence small needle perforations on outer gloves can be easily recognized.[17] The material of latex gloves is considered the most resistant to perforation and is used in standard gloves.[18] The aim of this study was to evaluate the incidence of glove perforation during the lower limb fracture fixation procedures and to determine the efficacy of double gloving.

MATERIALS AND METHODS

This study was conducted at orthopedic and spine surgery unit Hayatabad medical complex Peshawar from may 2014 to November 2014. Data was collected from a total of 85 lower limb fracture fixation surgeries. A total of 85 surgeons, 85 first assistants and 85 scrub assistants were included in the study. Double gloves were used by all of them. Gloves were changed for perforation during surgery or due to excessive soakage or contamination. Gloves used in surgery were from single company, which are regularly being used by orthopedic surgeons in our setup. A total of 1195 gloves were tested for perforation by water filling test. All gloves were infiltrated with approximately one liter of water and gently squeezed into each digit to find any perforation. Data of each operation was collected and put in proforma soon after the surgery. It included the A) type of surgery like dynamic hip screw (DHS), dynamic compression screw (DCS), platting, nailing, linear external fixator, Ilizarov external fixator or any other procedure. B) Open or close fracture. C) Emergency procedure or elective procedure. D) Intra operative glove perforation. E) Perforation detected by water loading test. F) Site and number of glove perforation (diagram of both hands was used for marking site of perforation). Data was analyzed using SPSS version 16.

RESULTS

In total 85 operations operative perforation rate was 49% (42/85) and the overall glove perforation rate was 16% (193/1195). Of 193 perforated gloves outer gloves were perforated 85 %(164/193) and inner 15 % (29/193). Out of 29 inner gloves perforation 22 inner gloves perforation accompanied outer gloves perforations at the same site and only on 7 occasions inner gloves were perforated without outer glove perforation. Only 24 %(46/193) of the perforated gloves were identified during surgery and 76 %(147/193) of the perforations were detected by water loading test. Of 85 total operations 17 were emergency surgeries while 68 were elective surgeries. Operative perforation rate was 70 %(12/17) and glove perforation rate was 27 %(59/219) in emergency

Table 1: Number of gloves perforated in different region

	Thumb	Index finger	Middle finger	Ring finger	Little finger	Palm	Total
Left hand	45	52	8	7	4	28	144
Right hand	16	16	4	3	2	8	49
Total	61	68	12	10	6	36	193

surgeries, which is significantly more than elective procedures. Among the elective surgeries the highest glove perforation was noticed for Ilizarov procedure, operative perforation rate was 90 %(8/9) and glove perforation rate was 40 %(53/134). Left hand was involved in 75% perforations. Commonly perforated site was left index finger (36%) followed by left thumb (31%).

Table 2: Details of perforations with emergency and elective procedures.

	Number of procedures n	Total number of gloves used n	Glove perforations n	Glove perforation rate (%)
Emergency procedures	17	219	59	27%
Elective procedures	68	976	134	14%

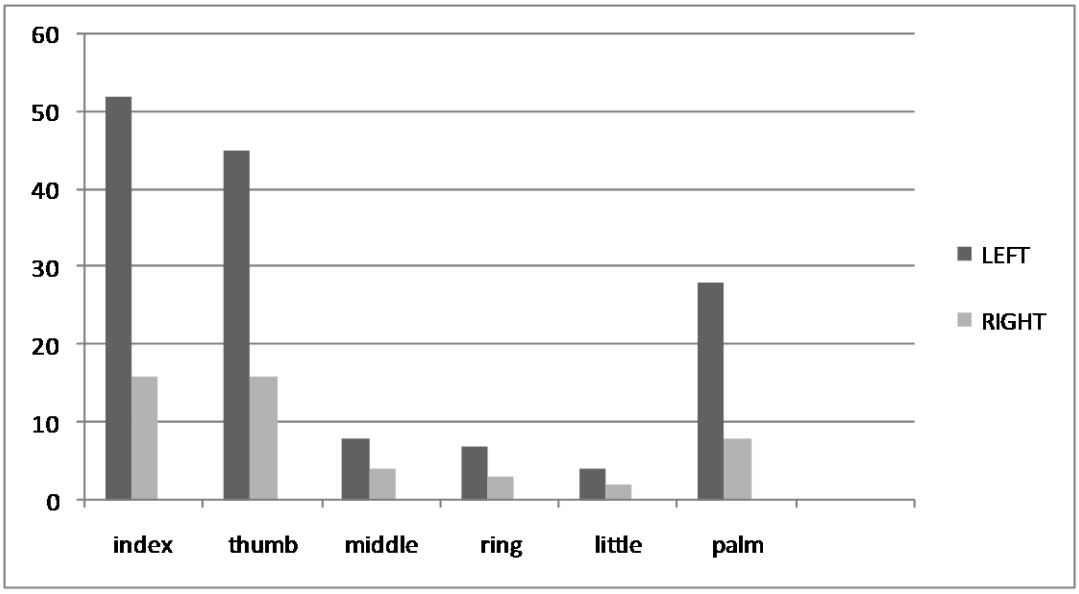

Figure 1: Histogram showing glove perforation by region of hand

DISCUSSION

Perforations in gloves are a recognized pathway through which surgeons and assistants could be exposed to secretions and blood of the patients. Our study proves that the rate of surgical gloves perforation in lower limb trauma surgery is high and double glove provide significant protection to both surgical team and patient. In our study we evaluated a large number of gloves for perforation and our focus was only on trauma surgeries performed on lower limbs. Previous studies on gloves perforation in orthopedic surgeries have reported operation perforation rate of 23% in foot surgery,[19] 38% in pediatric orthopedic surgery,[20] and up to 54% in internal fixation surgery.[21] Our results were almost the same as reported in the later study. In almost half of the orthopedic trauma surgeries gloves were perforated and the surgical team was in significant risk of exposure to patient's blood. Literature has shown that wearing two pairs of surgical gloves can reduce the frequency of glove perforation and hence the adverse consequences on both surgeon and patients.[22] Inner glove perforation in setting of intact outer glove is believed to occur from the durability or material failure after prolong usage of the glove being used. This type of glove perforation will be significantly reduced by double gloving method. In our study the incidence of inner glove perforation without outer glove being perforated was 3.6%.thus the double

gloving offer 96.4% reduction in blood contamination to the operative team's hand when compared with the single gloving. Double gloving decreases tactile sensation and may be uncomfortable for the surgeon therefore they removed the outer glove during 26% of operations.[23] However Philips et al[24] reported a significant effect on sensory function but a lesser effect on motor function performed under direct vision. Surgeons must balance the benefits of wearing a double-gloving system to protect them and against the minor disadvantage of loss of sensitivity, which diminished during the weeks and months of using it. Al-habdan[25] and Yinusa et al[26] reported that 94% and 73.9% of time perforations go unnoticed, respectively. In our study 76% of perforations were unnoticed. The unnoticed glove perforations are more likely to result in prolonged exposure of the surgeon's hand to the patient's blood. Literature has proved that the left hand is more affected than the right hand and the index and the thumb of left hand glove were the commonest site of perforation.[27] Probable explanation is that index and thumb of the non-dominant hand is often used to reposition or reach for needles, to hold tissue being cut or sutured, or used as a retractor to protect adjacent viscera during cutting or suturing.[28] In our study left hand was involved in 75% of glove perforations and left hand thumb and index finger were involved in 67% of perforations. Orthopedic and trauma surgeons should use double gloves in each and every case so that the chances of gloves perforation and hence contamination can be decreased. Further studies are suggested on the topic.

CONCLUSION

The incidence of glove perforation is high in orthopedic trauma procedures. Double gloving can provide better protection for surgical team as well as patient. Further studies are required whether gloves perforation increases orthopedic infection or not??

REFERENCES

1. Davis N, Curry A, Gambhir AK, et al. Intraoperative bacterial contamination in operations for joint replacement. J Bone Joint Surg Br 1999; 81-B: 886-9.
2. Al-Maiyah M, Bajwa A, Mackenney P, et al. Glove perforation and contamination in primary total hip arthroplasty. J Bone Joint Surg Br 2005; 87-B: 556-9.
3. Palmer, J.D, And J.W. Rickett, The mechanisms and risks of surgical glove perforation. J Hosp Infect 1992; 22(4): 279-86.
4. Lemaire R, Masson JB. Risk of transmission of blood-borne viral infection in orthopedic and trauma surgery. J Bone Joint Surg Br 2000; 82-B: 313-23.
5. Brignall CG, MCG. Hepatitis b vaccination: a survey of orthopedic surgeons. J Bone Joint Surg Br 1991. 73-B: 89-90.
6. Panlilio, AL et al. Blood contacts during surgical procedures. 1991;265(12): 1533-7.
7. Maffulli N, Capasso G, Testa V. Glove perforation in elective orthopedic surgery. Acta orthop scand 1989; 60: 565-6.
8. Yinusa W, Li YH, Chow W, Ho WY, Leong JCY. Glove punctures in orthopedic surgery. Int orthop 2004; 28:36-9.
9. Gerberding JL, Littell C, Tarkington A, Brown A, Scheter WP. Risk of exposure of surgical personnel to patients' blood during surgery at san francisco general hospital.n engl j med 1990; 322:1788-93.
10. 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;181:564-6.
11. Maffuli N, Capasso G, Testa V. Glove perforation in pediatric orthopaedic surgery. J pediatr orthop 1991; 11:25-7.
12. Bukhari SS, Harrison RA, Sanderson PJ. Contamination of surgeons' gloves fingertips during surgical operations. J hosp infect 1993; 24:117-21.
13. Patterson JM, Novak CB, Mackinnon SE, Patterson GA. Surgeon's concern and practices of protection against blood-borne pathogens. Ann surg 1998; 228:266-72.
14. Rabussay DP, DM Korniewicz, Improving glove barrier effectiveness. Aorn J 1997 Dec; 66(6):1043-6, 1049-54, 1057-60 passim.
15. Nicola P, Aldham CH, Allen PW. Increased awareness of glove perforation in major joint replacement: a prospective randomized study of regent biogel reveal gloves. J Bone Joint Surg Br 1997; 79(B): 371-3.
16. Hubner NO et al. Bacterial migration through punctured surgical gloves under real surgical conditions. Bmc infect dis 2010; 10: 192.
17. Mccue SF, Berg EW, Saunders EA. Efficacy of double-gloving as a barrier to microbial

contamination during total joint arthroplasty. J Bone Joint Surg am 1981; 63(5): 811-3.
18. Maffulli N, Testa V, Capasso G. Glove perforation in foot surgery. Foot ankle 1991; 11: 228-30.
19. Al-habdan I, Sadat-ali M. Glove perforation in pediatric orthopedi c practice. J pediatr orthop 2003; 23: 791-3.
20. Eckersley JRT, Williamson DM. Glove perforation in an orthopedic trauma unit. Injury 1990; 21: 177-8.
21. Laine T, Aarnio P. Glove perforation in orthopedic and trauma surger: a comparison between single double indicator gloving and double gloving with two regular gloves. J Bone Joint Surg Br 2004; 86(B): 898-900.
22. Matta H, Thompson AM, Rainey JB. Does wearing two pairs of glove protect operating theatre staff from skin contamination? Br med j 1988; 297: 597-8.
23. Philips AM, Birch NC, Ribbans WJ. Protective gloves for use in high-risk patients: how much do they affect the dexterity of the surgeon? Ann r coll surg engl 1997; 79: 124-7.
24. Avery CME, Taylor J, Johnson PA. Double gloving and a system for identifying glove perforation in maxillofacial trauma surgery. Br j maxillofac surg 1999; 37: 316-9.
25. Barbosa MVJ, Nahas FX, Ferreira IM, Farah AB, Ayaviri NAM, Bariani RL. Risk of glove perforation in minor and major plastic surgery procedures. Aesth plast surg 2003; 27: 481-4.