

Epidemiology of glove perforation in orthopaedic surgeries

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Abstract

Introduction: Surgical glove perforation is one of cause for percutaneous transfer of disease. Among many HIV HBV & HCV are deadliest diseases. Among the other surgical specialities, orthopaedics has the highest rate of glove perforation. Hence this study was conducted to study the incidence of glove perforation & their pattern in our institute.

Materials and Methods: all the gloves (1444) collected from 286 operations which occurred during 3months period were tested, out of which 172 were major procedures and 114 were minor procedures. During the procedure, if any perforation was detected to naked eye examination then they were labelled as perforated. And rest the gloves were tested as per American society for testing and material standard (ASTM d5151 - 06) guidelines for any perforations.

Results: In our prospective study, perforation occurred in 74(26%) surgeries. Total of 173(12%) gloves were perforated, 51(17.83%) from major & 23(8.04%) from minor procedures, the primary surgeon was most commonly involved (68%). Only 53(30.6%) glove perforation was detected during the procedure. Among the double glove users, inner glove perforation was seen in only 5% of cases. The most common fingers involved was left index (38%), then right index finger (28%) followed by left thumb (20%) and right thumb was (14%).the primary surgeon was most commonly involved (68%). The mean duration of the surgery in which perforation was noticed was 76±6minutes.

Conclusion: Double glove practice is better than the use of the single glove. Gloves have to be changed regularly in prolonged procedures.

Keywords: Glove perforation, Orthopaedic surgeries, Double glove.

Introduction

Caroline Hampton was the first person to use a glove during an operation. But it was for avoiding allergic reactions to mercuric chloride. From their gloves have been developed for reducing surgical site infection than to prevent health care hazardous.

Among the many percutaneously transferable disease, HIV HBV & HCV are deadliest diseases. The risk of seroconversion after a single percutaneous exposure is of 0.3% in HIV, 10% in HCV & 30% in HBV.¹⁻⁴

In a study conducted in the US in 1970, surgeons were more proven for HBV infection (13% to 18%) than the general population (3% to 5%).⁵

The mean risk of transmission of HIV after percutaneous exposure is thought to be 0.3%,⁶ but this increases markedly with the large volume of blood and higher titres in source blood.⁷ Intact glove during any procedures plays an important role in preventing from coming into contact with blood and body fluids. Glove perforation is frequent but is often unrecognised by the surgeons and scrub nurse.⁸

Among the other surgical specialities, orthopaedics has the highest rate of glove perforation ranging from 14% in paediatric orthopaedics to 57 % during hip fractures operations⁹⁻¹⁵ when compared to 10.1% to 43% in OBG, 35% to 54% in general surgery, 21.4% in plastic surgery and 26% in thoracic surgery.¹⁶⁻²⁰ This could be because of highest shear stress on gloves during orthopaedic procedure then in any other procedures.²¹

Hence this study was conducted to study the incidence of glove perforation, their pattern in our institute.

Materials and Methods

This prospective study was conducted over the period of 3 months between 1st January 2018 to 30th March 2018 in the department of orthopaedics in a tertiary health centre. Total of 286 operations occurred during this period, out of which 172 were major procedures and 114 were minor procedures. Total of 1444 gloves was collected, 946 from the major procedure and 498 from minor procedures. Averagely 4 staff had scrubbed for major and 2 for the minor procedure. The doctors and the scrub nurse were given the option of choosing either single or double glove based on their preference. If the surgeon used the double gloves, then the inner one was considered as 1st and the outer one was considered as the 2nd glove. During the procedure, if any perforation was detected to naked eye examination then they were labelled as perforated, and the involved glove would be removed and replaced with similar one immediately. After the procedure, all the gloves were identified, labelled and stored in polythene bags.

And rest of the gloves were subjected to test as per American society for testing and material standard (ASTM D5151 - 06).²² First, the gloves were secured and suspended at the wrist to rigid PVC pipe (Fig. 1a) and filled with 1 litres of water. For 2 minutes, they were

observed for breach of integrity. Observation of water on the outer surface of the suspended glove was considered a failed test and these specimens were categorized as having a perforation (Fig. 1b).

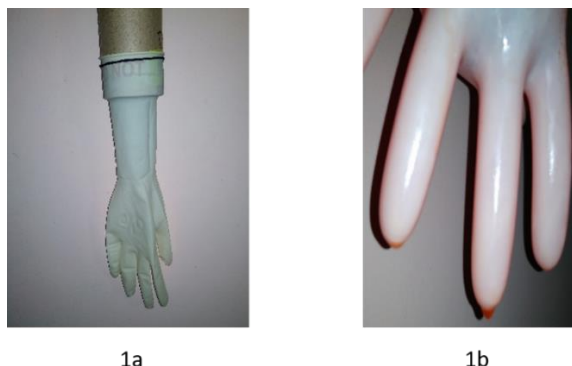


Fig. 1(a): Glove suspended from PVC Pipe, 1(b): Water noticed outside the glove surface

Table 1

	Open Reduction	Closed Reduction	Total
Number of operations	125(43.7%)	161(56.3%)	286
Glove perforation noticed in	52(70.3%)	22(29.7%)	74

Table 2

	Major(%)	Minor(%)	Total
Number of operations	172(60.1%)	114(39.9%)	286
Glove perforation noticed in	51(68.9%)	23(31.1%)	74

Results

In our prospective study among the 286 surgeries, perforations occurred during 74(26%) surgeries.

Out of 286 surgeries 125(43.7%) procedures open reduction internal fixation(ORIF) and rest 161(56.3%) were closed reduction procedures(CRIF). Out of the 74 surgeries in which perforation was noticed, 52(70.3%) were ORIF and 22 (29.2%) were CRIF (Table 1).

Total of 173 gloves were detected with perforation accounting for 12 % of gloves out of 1444. In which gloves recovered from major procedures were 51(17.83%) and minor was 23 (8.04%) (Table 2).

Out of 173 glove perforation, only in 53 of cases was detectable during the procedure, and the majority of glove perforation (120 out of 173) was detected after the operative procedure. Only 63.2% of staff including the scrub used double gloving, among which inner glove perforation was noticed only in 5% of cases.

Among the site, 56% of the perforation was noticed in non-dominant hand and 42% in dominant hand. The most common fingers involved was left index (38%), then right index finger (28%) followed by left thumb (20%) and right thumb was (14%).

About 68% of the perforated gloves belonged to a primary surgeon, 22% of the glove belonged to assistant surgeon followed by the scrub nurse (10%).

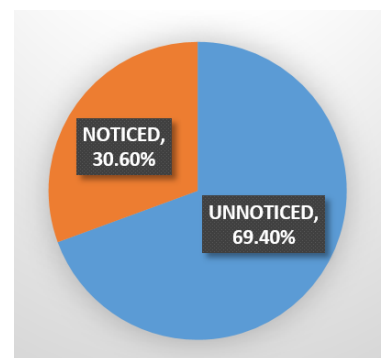


Fig. 2: Glove perforation detection during the surgery

The mean duration of surgery was 56 ± 4 minutes in major procedure and 40 ± 6 minutes in the minor procedure. But the duration of the surgery in which perforation was noticed was 76 ± 6 minutes.

Discussion

The incidence of glove perforation is not uncommon in an orthopaedic procedure. In our study, 26% of procedures had glove perforation.

Hence adequate precaution has to be taken to prevent exposure to blood and body fluids.

In our study the glove perforation rate was 12 % when compared, glove perforation varied from 14 % in paediatric orthopaedic procedures to 57% in hip procedures.⁹⁻¹⁵ In our study, gloves recovered from major surgeries and minor surgery contributed to 68.92% and 31.08% respectively. And in perforation was more common in ORIF (70.3%) then CRIF (29.7%) (Fig. 3).

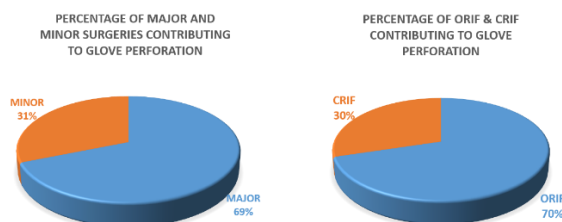


Fig. 3

The overall detection rate was only 30.63%, and detection was better in double gloving than single gloving. Which was also noticed in a study conducted by T. Laine & P. Aarino where they found out that detection

rate was only 23 % in single glove when compared to 36% in double gloving and 90.2% in the group using indicator gloves.¹¹ Hence the use of indicator glove has to be considered.

With respect to the duration of surgery, we observed that the duration increased the rate of perforation. Partecke et al noticed that perforation increased with the duration of wear, owing to mechanical stresses. He noticed 15.4% in 1st 90min, 18.1% between 91 to 150 min and 23.7% above 150 minutes.²³ So standard protocols have to be made with respect to change of glove to reduce the glove perforation. A study conducted by Partecke LI et al, concluded and recommended that gloves have to be changed by the operating surgeons after 90 minutes to prevent micro perforation.²³

Among the scrubbed members in our study, the primary surgeon is more prone for perforation (68%) followed by the assistant (22%) then the scrub nurse (10%). This may be due to the fact that most of the primary and difficult manoeuvres are done by the primary surgeons.

T. Laine & P. Aarino noticed in their study that 70% of the perforation were in non-dominant hand. Among which left index was first (32%) followed by left thumb (24%) then the right index finger (18%).¹¹ In our study index fingers more commonly involved followed by the thumb. But the results remained the same for non-dominant (58%) and dominant hand involvement (42%).

Thomas et al. noticed 3.75% of perforation in pre-existing gloves which makes single glove usage more risky.²⁴ The risk of contamination from blood was 13 times higher when using single compared with double gloves.¹¹

Eckersley and Williamson⁶ found that a single glove may be perforated more than 50% of the time during the course of internal fixation of a fracture and this rate was reduced to 17% with double gloving.²⁵

In our study, only 63.3% personals used double gloves, in whom inner glove perforation was reduced to 5%. All though double gloving is most commonly practised but it's not universal. One reason may be the suggestion that double gloving can reduce sensation in the hand. Although there does appear to be a significant difference in skin sensibility when using single or double gloves, most surgeons quickly adapt to double gloves, even in one day.²⁶

Conclusion

Orthopaedic surgeons are prone to glove perforation compared to other allied surgical branches.

Glove perforations are more common in major orthopaedic procedures then compare to minor procedures. And also common in open reduction and internal fixation when compared to closed reduction and internal fixation.

We encourage use of the double glove during any procedure because,

1. The detection rate of perforation is better in double gloving then single glove usage, which can be further improved with the use of indicator gloves.
2. The incidence of inner glove perforation is reduced. The pattern of glove perforation with regards to the site is unclear, which requires further studies.

The rate of glove perforation increased with duration of time, hence standard protocols have to be framed with regards to changing of gloves in cases of long procedures.

Among all, the primary surgeon is more proven to glove perforations, hence he should use double gloves and change them at regular interval to reduce the chance of glove perforation. Hence we promote the use of double gloves and encourage to change them at regular interval.

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