

Glove perforation in elective orthopedic surgery

Nicola Maffulli,^{1,2} Giovanni Capasso² and Vittorino Testa²

A survey of glove perforation in 16 orthopedic surgeons during a 6-month period was carried out. During this time, the surgeons performed 304 elective operations. In 1,398 pairs of gloves tested, evidence of perforation was found in 26 percent.

Only in about 6 percent of the cases does a surgeon actually recognize that the glove-skin barrier has been broken, and in only three quarters of these incidents are precautions taken (4). The area around Naples, Italy, is endemic for hepatitis B virus (HBV), with a HBsAg prevalence of 11 percent in the population (6). Hepatitis B is readily transferable from patient to surgeon and vice versa (7). Increasing concern is being expressed by health personnel about the possibility of being contaminated by the AIDS virus (1).

We report the incidence and causes of glove perforations in elective orthopedic surgery.

Participants and methods

The survey was performed at the First Institute of Orthopedics and Traumatology of Naples. A total of 16 surgeons participated. Nine were first-to-fifth-year residents and 7 surgeons were specialists. Seven (3 specialists and 4 residents) were fully aware of the study. All 304 surgical operations performed by the surgeons during the 6-month period January-June 1988 were monitored (Table 1). The latex gloves (Gammex-Ansell, Sempermed-Semperit and Perry) were collected. After each operation the surgeons recorded type and duration of surgery, whether a perforation had been noted, and, if so, what maneuver was being performed at that moment.

The operations were divided into three groups, i.e., joint replacements with an average duration of 104 (68-274) min, bone surgery 56 (16-103) min, and soft-tissue surgery 35 (12-64) min. Gloves were tested for holes by overfilling them with water and squeezing each finger and the palm individually (5). The test proved to be effective for holes made by 26-gauge needles or larger. A total of 20 unused pairs for each type of glove were used as controls: no holes were detected. Gloves were divided according to their users: surgeon, scrub doctor, first and second assistants (2). A total of 1,398 pairs of gloves were collected and tested during the study. Eleven pairs were discarded by mistake before testing.

The data were analyzed using the chi-square test and the chi-square-for-trend test. Significance was set at the 0.05 level.

Results

Totally, 651 gloves (26 percent) had a total of 726 holes (Table 1). In only 11 percent (67/651; 63 of which were caused by a needle) did the surgeons realize that a perforation had occurred. In all of these cases, precautionary steps were taken, such as rescrubbing in 17 cases, and change of both gloves in all the cases. When the surgeon was aware of a perforation, it had nearly always been produced by a needle during wound suturing.

The perforation rate of surgeons' and scrub doctors' gloves was similar, but higher than that of first and second assistants' gloves combined (Table 2). There was

Anesthetic and Respiratory Unit, Institute of Child Health¹ London, U.K., and Università di Napoli First Institute of Orthopedics and Traumatology², Napoli, Italy

Correspondence: Dr. N. Maffulli, Institute of Child Health, 30 Guilford Street, London WC1, U.K.

Table 1. Glove perforation related to type of operation

Type of operation	Glove perforation			
	n	%	n	%
Joint replacement	35	18	476	73
Bony surgery	175	58	107	17
Soft-tissue surgery	94	24	67	10

Table 2. Glove perforation related to user

	n	%
Surgeon	224	34
Scrub doctor	213	33
First assistant	127	20
Second assistant	87	13

Significant difference of perforation rate ($P < 0.05$): Surgeon > scrub doctor > first assistant > second assistant.

Table 3. Residents' number of perforated gloves

	No. of residents	Glove perforation	
		n	%
First year	3	158	37
Second year	2	129	30
Third year	2	79	18
Fourth year	1	40	9
Fifth year	1	26	6

Significant difference of perforation rate ($P < 0.05$): First year = second year > third year > fourth year > fifth year.

no difference among the specialists. In the surgeons' group, the majority of perforations occurred while performing total joint replacements and bone surgery.

The residents in the first 2 years of their program showed a higher number of perforations (Table 3) than the final 3 years' residents.

The glove perforation rate increased with duration of the operation. In operations shorter than 1 hour, 1.4 gloves per operation perforated as compared with 3.7 in operations longer than 2.7 hours.

Discussion

Our survey documents the high risk of accidental injury to an orthopedic operating team. Among the surgeons in training, it was lower in those relatively more experienced. Clearly, the risk of injury can be offset by expertise and, hopefully, by risk awareness.

It is important to note the pattern of glove perforation in residents. After the first 2 years, the number of perforations decreases. The fourth- and fifth-year residents' perforation rate was relatively low, probably reflecting the effect of training, and also that they were not performing "at risk" maneuvers. This implies that it takes 2 years of nearly daily practice to reduce the risk of being injured.

Finally, the greatest number of glove perforations in our study occurred during wound suturing. Strict attention to detail and utmost caution will pay dividends also in this aspect of orthopedic surgery.

References

1. HIV and AIDS. Ethical considerations for the medical profession. British Medical Association. London 1988.
2. Brough S J, Hunt T M, Barrie W W. Surgical glove perforations. Br J Surg 1988;75(4):317.
3. Cruse PJ, Foord R. The epidemiology of wound infection. A 10 year prospective study of 62,939 wounds. Surg Clin North Am 1980;60(1):27-40.
4. Hussain S A, Latif A B, Choudhary A A. Risk to surgeons: a survey of accidental injuries during operations. Br J Surg 1988;75(4):314-6.
5. McCue S F, Berg E W, Saunders E A. Efficacy of double gloving as a barrier to microbial contamination during total joint arthroplasty. J Bone Joint Surg (Am) 1981; 63(5):811-3.
6. Pasquini P, Kahn H A, Pileggi D, Pana A, Terzi J, Guzzanti E. Prevalence of hepatitis B markers in Italy. Am J Epidemiol 1983;118(5):699-709.
7. Acute hepatitis B associated with gynaecological surgery. Public Health Laboratory Report. Lancet 1980;1(8158): 1-6.