

Clinical Summary

Surgical glove perforations and the risk of surgical site infection

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Key Points

- This observational study analyzed the clinical consequences of surgical glove perforation during surgery, as measured by incidence of surgical site infection (SSI)
- The risk of developing an SSI was found to be significantly higher in surgical procedures in which gloves are perforated and no antimicrobial prophylaxis is administered
- The authors comment that the most effective method for lowering the frequency of glove leakage is through double gloving - particularly with the use of indicator systems

Introduction

The transfer of pathogens during surgery is frequently caused via skin or blood contact between surgical staff and patients,^{1,2,3,4} specifically, skin-borne pathogens on staff hands are particularly susceptible to transfer. This, alongside the growing awareness amongst operating staff of the risk of exposure to disease from patients, e.g., HIV and Hep B,^{5,6} means that the use of sterile gloves during surgical procedures is now routine.

When gloves are perforated – for example, as a result of puncture by needles, spiked bone fragments, or sharp surfaces on complex instruments^{7,8} – the barrier breaks down and pathogens are transferred. The risk of glove perforation increases with duration of operating time – significantly so after two hours^{9,10} – and occurs more often when gloves do not fit properly.¹¹ The frequency of glove perforation during surgery ranges from 8% to 50%.^{7,9,12,13,14,15,16}

This study assessed the clinical consequences of glove perforation during surgery, as determined by the incidence of SSI.

Methods

A prospective observational cohort study of 4,147 consecutive surgical procedures performed in the Visceral Surgery, Vascular Surgery and Traumatology divisions of the Department of General Surgery at University Hospital Basel, between January 1, 2000 and December 31, 2001. While the use of single gloves was standard practice, double gloving was left to the surgeon's discretion, based on their assessment of the risk of glove perforation.

Primary predictor variable - Compromised asepsis due to glove perforation.

Other variables - Patients received antimicrobial prophylaxis (intra-venous antibiotics) as follows:

- For any surgery classified as Centers for Disease Control and Prevention (CDC) wound classes 3 (contaminated), 2 (clean contaminated) and 1 (clean) involving a nonabsorbable implant.
- At the discretion of the surgeon, for any clean operation in which a subsequent SSI would have posed high risk to the patient.

Assessing the outcome of interest: incidence of SSI

During the hospital stay a prospective surveillance form was completed by the surgical resident and cross-checked by the attending surgeon. Post-discharge, primary care practitioners were requested to report any SSIs in the relevant patients to the study team and medical records for readmissions and outpatients at the hospital were screened. Finally, if these two post-discharge steps could not be performed, one of the study physicians conducted telephone interviews with the patient using a standardized questionnaire.

Results

- Overall the SSI rate was 4.5% (188 out of 4,147 procedures)
- 51 instances of SSIs from 677 perforated gloves (7.5%) vs. 137 instances of SSIs from 3 470 intact gloves (3.9%)
- **There is higher likelihood of SSI in procedures in which gloves were perforated compared with interventions where gloves remained intact (P=0.001)**

Surgical antimicrobial prophylaxis GIVEN

- Antimicrobial prophylaxis was applied in 3,233 interventions and glove perforations were found in 605 of these procedures
 - SSIs in perforated gloves = 6.9%
 - SSIs in intact gloves = 4.3%
- After adjusting for confounders, there was no statistical difference in the development of SSI in the presence of glove puncture compared to procedures with intact gloves

Surgical antimicrobial prophylaxis NOT GIVEN

- 914 procedures where antimicrobial prophylaxis was not given
 - SSIs in perforated gloves = 12.7%
 - SSIs in intact gloves = 2.9%
- This difference was proved statistically significant
- The risk of SSI is significantly higher in surgical procedures in which surgical glove(s) are perforated and no antimicrobial prophylaxis is administered

Rate of SSI%			
	Perforated gloves	Intact gloves	P-value
Overall	7.5%	3.9%	<.001
With antimicrobial prophylaxis	6.9%	4.3%	0.26 (not significant)
Without antimicrobial prophylaxis	12.7%	2.9%	<.001

Conclusion and Comment

Where no surgical antimicrobial prevention measures are put in place, perforation of gloves during surgical procedures increases the risk of SSIs.

The authors comment that the most effective method for lowering the frequency of leakage is through double gloving, which reduces glove failure significantly from rates as high as 51% with single gloves to as low as 7% puncture of inner gloves where two pairs are used.^{15, 17, 18, 19} They also point out that inner glove perforation rates are significantly lower with the use of indicator systems than with the conventional variety.^{16, 20, 21}

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