We performed a prospective, randomised study comparing the rates of glove perforation using double latex gloving with or without a disposable protective glove liner (Paraderm) on 118 patients undergoing primary or revision arthroplasty of the hip or knee by one surgeon (FRH). The patients were randomly allocated into two groups: in group 1 an inner and outer pair of latex gloves were worn as double gloves and in group 2 the glove liner was worn between the two latex gloves.

There was glove perforation in at least one outer glove in 99 operations (84%). The operating surgeon was aware of the perforation in 21 of these. There were 22 perforations of the inner glove. Group 1 had a significantly higher perforation rate per operation \( p < 0.05 \) than group 2.

Our findings show that protective glove liners significantly reduce the rate of perforation of the inner glove during hip and knee arthroplasty.

Contamination of surgeons’ hands with blood from patients is a potential route of occupationally-acquired infection. Orthopaedic and trauma surgeons are thought to be at particular risk.\(^1\)\(^2\) Latex gloves protect against this but are often punctured, rendering them ineffective.\(^3\)\(^-\)\(^6\) There is evidence that wearing two pairs of latex gloves (double gloving) improves protection, but there is still a high rate of perforation of the inner glove.\(^2\)\(^,\)\(^3\)\(^,\)\(^6\)\(^-\)\(^7\)

The Paraderm disposable glove liner (Vigard Medical Products, Frinton-on-Sea, UK) is made of knitted fibres of extended-chain polyethylene and is claimed to be cut-resistant. We have examined the efficacy of these liners in arthroplasty of the hip and knee during which it has been shown that glove perforation is common.\(^9\)

Materials and Methods

Over an eight-month period all patients operated on by a single orthopaedic surgeon (FRH) for arthroplasty of the hip or knee were randomised (using sealed envelopes) into two groups. In group 1 \( n = 62 \) the surgeon wore two pairs of latex gloves (Ansell Nutex inner glove, Ansell Medical, Surbiton, UK) and Regent Biogel outer glove (LRC Products, Ltd, London, UK). In group 2 \( n = 56 \) the Paraderm glove liner was worn between the two layers of latex gloves according to the manufacturer’s instructions. Plainly, in group 2 an extra pair of gloves was used but it was felt that as the liner is designed to be worn between two pairs of latex gloves comparison should be made with an accepted method of wearing such gloves. There is little evidence to suggest that wearing three pairs of standard latex gloves has a greater protective effect than double gloving.

At operation a proforma was completed recording the patients’ details, the duration of each procedure and all operative complications. The number of needles and drains used, the stage and reason for any glove changes and whether the surgeon was aware of glove puncture were recorded.

For each patient the outer gloves were changed in pairs, either as part of the surgeon’s usual routine, for example before cementing a component of the prosthesis, or if the surgeon became aware of puncture of the glove. All used gloves were gently washed and saved for later testing.

At the end of the study the gloves were assessed for punctures by a method which has been previously described and validated.\(^8\) This involves filling each glove with water to a diameter of 10 cm around the palm and sequentially squeezing the fingers to a diameter of 4 cm. The site of all punctures was recorded. The investigator testing for punctures was blind to which group the gloves belonged.

The proportion of operations during which inner gloves were perforated was compared in the two groups by calcu-
lating a confidence interval (CI) for the difference in puncture rates. Student’s t-test was used to test for differences between the two groups in all other variables.

**Results**

A total of 840 gloves was used. The use of the glove liners was evenly distributed between both types of operation (Table I). There were no significant differences between the two groups as regards the mean duration of the operation (p = 0.45, 95% CI –4 to +9 minutes), the mean number of needles used (p = 0.09, 95% CI –0.03 to +0.44) and the mean number of drains employed (p = 0.67, 95% CI –0.2 to +0.3). There was no consistent pattern of distribution between left and right gloves or the part of the gloves punctured (Table II).

Overall, there were 22 perforations of the inner glove (Table III). Of the 56 operations in which the glove liner was used, five resulted in perforation of an inner glove (8.9%). Of the 62 operations performed without the liners, perforation of the glove occurred in 14 (22.6%). This difference is significant (p = 0.04, 95% CI 0.6% to 26.7%).

Perforation of the outer glove occurred on 142 occasions when the glove liners were not used and on 177 when they were (Table IV). Perforation of an outer glove occurred in 49 of the 62 operations (79%) carried out without the glove liners. When the liners were used perforation of an outer glove occurred in 50 of 56 operations (89%). This difference is not significant (p = 0.13, 95% CI –3% to +24%).

**Discussion**

Contamination of the hands with blood during surgical operations is a potential means of exposure to infection. Several different methods of protection have been tried including leather gloves, chainmail gloves and the placement of antiseptic solution between layers of latex gloves. While protecting the hands, these procedures tend to decrease tactile awareness. The manufacturers of glove liners claim to overcome some of these problems by combining high-tensile strength and cut resistance with lightness and flexibility, minimising the loss of tactile sensation.

Our study did not compare the rates of puncture when wearing a single pair of latex gloves and when double gloving. The large discrepancy between the number of punctures of the inner and outer gloves, however, fits with the findings of others who claim that double gloving has a protective effect on the hands. We found that the protective liner significantly improved this effect but it is important to realise that it is knitted and therefore unlikely to prevent direct puncture with a needle. Simply reducing the number of perforations of the inner glove,
however, will reduce the rate of contamination of the hands.

The surgeon noted no difficulty with dexterity when using the glove liners and the mean operating time was the same for both groups of patients. The proportion of operations in which perforation of the outer glove occurred is not significantly different between the two groups, although the 95% CI shows that in the most extreme case the proportion of operations in which an outer glove was perforated was 24% higher when the liners were used. Similarly, if the mean number of perforations of the outer glove per operation is examined the 95% CI for the difference is –0.24 to +1.98. Despite not reaching statistical significance these differences may imply that there is a greater chance of puncture of the outer glove when the liners are used. This may be due to reduced dexterity (of which the surgeon was unaware) or overconfidence in the liners, resulting in less care being taken to avoid puncture. Even if there is a genuinely higher rate of outer puncture when wearing the protective liners, however, this effect is taken into account when measuring the rate of inner puncture.

We believe that there is a role for these glove liners in lessening the risk of contamination from patients’ blood at operation.

The authors wish to thank Cynthia Crowther for her help collecting the gloves.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References