GLOVE PERFORATION DURING HIP ARTHROPLASTY
A RANDOMISED PROSPECTIVE STUDY OF A NEW TAPERPOINT NEEDLE

K. U. WRIGHT, C. G. MORAN, P. J. BRIGGS

From the Teesside Group of Hospitals, Teesside, England

Exposure to blood is a hazard for all surgeons. We assessed the incidence of glove perforation and needlestick injury from a new blunt taperpoint needle designed to penetrate tissues other than skin with the minimum of force. We performed a prospective, randomised trial comparing the incidence of perforations of surgical gloves with the new needle and a standard cutting needle during wound closure after hip arthroplasties.

There was at least one glove perforation in 46 of 69 such procedures (67%). The use of the taperpoint needle produced a significant decrease in perforations ($p = 0.049$).

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Vaccination against hepatitis B virus is now available, but only 60% of surgeons are reported to be immunised (Berridge et al 1990; Brignall and Moran 1991). There is no vaccination against the human immunodeficiency virus (HIV); emphasis must continue to be on protection against contamination. Needlestick injuries are the most common source of blood contamination during surgery (Brough, Hunt and Barrie 1988; Hussain, Latif and Choudhary 1988).

In view of this a new ‘pointless’ suture needle was developed (Ethiguard; Ethicon Ltd, Edinburgh, Scotland). This needle has a blunt tapering point which allows tissue penetration with minimum force, but does not puncture gloves or skin (Fig. 1). We assessed the possible reduction of the incidence of needlestick injury and glove perforation during a standard wound closure.

PATIENTS AND METHODS

We compared the new needle with the traditional ‘cutting’ needle in a prospective randomised trial of all patients who underwent total hip arthroplasty or hemiarthroplasty in our group of hospitals over a ten-week period. Surgeons were asked to use a standard method of wound closure, with polyglyactin sutures (Vicryl; Ethicon, Edinburgh, Scotland) mounted on a needle allocated preoperatively by a random number. A disposable staple machine was used with a no-touch technique to close the skin. The randomisation was stratified to equalise the numbers of total hip replacements and hemiarthroplasties in each group.

All surgeons wore two pairs of gloves; the outer pair was changed before the insertion of the prosthetic components and also before wound closure. The inner gloves were worn throughout the operation unless there was a known puncture. Two types of glove were used, according to the preference of the surgeons: Biogel and Regent Dispo (LRC Products Ltd, London, UK).

After the operation all the gloves used by the surgeon

![Fig. 1](image-url)
were labelled and tested for perforations by water inflation (Brough et al. 1988). Each glove was inflated with water to a diameter of 10 cm about the palm, and then squeezed to inflate each digit to a diameter of 4 cm. The number and site of perforations were recorded. This technique was validated by perforating six new gloves with various sizes of needle. All perforations greater than those produced by a 27-gauge needle were detected.

Each surgeon completed a form which recorded patient and operative details, needlestick injuries, glove perforations and blood contamination of the hand. A linear analogue scale recorded the ease of use of the needle during closure of fascia, muscle and subcutaneous fat.

Statistical analysis was performed of the number of operations in each group which led to perforations, using the chi-squared test for trend. The ease of use of the needle in each tissue layer was compared using the Mann-Whitney test after ranking the results for each of the tissue layers.

RESULTS

Sixty-nine patients entered the trial and none was excluded. The taperpoint needle was used in 38 operations and the cutting needle in 31. There were no other significant differences between these groups (Table I). The operations were performed by 17 surgeons; no surgeon performed more than ten operations. The approach to the hip was lateral (without trochanteric osteotomy) in 66 operations, posterior in two, and anterior in one.

Glove perforations. A total of 518 inner and outer gloves were used and there were 159 perforations at sites shown in Figure 2. At least one glove perforation was recorded in 46 of the 69 operations (67%). Perforations were most common during the earlier stages of surgery (Fig. 3), but 35% of all outer glove perforations occurred during wound closure. The type of latex glove worn by the surgeon did not affect the incidence of glove puncture.

Outer glove perforation during wound closure. A total of 138 outer gloves were worn during wound closure. Of these, 62 were worn while using the cutting needle; 31 perforations were found in 16 of them. In the 76 gloves worn while using the taperpoint needle there were 18 perforations in 10 gloves. This difference is significant: chi-squared test for trend, p = 0.049. Four inner gloves (two in each needle group) were found to have perforations corresponding to those found in outside gloves worn during wound closure.

Table I. Details of operations and patients

<table>
<thead>
<tr>
<th>Needle</th>
<th>Cutting</th>
<th>Taperpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total hip replacement</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Hemiarthroplasty</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>38</td>
</tr>
<tr>
<td>Sex</td>
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<td>Female</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Mean age (yr)</td>
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</tr>
<tr>
<td></td>
<td>72</td>
<td>73</td>
</tr>
<tr>
<td>Mean operation time (min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>79.5</td>
</tr>
<tr>
<td>Glove type</td>
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<td></td>
</tr>
<tr>
<td>Biogel</td>
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<td>25</td>
</tr>
<tr>
<td>Regent</td>
<td>11</td>
<td>13</td>
</tr>
</tbody>
</table>
**Inner glove perforation.** Inner gloves were not changed during the operation and in some cases it was uncertain at which stage the perforations had occurred. A total of 138 gloves were used; 15 of these contained 20 perforations. In four of these gloves (with seven perforations) there was no evidence of any corresponding outside glove perforation. Thus 3% of inner gloves must have either had pre-existing perforations, were punctured while the surgeon was putting them on, or had corresponding outer-glove punctures which we did not detect.

**Needlestick injury.** The surgeon recognised glove damage in only 11 cases (7% of perforations); testing confirmed perforation in all these cases. Three perforations were caused by needlestick injury, two from cutting needles and one from a wound-drain introducer. No needlestick injury was caused by a taperpoint needle.

**Ease of use.** The linear analogue scale for ease of use of a needle was 14 cm long, and assessments were expressed as percentages of its length, from 0% = very difficult to 100% = very easy. For use in the fascia lata the average grading was 97.9% (SD ± 5.3) for the cutting needle and 86.4% (SD ± 2.6) for the taperpoint needle. For closure of the fat and muscle, the average grading was 98.1% (SD ± 5.3) for the cutting needle and 83.1% (SD ± 2.6) for the taperpoint needle. Ranking and analysis of scores by the Mann-Whitney test showed a highly significant difference (p < 0.001) for both tissues.

**DISCUSSION**

Sharp injuries are common during operations (Eckersley and Williamson 1990) and it is suggested that about 5.6 injuries occur per 100 procedures (Hussain et al 1988). The risk of seroconversion after needlestick injury from an HIV-positive source is estimated as 1 in 250 (Marcus and the CDC Cooperative Needlestick Surveillance Group 1988), and the cumulative risk of seroconversion during a surgical career is considered to range from 1% to 10% (Lowenfels, Wormser and Jain 1989; Rosenberg, Becker and Cone 1989; McKinny and Young 1990). The risk of seroconversion is thought to be less after cutaneous exposure (Adler 1987; Becker, Cone and Geberding 1989), but it is possible that glove tears and perforations pose a significant risk because of their frequency.

The incidence of glove puncture varies with the type of orthopaedic surgery, being lower in paediatric orthopaedics (14%; Maffulli, Capasso and Testa 1991), and as high as 50% in hip operations and internal fixations (Eckersley and Williamson 1990). From half to two-thirds of glove punctures are caused by suture needles (Hester and Nelson 1991). Cutaneous exposure to blood is reduced by wearing double gloves (Matta, Thompson and Rainey 1987; McLeod 1989; Cohn and Seifer 1990), in our study by 90%, the use of outer cloth gloves may provide further protection (Sanders et al 1990).

Our study showed glove punctures in 66% of hip arthroplasties, with 35% of outer-glove perforations occurring during wound closure. No needlestick injuries were reported with the new taperpoint needle, and its use halved the proportion of glove perforations. The new needle is slightly more difficult to use, but all surgeons found that this had a minimal effect on their technique.

We conclude that the use of the new design of needle, significantly reduced the risk of accidental glove perforation and of needlestick injury. The routine use of this and double gloving could reduce the risk to surgeons of blood-borne disease.

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**REFERENCES**


