Needlestick injuries during surgical procedures: a multidisciplinary online study

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Background Needlestick injuries are common during surgical procedures. Following such an injury, local protocols should be followed to minimize the risk of infection.

Aims To identify who sustains such injuries, under what circumstances and what actions are taken to minimize the risk and in response to intraoperative needlestick injuries.

Methods A questionnaire was submitted via e-mail to all staff in a National Health Service trust who took part in operations. The results were checked against occupational health department (OHD) records.

Results One hundred and thirty-six of 255 appropriate responders completed the questionnaire (53%). Fifteen of 31 consultants (48%), 12/36 junior doctors (33%), 0/39 midwives (0%) and 8/30 theatre staff (27%) reported having had at least one intraoperative needlestick injury over the past year. Awareness of local protocols was significantly worse in the junior doctor group. Ninety-three percent of consultants, 67% of junior doctors and 13% of theatre staff did not comply with local protocols. The length of time it takes to do so (48%) and a perceived low infection risk of the patient (78%) were the commonest reasons for this. Hand dominance, role during surgery and double gloving were not significant risk factors; however, rare use of a no-touch technique was. Comparison with OHD records suggested that a maximum of 16% of intraoperative needlestick injuries were dealt with in accordance to local policy.

Conclusions Non-compliance with needlestick injury protocols is commonest among senior surgical staff. A revision of the protocol to reduce the time it takes to complete it may improve compliance.

Key words Hepatitis; hepatitis B; hepatitis C; HIV; hospital staff; injury; needlestick; needlestick injuries; NHS Occupational Health Department; survey.

Introduction

The second commonest cause of occupational injury within the National Health Service (NHS) is needlestick injury. This is where a person comes into contact with someone else’s body fluids either by direct inoculation by a sharp instrument, such as a blade or a needle, or by splashes of the body fluid in question to the recipient’s skin, mucous membranes or eyes [1]. The second commonest site in which such injuries are sustained is in theatre [2]. In addition to the danger of blood-borne virus contraction by the injured person and the associated anxiety experienced by themselves and their contacts, there is also a significant cost to the organization, both financial and in terms of lost man-hours [3,4].

In the NHS, it is compulsory when a member of staff sustains a needlestick injury that the incident is reported and that local needlestick injury protocols are followed. This allows the appropriate occupational health staff to conduct a risk assessment and evaluate the need for the injured party to be given post-exposure prophylaxis against blood-borne viruses. This can be an expensive and time-consuming process [3,4]. A full risk assessment involves the donor consenting to have their blood tested for such infections and the recipient having their blood taken for storage. Potentially, the recipient may also require a series of immunizations and potentially harmful antiretrovirals as prophylaxis. Previous studies have suggested that adherence to these protocols amongst surgeons is poor [5–7]. The aim of this study was to see if this was equally true amongst non-medical staffs who sustained such injuries during the course of surgery.

Methods

As part of a trust-wide audit, a questionnaire comprising 16 questions with a mixture of free-text and tick-box
responses was designed by the authors and incorporated into an on-line market research programme [8]. It was then submitted via the hospital internal e-mail system to all personnel who it was felt could be actively involved in surgical procedures in the trust. The rationale for using the market research software was that it would allow us to guarantee full anonymity, prevent duplicate responses and make distribution of the questionnaire and collation and interpretation of the data easier.

The e-mail addresses were obtained using the group mailing lists for all medical staff in the surgical specialities above the grade of foundation year 1, and all theatre and midwifery staff. Each group mailing list was then examined individually and the e-mails of the appropriate staff were collated onto a spreadsheet. Those staff members who were identified from this process as not scrubbing for surgical procedures (e.g. clerical/managerial staff) were excluded. We were therefore able to calculate the maximum number of responses that we could potentially receive.

An e-mail was distributed one week prior to sending out the questionnaire in order to check that the addresses were correct and so that people had an opportunity to ask questions about the project if they wished to. This e-mail clearly stated the aims of the project and who should respond to it. In addition, several posters advertising the project were placed at strategic points around the theatre department with the same messages. In total, the questionnaire was sent out four times with the message that those who had previously responded need not do so again. Once we seemed to have reached a plateau with regard to responses, the results were individually examined and all incomplete or inappropriate responses were deleted. The data were analysed by our trust’s statistical service using the chi-squared test.

The accuracy of our results was assessed by checking them against the records held by our trust’s occupational health department (OHD).

Ethical approval by our trust’s research and development committee was obtained.

Results

One hundred and thirty-six completed and appropriate responses were returned (53% response rate).

A significant difference was seen between the medical (consultants and junior doctors) and non-medical (midwives and theatre nurses) groups in terms of injury rate, knowledge of local needlestick injury protocols and the subsequent adherence to these protocols (see Table 1).

Of the 23 responders who did not follow the protocol for some, most or all of their injuries, a perceived low infection risk of the patient involved and the length of time it takes to do so were cited as being the reasons for this in 18 (78%) and 11 (48%), respectively (see Figure 1).

Hand dominance, operative role at the time of injury and frequency of double gloving were not found to be significant risk factors for sustaining a needlestick injury during surgery. Rare use of a no-touch technique was significant although it should be noted that our study was not specifically powered to detect this (see Table 2).

Twenty-six (79%) of 33 respondents who could recall whether or not they were in control of the needle at the time of receiving an injury reported that they were for some, most or all of their injuries. For those injuries that could be recalled, the specific circumstances during which the injuries were sustained are shown in Figure 2. Figure 3 shows which specialties responders reported frequently taking part in.

| Table 1. The number of needlestick injuries sustained during surgery in our trust over the past 12 months by demographic group and the frequency of non-compliance with needlestick injury protocols |
|---|---|---|---|---|
| | All four groups | Medical staff | | Non-medical staff |
| | Consultants | Junior doctors (F2-ST8) | | Midwives | Theatre staff |
| No. responses/no. in group (percentage) | 136 (53%) | 31 (56%) | 36 (47%) | 39 (75%) | 30 (42%) |
| No. injuries in past year/no. responses (percentage) | | | | | |
| 0 | 101 (74%) | 16 (52%) | 24 (67%) | 39 (100%) | 22 (73%) |
| 1–2 | 28 (21%) | 11 (35%) | 9 (25%) | — | 8 (27%) |
| 3 | 7 (5%) | 4 (13%) | 3 (8%) | — | — |
| No. aware of local protocol/no. responses (percentage) | 120 (88%) | 27 (87%) | 25 (69%) | 38 (97%) | 30 (100%) |
| No. not following protocol for some, most or all injuries/no. with ≥1 injuries in past year (percentage) | 23 (66%) | 14 (93%) | 8 (67%) | — | 1 (13%) | 14.36 (1) | P < 0.001 |
| | | | | | 13.03 (1) | P < 0.001 | 13.03 (1) | P < 0.001 |
Of the 44 responders who reported the use of double gloving, some, most or all of the time 15 (34%) cited a reduced infection risk for the patient and 34 (77%) cited a reduced infection risk for themselves as their reasons for doing so. Conversely, of the 92 responders who rarely used double gloving, 25 (27%) cited the opposite (a lack of reduction in infection risk for themselves) as a reason for not double gloving. Reduced sensation was the commonest reason for rare use of double gloving [55 responders (60%)].

From the 136 respondents, at least 49 incident reports of needlestick injuries sustained during surgery should have been filed with the OHD in the preceding 12 months (28 people with one to two injuries plus seven people with three or more). Our OHD had records of only 11 such reports (5 doctors, 6 nurses). Three of the reports (all involving doctors) were reported by the pathology department forwarding blood-borne virus test results to the OHD suggesting that normal processes had not been observed. Although our questionnaire suggests that 12 of the 35 staff who have had such injuries followed local protocols, the OHD records suggest that a maximum of 8 of a minimum of 49 (16%) intraoperative needlestick injuries sustained during surgery in the past year in our trust were dealt with in accordance to our local policy.

**Discussion**

Our study found that one in four members of staff reported receiving at least one needlestick injury during a surgical procedure in the preceding 12 months. However, previous similar studies have shown rates exceeding 14 per person per year in certain groups [5]. Obtaining accurate figures for the incidence of needlestick injuries is very difficult. For example, it is often not possible for an injured person to remove themselves from the operation and follow the bleed it/wash it/report it routine. This, if combined with a high frequency of such injuries, may lead to them being ignored and subsequently forgotten thus introducing recall bias. The fact that our OHD records show a much lower reporting rate than the questionnaire results alone would suggest this may be partly explained by this recall bias, but it is also possible that there may be a degree of dishonesty in the responses. Additionally, the comparatively low reported incidence of intraoperative needlestick injuries compared to the relatively high rates of glove perforation suggest that some such injuries may go unnoticed at the time. Glove perforation rates of up to 61% have been reported with these perforations being occult 90% of the time [9,10].

The reaction an injured person may experience following a needlestick injury covers a wide spectrum ranging from casual indifference to clinically significant anxiety [11]. A perceived low infection risk has been shown to be associated with non-compliance with universal precautions [7,12]. It therefore follows that low-infection risk could also be associated with non-compliance with needlestick injury protocols. It is not known whether or not non-compliance is affected by a person’s immunization status against hepatitis B. The most serious potential consequence of not following needlestick injury protocols is that exposure to such an infection may occur and the injured person would not receive prompt prophylactic...
treatment to prevent seroconversion. It has been shown that low-infection risk is not in itself a justification for complacency, as 25% of patients testing positive for HIV have no identifiable risk factors [12,13]. Furthermore, HIV prophylaxis is most effective when commenced within 2–3 h of exposure, although even then the protection achieved is not absolute and cases of seroconversion in health workers following needlestick injury have occurred despite post-exposure prophylaxis administration [12,14,15]. Similarly, early diagnosis and treatment of hepatitis C virus (HCV) infection has been shown to offer significantly improved cure rates (99% for early acute infection versus 50% for chronic infection) [16,17].

Although anxiety tends to be greatest over the risk of contraction of HIV infection, viral hepatitis poses the greater risk. The risk of seroconversion following inoculation with infected blood is 30, 3–10% (increases 10-fold with high viral titres in the source patient) and 0.3%, respectively, for hepatitis B virus (HBV), HCV and HIV with 66 000 HBV, 16 000 HCV and 1000 HIV infections estimated to occur annually worldwide in susceptible health care workers following percutaneous injuries [17–20]. Even when taking into account the comparatively low prevalence of HIV in Europe, estimates of the lifetime risk of contracting HIV as a result of such an injury during surgery are as high as 0.3% [21]. Estimates of the lifetime risk of a surgeon becoming HCV RNA positive by the end of their career vary from 3 to 26% [17].

Cumulative evidence of both the risk of infection and the efficacy of existing safety measures have resulted in various groups producing guidelines or 'universal precautions' for safe practice in the operative environment [22].

Our study does not show an increased injury risk with double gloving. Successive studies have shown that double gloving provides greater protection from bloodborne virus infection [9,23–25]. It has been argued however that the additional financial cost of routine double gloving is out of proportion to the overall risk posed [26].

A significant proportion of the needlestick injuries reported in our study and in the literature occurred during wound closure or closure of the abdominal fascia [10,27]. Randomized trials have shown that blunt tipped needles significantly reduce, and in some cases eliminate, glove perforation without hindering operative technique [22,27–29].

Results of studies assessing the effectiveness of a no-touch or hands-free technique, in which a 'neutral zone' is employed when passing sharp instruments between colleagues, have varied [22,28]. Our results show that rare use of this technique is significantly associated with intraoperative needlestick injuries. Stringer et al. [30] showed that in operations where blood loss was >100 ml, the no-touch technique did significantly reduce intraoperative injuries, whereas if blood loss was <100 ml, no significant reduction was seen. Other studies have shown no significant benefit; however, since no adverse effects have been seen either it is generally felt to be good practice or to employ the technique wherever possible [22,28].

Although needlestick injury protocols vary little between NHS trusts, there is a significant difference in the awareness of our protocols in the junior doctor group. This is the only group with non-permanent contracts and so this lack of awareness may be due in part to the nomadic nature of surgical training. Given the accessibility and success of on-line advice and reporting systems for needlestick injuries, the authors feel that perhaps the time has come to consider developing such a system for use across all NHS trusts. This might reduce the number of staffs failing to report their injuries as a result of not knowing the protocol.

The group most likely both to receive intraoperative needlestick injuries and not to report them are the consultants, who are also the most likely to be indispensable with regard to an ongoing operation and the completion of an operating list. The second commonest reason for non-compliance with the protocol was the length of time

![Figure 3. The incidence of sustaining or not sustaining an intraoperative needlestick injury by speciality.](image-url)
taken to follow it. Although further study would be required to prove it, a quicker-to-follow streamlined update of the current protocol, in conjunction with a campaign highlighting the importance to the individual of adhering to it, may improve the reporting rate.

Key points

- The reporting rate for needlestick injuries incurred during operations is very poor.
- Those at most risk of incurring such injuries have the poorest reporting rates.
- A simpler quicker protocol with a campaign highlighting the dangers of non-compliance may improve the figures.

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Conflicts of interest

None declared.

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