A study of telephone screening and direct observation of surgical wound infections after discharge from hospital

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Post-discharge surveillance of surgical site infection is necessary if accurate rates of infection following surgery are to be available. We undertook a prospective study of 376 knee and hip replacements in 366 patients in order to estimate the rate of orthopaedic surgical site infection in the community. The inpatient infection was 3.1% and the post-discharge infection rate was 2.1%. We concluded that the use of telephone interviews of patients to identify the group at highest risk of having a surgical site infection (those who think they have an infection) with rapid follow-up by a professional trained to diagnose infection according to agreed criteria is an effective method of identifying infection after discharge from hospital.

Surgical site infection (SSI) is an important indicator of outcome after surgery. The costs for the patient, hospital and community care team are high.[1] In England, these have been estimated to total £61 million per annum, with a cost per infection of some £3200.[2] National surveillance systems in the United Kingdom have been established using the Centre for Disease Control and Prevention (CDC) definition for SSI.[3] However, only mandatory pre-discharge rates of SSI are identified and these underestimate the true rates of SSI. It is estimated that 70% of post-operative infections present after discharge.[4]

Surveillance after discharge is challenging as the patient is no longer under direct medical supervision. A Department of Health working group[5] recommended that priority should be given to procedures involving a short length of stay. The authors also suggest that direct observation of the surgical site, the most reliable and valid way of detecting infection, should be included in the normal patient pathway to minimise additional cost.

Direct observation in the course of normal clinical care is easily achieved with procedures as Caesarean sections, in which patients are seen routinely during the period after discharge. However, when such post-operative follow-up is not routine, monitoring all patients by healthcare workers is costly.[6]

Orthopaedic implant infection rates are reported to be between 1% and 15% depending on the methodology and definitions adopted. These patients are not routinely seen in the six weeks following surgery and there is no healthcare worker in the normal patient pathway during this period. Hence, there is a need to consider alternative methods of collecting data.

Methods for SSI surveillance after clean surgery include telephone enquiry or questionnaire to patient or surgeon.[7-11] With those methods infection rates range between 1.5% and 17%. However, SSI surveillance using direct observation of the wound for up to 30 days by one observer reported infection rates between 9% and 16%.[12-15] While it is clear that direct observation is the most sensitive method for detecting infection, it is also expensive.[6,16]

Several large studies have suggested that feedback of the data for SSI to surgeons can reduce infection rates.[7,17-19] However, the varying definitions used do not allow the comparison of infection rates. Further, where data were collected beyond the inpatient stay, the follow-up consisted only of a monthly report, by the surgeon to the project nurse, of the number of infections,[7] possibly leading to bias. It may be that the steadily falling rates of infection reported by Cruse and Foord[7] and Haley et al[19] are due to a shorter inpatient stay with an ineffective post-discharge surveillance programme and not, as assumed, the results of feedback of the incidence of infection to surgeons.

Recently, attention has been focused on the patient's ability to detect surgical infection. Postal questionnaires returned by the patient to the hospital have been used,[20,21] but this approach is limited by the response rate. Some studies have explored the use of telephone questionnaires[22,23] as a method of detecting SSI but it has not been validated. It has been iden-

tified as a practical method with good response rates. Telephone surveillance could be used to screen-out patients who report that they do not have a SSI, and allow time for direct observation of only those who state that they have problems. Direct observation of the patient by a trained observer has indicated that patients know when they do not have infections, 98.2% of the time, but only 66% of patients know when they do have an infection.[24]

Bruce et al[4] have shown that research is needed to formally assess the reliability of patient self-diagnosis and validate the performance of the definitions used for SSI in hospital[3] for use in the community setting. The associated costs of collecting this information need to be considered to determine the most appropriate healthcare worker to be employed.

The aims of this study were to estimate orthopaedic SSI in the community and test the validity of both telephone surveillance and SSI case definitions.

Patients and Methods

This was a prospective study of patients who were about to undergo elective hip or knee arthroplasty and who lived within Tayside. Patients were excluded if they were unable to give informed consent, could not communicate directly by telephone or were inpatients up to 30 days post-operatively.

Consenting participants were given a form to take home which they were instructed to give to their general practitioners or district nurse should they have any problems with their wound. All 72 general practice surgeries in Tayside were contacted and provided details of SSI case definitions. They were instructed to post the form back to the hospital once complete.

All patients were also telephoned by the research nurse ten, 20 and 30 days post-operatively in order to ascertain the state of the wound using a standard interview schedule. At each telephone interview, patients who identified problems with their wound were told to ask their general practitioner or district nurse to complete the form they had been given on discharge and post it back to the hospital. Independently of this, all patients identifying problems with their wound, and 10% of those who did not, were visited by a trained research nurse following the telephone interview, in order to observe their wounds.

Statistical methods. The effectiveness of telephone surveillance was investigated through tests of sensitivity, specificity, positive and negative predictive values.

Results

During the study period, 422 patients were admitted, all of whom were included in the ongoing acute stay surveillance programme in order to determine accurate inpatient rates. We excluded patients who did not meet the inclusion criteria. Of the 376 procedures which did satisfy the inclusion criteria, there were 175 knee replacements and 201 hip replacements, in 201 women and 165 men. The primary diagnoses for the procedures are given in Table I.

Table I. Primary diagnoses for the procedures included in the study

Diagnosis	Hip replacements	Knee replacements	Total
Osteoarthritis	182	161	343
Inflammatory joint disease	6	8	14
Hip fracture	6	0	6
Other	3	0	3
Not recorded	4	6	10
Total	201	175	376

Table II. Telephone surveillance *versus* research nurse assessment of infection

	Telephone surveillance			
	No infection	Infection	Not sure	Total
Research nurse				
No infection	72	2	20	94
Infection	1	6	4	11
Total	73	8	24	105

The majority of cases (350) were unilateral. The mean age was 67 years (30 to 91; SD 10.4). The majority of patients (78.2%) had a Centre for Disease Control and Prevention (CDC) National Nosocomial Infections Surveillance risk index[25] of 0 or 1. This index is based on three risk factors (American Society of Anaesthesiologists score, wound class and duration of operation) and scored as 0, 1, 2 or 3. The CDC's experience is that the infection rate increases with an increasing risk score.

The research nurse, regarded as the gold standard for the detection of infection, visited 105 of the 366 patients in order to assess their wounds. The inpatient infection rate was 3.1% (13 validated SSI of a total of 422 cases), and the post-discharge infection rate was 2.1% (eight validated SSI of the 376 cases included in the surveillance study).

The numbers of patients categorised as infected or not infected in the telephone surveillance report and by the research nurse are shown in Table II.

The effectiveness of telephone surveillance was calculated first when responses of 'not sure' from patients were recorded as 'no infection' and then when they were classified as infected (Table III).

Of the 1026 telephone reports of no infection problems, 90 were checked by the research nurse and one (1.1%) was found to have an infection. General practitioners prescribed antibiotics for 39 (11%) of the patients. Thirty-one of 83 community healthcare worker forms received recorded the presence of infection, three of which were validated. While the sensitivity and negative predictive value of community reporting of SSI are high (100% in both cases), the specificity and positive predictive value are low (7.4% and 19.4%, respectively).

Discussion

This is the first study, to our knowledge to examine the validity of patient diagnosis of SSI post-discharge using the CDC definitions.[3]

Table III. Telephone surveillance *versus* research nurse assessment of infection

	Patients not sure	
	No infection	**Infection**
Sensitivity*	0.5454 (0.2801 to 0.7873)	0.9091 (0.6226 to 0.9838)
Specificity†	0.9787 (0.9257 to 0.9941)	0.7660 (0.671 to 0.8401)
Positive predictive value‡	0.75	0.3125
Negative predictive value§	0.9485	0.9863

* Probability the telephone report was positive given the wound was infected (true +ve)

† Probability the telephone report was negative given the wound was not infected (true -ve)

‡ Probability the wound was infected given a positive telephone report

§ Probability the wound was not infected given a negative telephone report

When responses of 'not sure' were classified as positive for infection in our study, the method could detect most infections (90.91%). The positive and negative predictive values (31.25% and 98.63%, respectively) were comparable with the figures reported by Whitby et al[24] (28.7% and 98.2%).

The categorisation of 'not sure' as negative for infection increased the specificity but decreased the sensitivity of the method. In addition, a positive result from this categorisation was more likely to indicate the presence of infection and a negative result was less likely to do so.

The number of patients who were unsure they had an infection was relatively small and, in the interests of obtaining an accurate measure of the infection rate, they should be included for follow-up.

This study suggests that patients can reliably self-diagnose SSI and that telephone screening of patients is a valid method for detecting infection. The specificity of the method could be maximised if it was used to screen-out patients with no SSI, allowing direct observation of those who say they have, or are unsure if they have, an infection.

While community health workers identified all the infections in patients they observed, the specificity of their assessment was poor. Although this study did not find the use of community staff in this way a reliable and valid method for detecting SSI, collaborative work should aim to find new approaches to enhance communication to improve surveillance after discharge. It may be useful to screen patients who believe that they have a wound problem and those that are not sure, or to provide open access wound clinics.

The infection rate after discharge was higher than the inpatient rate. Without post-discharge surveillance, eight infections would not have been detected.

This study was carried out on an orthopaedic patient population from a single hospital and therefore the methodology needs to be repeated in differing settings and surgical patient populations to assess the applicability of the findings. Another limitation of our study is the small numbers of patients included.

Supplementary Material

The Centre for Disease Control definition of surgical site infection; the telephone, nurse, and healthcare worker questionnaires, a flowchart of the research method used in this study and a further opinion by Professor Sean Hughes are available with the electronic version of this article on our website at www.jbjs.org.uk.

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