Quality of the surveillance of surgical wound infections

A 10-year prospective study of 12,364 wounds

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ABSTRACT We did a survey of postoperative wound infection rates in our department over a 10-year period. It was based on the results of forms completed by surgeons in the department after each operation and when an infection was diagnosed (primary registration). These forms were sent to the electronic data processing department for registration of data in a database. Every third month, detailed reports of the data were discussed with the surgeons.

The quality of this routine survey was evaluated as follows: 1) Every year, the year's data in the surveys database were compared with those in the National Patient Register and, in case of discrepancies, the patient's records were checked and missing information about the operation and infections were recorded in the surveys database (secondary registration). 2) In case of a primary registered infection, the patient's record was carefully examined. Infections not fulfilling the criteria for an infection were called registration failures.

The primary registration of operations reached an acceptable level (about 95%) after 5 years of the survey, but the recording of infections was unreliable throughout the study due to an unacceptably low registration rate (about 60%) and to a high rate of registration failures.

The risk of postoperative wound infection has many causes depending on the type and duration of the operation, surgical technique, type and quantity of microbial contamination during surgery and underlying illness of the patients. Several studies have shown a positive effect of prophylactic measures, such as use of antibiotics (Ericson et al. 1973, Hill et al. 1981) and improved air quality in the operating room (Lidwell et al. 1982).

Continuous registration of the postoperative wound infection rate can be used to determine the quality of the infection control practices in a surgical department. The quality of the registrations and the reliability of the conclusions about the data collected depend on the ability of the personnel to find and record data consistently and correctly. We have been studying the postoperative wound infections in our department since 1985 and, in the present study, we analyze the quality of the records.

Material and methods

In January 1985, a survey of the postoperative wound infection rate was started in our department (Bremmelgaard et al. 1989). Our ambition was to include all operations (including day-surgery) with primary or secondary wound closure and arthroscopic procedures. The present study deals with the first 10 years of this survey.

Primary registration of operations and infections. The survey was based on forms filled in by the surgeons in the department. The data include patients' personal identification number, date of operation, code number for the type of operation (according to the Danish National Board of Health), letter of identification by the operating surgeon, and the date and type (superficial or deep) of wound infection. The forms were sent by the secretaries of the orthopedic department to the department of electronic data processing (EDP) where they were recorded in a database.

Data on operations recorded by the surgeons immediately after the operations, and concerning postoperative wound infections were recorded by the surgeons who diagnosed the infections. However, during the study, the forms and the mailing procedure were changed. During the first 3 years, 2 separate forms were used, concerning the operation and another the infection. From 1988, the 2 forms were combined into 1 with 2 copies. The upper part of this form contained the patient's identification number and peroperative data and the lower part, the data about the infection. The new form had a very eye-catching design. During the first 3 years, the forms were mailed to the EDP department when the patient was discharged. In case of wound infections, diagnosed after discharge, the form concerning infections was filled in. From 1988, the first part of the combined form was sent just after the operation, leaving a copy in the patient's record to be completed and sent if an infection developed. The second copy was left in the patient's record.

Every 3rd month, detailed reports of the overall rate of infection and the individual surgeon's rates of infection were discussed with the surgeons.

Secondary registration of operations and infections. The quality of the registrations was evaluated every year. The database of the survey in the hospital EDP department was compared with the data for our department registered in the National Patient Register. This register contains information about all patients treated in Danish hospitals, including the personal identification number and the date and type of operation (but no information about postoperative infections). If discrepancies were detected in the registered data, the patient's records were checked and missing operations or infections were filled in and sent to the EDP department. Likewise, when the data in the database consist in codes of operations that concern treatment of infections, these cases were checked and missed infections were registered.

From 1987, we recorded whether missing operations and infections were due to missing or incomplete filling in of forms by the surgeons or to failure in the mailing procedure.

The definition of wound infection was: 1) pus in the wound or 2) positive culture of fluid (including serous secretion) or tissue from the wound or 3) signs of infection on reoperation, or histopathologic, radiographic or scintigraphic evidence of infection. The latter concerns deep infections involving implanted foreign materials, such as prostheses or internal fixation devices (Sørensen et al. 1997). These criteria were used for secondary registered infections. For primary registered infections, the patient's hospital records were checked, and if the criteria were not met, the case was considered as not infected and a registration failure. All the infections were classified as superficial (if superficial to the fascia) or deep (if they involved subfascial layers or implanted foreign material). In 17 cases, the type of infection was uncertain. Secretions from these wounds were found with a positive culture, but no wound break-down or surgical intervention. These infections were recorded as superficial.

To test our method for assessing samples, all hospital records of patients with primary recorded operations during a 3-week period (1–21 May) for each year were examined and missed infections were recorded.

From 1987, an orthopedic surgeon with special interest in surveys was placed in the registration. However, examination of the surgical wounds for an infection was not a part of his job and no financial resources were allocated for this.

Results

The accuracy of the registration of operations improved markedly during the 10-year period, from 56% in 1985 to 92–96% after 1989 (Table 1). The improvement from 1986 to 1987 coincided with the fact that an especially interested surgeon was assigned to the survey and the improvement from 1987 to 1988 coincided with a change in the design of the registration form. Surgeons who did not complete the forms were the main cause of missing registrations (Table 2).

During the 10-year period, 231 infections were recorded on the primary registration; however, 58 (25%) did not meet the criteria for an infection (registration failures) (Table 3). The percentage of registration failures was 60% for the first year and, on average 16 (8–31)% in the following years. No improvement occurred in the frequency of real

Table 1. Registration of operations

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Primary registrations	547	617	791	970	1148	1325	1256	1227	1324	1366
Secondary registrations	427	418	257	155	165	75	70	103	72	58
Total number	974	1035	1048	1125	1313	1400	1326	1330	1396	1424
Primary registrations (%)	56	60	76	86	87	95	95	92	95	96

Table 2. Causes of missed registration of operations (1987–1994)

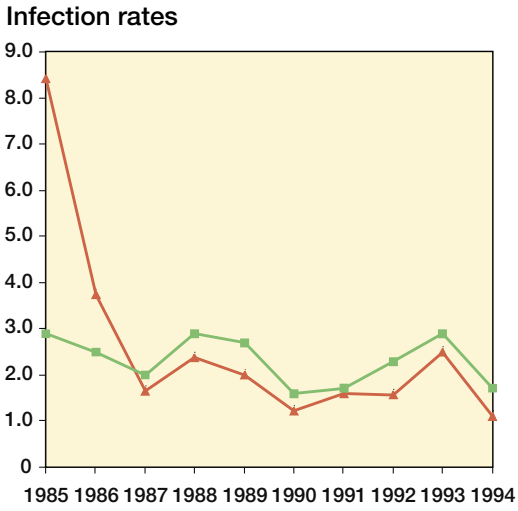
Year	1987	1988	1989	1990	1991	1992	1993	1994
Surgeon's fault	194	98	121	60	50	88	59	53
Error in mailing procedure	63	57	44	15	20	15	13	5
Total number of mistakes	257	155	165	75	70	103	72	58
Surgeon's fault (%)	75	63	73	80	71	85	82	91

Table 3. Registration of infections

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Primary registrations of infections	46	23	13	23	24	15	20	19	33	15	231
Criteria not met	28	2	1	5	4	5	3	4	3	3	58
Primary registrations of real infections	18	21	12	18	20	10	17	15	30	12	173
Secondary registrations of infections	10	5	9	15	16	12	5	16	12	12	112
Total number of real infections	28	26	21	33	36	22	22	31	42	24	285
Frequency of primary registrations of real infections (%)	64	81	57	55	57	46	77	48	71	50	61

infections recorded on primary registration did not improve during the years, the average being 61 (48–81)%. Surgeons were responsible for all missing infection registrations since they had failed to complete the form in case of infection. After excluding the incorrectly registered infections and including the secondary registrations, the annual infection rates were unchanged during the period (Figure). The proportions of deep infections and of infections meeting the criteria of infection after discharge were lower for primary than for secondary registered infections (Table 4).

The test sample (Table 5) consists of 611 operations and 12 infections recorded as primary registrations. However, after examining the patients' hospital cards, we found 6 more infections, and 3 of these met the criteria for infection, while the patients were still in hospital. During the same period, 53 operations and 12 infections were



Infection rates on the basis of primary registration (red; before revision) and after excluding primary registration failure and including secondary registration (green).

Table 4. Distribution of infections according to method of registration, type of infections and the criteria met for infection

	No.	Deep infection n (%)	Criteria met after discharge n (%)
Primary registations of real infections	173	95 (55)	67 (39)
Secondary registations of real infections	112	74 (66)	55 (49)
Total	285	169 (59)	122 (42)

Table 5. Test sample. Operations and infections during a 3-week period for each of the years (1985–1994)

Registration	Operations n	Infections total (deep)	Infection rate (%)
Primary	611	12 (6)	1.96
Secondary	53	12 (7)	3.61 [a]
Test sample	–	6 (3)	4.52 [b]
Total	664	30 (16)	4.52

[a] On the basis of primary and secondary registrations.
[b] On the basis of primary, secondary and test sample registrations.

recorded as secondary registrations. Thus, one-fifth of the infections were not recorded, either on the primary or the secondary registration.

Discussion

Several studies over the last 20–30 years have dealt with registration of surgical wound infections. Their aims have been to determine a reliable infection rate, to find risk factors, as well as to reduce the infection rate (Cruse and Ford 1980, Bibby et al. 1986, Mishriki et al. 1990). Several authors believe that the introduction of surveys of surgical wound infections reduces the infection rate (Condon et al. 1983, Gil-Egea et al. 1987, Olson and Lee 1990). Our study does not support this. In the first year of our registration, 60% of the primary registered infections were incorrectly registered according the criteria for infection. After exclusion of these registration failures, the overall rate of infection of 2.8% in the first year became similar to the rates in the following years (2.3–2.9%).

Several authors have found errors in registration of all the operations and especially of all the infections (Cohen et al. 1962, Eickhoff et al. 1969, Laurell 1976). If registration has been a part of a scientific study—i.e., finding risk factors—an employer has often been asked to register infections to ensure that all of them are registered. If the survey of wound infections is part of the daily routine, the frequency of registration has often declined after a few months even if the amount of information is still thought to be high (Cohen et al. 1962).

In the first years of our study, the frequency of registered operations was unacceptably low (50–60%). This was mainly caused by failure of the surgeons to fill in the registration form and less to the method of mailing the form to the EDP department. The improvements in the quality of the survey (frequent feedback, changes in design of the form and mailing procedure) gradually increased the frequency of registration of the operations, which reached an acceptable level after 5 years.

During the first year, the frequency of primary registered real infections was unacceptably low and showed no improvement during the 10-year study period. The surgeons in the department were responsible for all the missed registrations since they did not fill in the registration form when the infections were detected on clinical examination. It is well known that infections after discharge are often missed in surveys (Reimer et al. 1987, Poulsen and Meyer 1996). However, this does not seem to be an adequate explanation of insufficient primary registration. About half of the infections not registered primarily were clinically detectable while the patients were still in hospital. About 60% of the infections in the study were deep, and most cases required readmission and prolonged hospitalization as well as one or more reoperations. Many surgeons were involved in the treatment of these serious complications, which would have provided several opportunities for registration. However, only about half of the deep infections were recorded primarily.

Unlike the operations, comparatively few post-operative wound infections occurred in the daily work of the department. This probably accounted for the lack of improvement in primary registration of infections. The various surgeons never acquired

the habit of filling in the registration form in cases of infection.

We believe that it is important to have a staff member who is responsible for the registration and acts as an internal "police officer". We also believe that the person should be reimbursed for this work, which was not the case in our study.

When continuous registration of postoperative wound infection rates is used as a basis for measuring the quality of surgical procedures, the rates must be sufficiently accurate for comparisons, between hospitals or in the same hospital over time. In our study, the registration was based on recordings by the surgeons in the department as part of their daily work. It was our ambition that the quality of the registration after some time would reach an acceptable level. Unfortunately, it has not done so until now.

We can not recommend surveys of infections as a part of daily routines unless several time-consuming check systems are built into the survey and, even then, the frequency of infection may be a very uncertain parameter.

No competing interests declared.

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