ORIGINAL ARTICLE

Incidence of nosocomial infection in open prostate surgery

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KEYWORDS
Prostatectomy; Surgical wound infection; Incidence; Monitoring; Antibiotic prophylaxis

Abstract

Objectives: To know the rate of nosocomial infections in open prostate surgery and to assess the application of pre-surgery preparation and preoperative antibiotic prophylaxis protocols at three public hospitals in the Autonomous Community of Madrid.

Materials and methods: Prospective observational and multicentre study, including all the patients operated on at the services monitored and admitted for more than 48 h between 1 January and 31 December 2009. They were monitored from admittance until their discharge.

Results: The rate of hospital infection observed was 3.38%. The most frequent infection was surgical localization, with an incidence rate of 2.77% (superficial = 1.23%; deep = 0.31%; organ-space = 1.23%). The percentage of appropriate surgical prophylaxis, both in the indication and in the selection of antibiotics, initiation and duration, with respect to all those patients that received it, was 47.42%. According to the data obtained from their clinical records, the percentage of patients in which the pre-surgery preparation protocol was correctly complied with, was 92%.

Conclusions: The results obtained in this multicentre study can serve not only as a reference to other public hospitals but they are also comparable to other international monitoring systems. Monitoring and controlling infections associated with healthcare must be a key aspect in Patient Care and Safety programmes.

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Introduction

Infections related to health care are a side effect and major cause of mortality and morbidity among patients. Of them, one of the most common is surgical site infection (SSI). Patients who develop SSIs are 60% more likely to enter an Intensive Care Unit (ICU), five times more than those who are re-admitted into hospital and twice as likely to die than patients without SSI. Furthermore, the development of an SSI prolongs hospitalization, increases costs significantly and is a major health and emotional cost to patients and their families.

It is believed that a third or more of the infections could be prevented in many hospitals. Many of the preventive measures are inexpensive and generally, they are less expensive than the cost of caring for an infected patient. The first system of ongoing prospective surveillance of hospital infections, the National Nosocomial Infection Surveillance System (NNIS) was established in the U.S. in the 70s, proving its cost-effectiveness. In 1997, VICONOS, the Continuous Surveillance of Hospital Infection Programme, was implemented in Spain, which later changed its name to INCLIMECC (Indicators of Continuous Quality Improvement). Currently many agencies such as the World Health Organization (WHO), in its Alliance for Patient Safety, or Quality Plan of the National Health System, focus their efforts on reducing hospital infections, with a strong emphasis on SSI.

Between 1 January and 31 December 2009, a study was conducted on hospital infection surveillance focused on SSI in 14 public hospitals of the Autonomous Region of Madrid, with the aim of measuring the rates of SSI and assessing the correct application of preoperative preparation and preoperative antibiotic prophylaxis protocols established at the hospitals and services under surveillance. This article describes the data obtained in the three participating hospitals that performed the procedure for monitoring open prostate surgery.

Materials and methods

We performed a prospective observational study including all patients undergoing open prostate surgery who were hospitalized ≥48 h from 1 January to 31 December 2009 in participating hospitals. They were monitored from admission to discharge. Surveillance of possible readmissions due to infection continued until 31 January 2010. The study included three acute hospitals of the Autonomous Region of Madrid. The hospitals that provided data on the surgery were the Ramón y Cajal University Hospital (1090 beds), the Fundación Alcorcón University Hospital (448 beds) and the Severo Ochoa de Leganés University Hospital (412 beds).

Data were collected by nursing staff belonging to the Preventive Medicine Services, specifically trained to this end, supervised and validated by medical specialists in preventive medicine. Information was taken from the medical records, nursing notes, clinical records, diagnostic techniques and microbiological results and direct contact with the medical and health team of the areas under surveillance.

A format predesigned by the INCLIMECC surveillance program was used for data collection, which includes demographic variables, intrinsic and extrinsic risk factors, surgical interventions according to the International Classification of Diseases 9th Clinical Modification Revision (ICD-9-CM), ASA risk, type of surgery (emergency or scheduled), antibiotic
Preoperative antibiotic prophylaxis is classified as adequate or inadequate according to each center’s antimicrobial policy, established by Hospital and Antimicrobial Infection committees. Participating hospitals recommended a single intravenous dose of 2 g of cefazolin or amoxicillin clavulanate administered in the hour before surgery. In the case of allergies, the use of ciprofloxacin (500 mg), levofloxacin (500 mg) or vancomycin (1 g) was recommended. We considered the prophylaxis of choice to be inadequate when the antimicrobial used was not recommended in the center’s guidelines; inadequate for initiation when administered over 60 min before surgery, or thereafter, and inadequate duration when it extended beyond 24 h after surgery.

Preoperative preparation was described as “correct” if all the steps of the protocol in force at each hospital were complied with, “incorrect” if it they were not fully complied with (e.g., not washing with antiseptic soap, rinsing with antiseptic, or shaving the skin with a razor, etc.); “not prepared” if no steps had been taken, and if no information was provided in the medical record or if the surgical report stated “no record.” The definition criteria for SSI infections were established by the Centers for Disease Control and Prevention (CDC).

To calculate hospital stay and demographic variables, a descriptive statistical analysis was performed with calculation of central trend measurements (mean and median) and dispersion measurements for continuous variables; and in the case of categorical variables, frequency distribution was calculated. To determine the frequency of nosocomial infection cumulative incidence was calculated. Comparison of hospital stay between patients with and without infection was done using the nonparametric Mann–Whitney test.

Calculations were performed using SPSS 15.0 software.

Results

325 patients were included in the study, in which 330 surgical interventions were performed, as 4 patients were reoperated due to postoperative bleeding (one of them on two occasions). 100% of the interventions were programmed and reoperations were urgent. 3.08% of the patients were classified as ASA 1 risk, 73.54% as ASA 2 and 23.28% as ASA 3. The surgical interventions performed are listed in Table 1. The mean age was 67.06 years (±7.74) and mortality was 0%.

Of the patients operated, 11 developed a nosocomial infection of some type (3.38%). In total, 12 nosocomial infections were recorded: nine SSI, three urinary tract infections (UTI) and one case of postoperative pneumonia. Moreover, one patient developed a UTI that presented secondary bacteraemia.

The overall rate of SSI observed was 2.77% (9 infected patients), four with superficial infections (1.23%), one serious infection (0.31%) and four organ/space infections (1.23%).

The three UTIs were caused by different microorganisms, *P. aeruginosa* (also the cause of secondary bacteraemia), *E. faecium* and *Staphylococcus* sp. Samples were not taken from the patient with pneumonia. The most common microorganism isolated in the SSI cultures was *E. coli* in 55.6%, followed by *E. faecalis* (22.2%). The rest of the microorganisms isolated were *Acinetobacter iwoffii*, *E. cloacae*, *P. aeruginosar*, *S. epidermidis*, *S. aureus*, *S. aureus* resistant to methicillin (MRSA) and *Streptococcus* spp., each in 11.1% of the crop. In three of the SSI cultures (33%) more than one organism was isolated (a superficial SSI, a deep SSI and organ/space SSI).

0.62% (2) of the patients received no prophylaxis although it was indicated. The percentage of appropriate surgical prophylaxis both when indicated and as the antibiotic of choice, initiation and duration, for all patients who received it, was 47.42%. The main cause of inappropriate antibiotic prophylaxis was its election (55.4% of inappropriate prophylaxis were due to the choice of antimicrobial, 40.6% due to duration and 4% due to initiation). Antibiotic prophylaxis was maintained for an average of 2.2 days. The antimicrobials used as prophylaxis are shown in Table 2.

### Table 2 Antimicrobials used in preoperative prophylaxis.

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Proportion (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin + gentamicin</td>
<td>2.13% (7)</td>
</tr>
<tr>
<td>Amoxicillin – clavulanate</td>
<td>37.80% (124)</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>52.74% (173)</td>
</tr>
<tr>
<td>Cefacetril</td>
<td>0.61% (2)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>5.49% (18)</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>1.22% (4)</td>
</tr>
</tbody>
</table>

* Of the total prophylaxes administered (328).

### Table 1 ICD-9 CM codes included in the “prostatectomy” (PRST) procedure and surgical interventions carried out.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Interventions</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open prostate biopsy (60.12)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Suprapubic prostatectomy (60.3)</td>
<td>24 (7.38%)</td>
<td>0</td>
</tr>
<tr>
<td>Retropubic prostatectomy (60.4)</td>
<td>136 (41.85%)</td>
<td>6 (4.41%)</td>
</tr>
<tr>
<td>Radical prostatectomy (60.5)</td>
<td>161 (49.54%)</td>
<td>3 (1.86%)</td>
</tr>
<tr>
<td>Local excision of prostate lesion (60.61)</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>Perineal prostatectomy (60.62)</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>Other prostatectomy (60.69)</td>
<td>4 (1.23%)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>325 (100%)</td>
<td>9 (2.77%)</td>
</tr>
</tbody>
</table>

* Does not include transurethral resection.
Incidence of nosocomial infection in open prostate surgery

According to the data obtained from medical records, the percentage of correctly prepared patients was 92%. 1.4% was not prepared for surgery, 2% were incorrectly prepared and in 4.6% of the cases, the preparations implemented were not mentioned in the clinical record.

Average hospital stay was 9.6 days (±8.01), with a median of 8 days (interquartile range [IR]: 6–10). Patients who developed SSI had an average stay of 24.73 days (±17.27), with a median of 17 days (IR: 9.5–46.5) compared with an average stay of 9.09 days (±6.97) and a median of 8 days (IR: 6–10) of uninfected patients ($p$ = 0.01).

Discussion

The existence of an infection control program is a key part of healthcare and is a reflection of the standard of care provided at a center; moreover, SSIs prolong hospital stay, so any measure that helps to reduce their incidence will also decrease the mean hospital stay and therefore related costs.1,2

In our study, the incidence of SSI was 2.77%, with an overall hospital infection rate of 3.38%. The bibliography contains highly variable SSI rates in urological surgery, from 0.3% to 33%.3–16 In the studies conducted in Japan,3–11 the rates of infection generally found were higher than those of studies conducted in Europe or the U.S.,11–17 also generally with a higher number of surgical interventions, in which the SSI ranged from 0.3 to 3.2%, which is closer to ours.

In a study conducted at the Marqués de Valdecilla hospital in Santander between 2002 and 2005, also with patients that underwent open prostate surgery and with a similar methodology,18 SSI found was 4.36%, ranging from 2.06% in 2004 and 7% in 2003. With respect to the overall rate of hospital infection, the figures ranged from 6.62% in 2002 and 5.59% in 2004, with an average of 6.1%, slightly higher than what we found.

In retropubic prostatectomies, our rate (4.41%) did not differ from that found in other studies conducted outside Spain, which described rates of between 0.3 and 7.5%.11–13,15,16,19 This also occurred in the case of radical prostatectomy, with an SSI of 1.86% in the literature ranging from 1.6 to 2.3%.9,10,14,15

Despite being the most frequent infection related to the surgical wound, SSI has a lower rate than in other studies, 0.92%. For example, in the study conducted in Santander, the rate of SSI in urological surgery ranged from 2.75% to 4.07%, with a mean of 3.42%.18

The microorganisms most frequently isolated in SSIs were Gram-negative (E. coli and E. faecalis), as in most of the studies, except those conducted in Japan, where MRSA was the most common organism (11% in our study).9,11

Antibiotic prophylaxis is a proven effective measure to reduce the frequency of postoperative bacterial infections.20 Controlling the application of the prophylaxis is just as important as controlling its non-administration when it is indicated and errors in its use, which may result from incorrect choice (indication of the antibiotic administered), from the moment of administration and duration. The appropriate surgical prophylaxis, particularly its administration in the 60 min prior to the surgical incision, is one of the objectives proposed by different organizations, such as the WHO in its initiative, “Safe Surgery Saves Lives”, within the framework of its “World Alliance for Patient Safety.”21 In our study 0.62% of patients in whom antibiotic prophylaxis was indicated, did not receive it, a figure very similar to the 0.14% of the Ballestero Diego et al. study on the adequacy of antibiotic prophylaxis in Urology; however, our rate of adequacy of prophylaxis was far lower (47.42% vs. 83.16%).22

In the case of inadequate prophylaxis, the most common reason for it is the incorrect choice of antimicrobial, although all centers have established recommendation protocols. This is followed by extended prophylaxis, lasting a mean of 2.2 days. Numerous studies have been carried out in urological surgery, comparing short antimicrobial prophylaxis guidelines to those of prophylaxes lasting several days; no advantage was found in their extension and the European Association of Urology recommends a single preoperative dose of prophylaxis in clean-contaminated surgery.23–26

Preoperative preparation of the patient comprises a set of measures that are routinely practiced following the protocols established in the rules of each hospital. The different measures include the patient showering or bathing with antiseptic soap, as well as preparing the patient’s skin with antiseptic solution to reduce the number of resident and transient bacteria to a minimum, thus reducing the risk of wound contamination and infection. It is comparable to the surgical team washing its hands. 92% of the patients studied had adequate preparation; this figure could be higher in 4.6% of the cases, as the patient’s preparation was not mentioned in the clinical record. Most studies published focus on antibiotic prophylaxis, whereas little research has been carried out on compliance with preoperative patient preparation protocols.

One limitation of this study is the absence of active post-discharge surveillance, as it was not feasible to use a uniform method at all the centers due to their characteristics. We believe that using a different methodology at each participating hospital, tailored to its particular characteristics and those of its health area would provide very different and difficult to collect data, especially if the patient’s subjective opinion is taken into account, which has proven not to be too reliable.27,28 Because of this, and for the lack of a robust and standardized post-discharge surveillance method, we decided not to carry it out.29,30 This may underestimate infection rates, especially after those procedures in which hospitalization is shorter. Infections that due to their seriousness led to readmission are included, which means that only the non-serious ones would have been missed, which would supposedly be superficial infections. As in other studies, we did not establish differences regarding other variables such as catheterization and bacteriuria after, which could increase the risk of UTIs.18

Hospital infection must continue to be monitored so as to analyze trends and to assess the impact of potential improvement measures to be carried out. Surveillance and control of infections associated with health care provide indicators that must be taken into account in health care quality and patient safety programmes and should be a goal that involves not only Preventive Medicine services.
but also each center’s management, surgeons and nursing staff.

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Conflict of interest

The authors declare that they have no conflict of interest.

References
