

Rate and risk factors of surgical site infections with antibiotic prophylaxis

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ABSTRACT

Objective: This study is aimed at determining the incidence of surgical site infections, with antibiotic use. Furthermore, to correlate infection with type of operations, length of intervention, number of stitches, pre-operative hospitalization, age and sex of the patient.

Methods: All Yemeni patients (N=601) who underwent surgical intervention, with preoperative antibiotic prophylaxis, at Al-Kuwait University Hospital, Sana'a, Republic of Yemen, during 1st August 2000 through to 30th November 2000 were followed up until stitch removal or discharge. Data was registered in a spreadsheet and processed statistically by statistical package for social sciences 10.0.

Results: Overall incidence of surgical site infections was 2.2%, 0.5% in clean operation, 2.8% in clean contaminated, 9.1% in contaminated and 2.3% in dirty operations. Surgical site infections were found positively correlated with duration of operation (P=0.015) and number of stitches (P=0.017), but insignificantly associated with sex, age, type of operation and pre-operative hospitalization.

Conclusion: In conclusion, surgical site infections, with antibiotic use, were found low. Higher number of stitches and longer duration of operation were the risk factors.

Keywords: Antibiotics use, risk factors, surgical site infection.

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Nosocomial infections, including surgical site infections (SSI), still form a large health problem even in the developed countries. Most of nosocomial infections including SSI contribute substantially to patient morbidity, mortality, prolonged hospital stay and prolonged therapy. Surgical site infections are the 2nd most common hospital acquired infections, accounting for 16% of nosocomial infections.¹ Surgical site infections prolong hospitalization from 1.5 to 16.6 days.² The estimated average cost of each SSI in the United States of America (USA) is \$2,739.³ In developing countries, like the Republic of Yemen, the importance of preventing nosocomial infections is more evident and very vital due to limited economic resources. Rates of SSI vary from country to country. In the Republic of Yemen the rate

of SSI was 7.6% in clean wound infection without prophylactic antibiotics.⁴ In the USA infection rates, with pre-operative antibiotics, ranged from 0.8%-1.3% and 10.2% for clean, clean contaminated and contaminated wound,¹ whereas in Britain the SSI rates were 1.3%-3.9% in clean, 3%-4% in clean contaminated, 8.5% in contaminated and 28%-40% in dirty operations.² In Poland, a case control study of 1527 surgically treated patients, revealed wound infection rate of 8.9%.⁵ In a study of SSI rate in the obstetrics and gynecology in the USA, revealed that 24 infections (5.2%) were detected out of 469 surgical procedures.⁶ In a prevalence study, in Italy, 79 (1.61%) nosocomial wound infections were recorded among 4983 operated patients.⁷ In Australia, 138 wound infections were diagnosed (incidence

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10.1%) of which less than one 3rd were before discharge and the remainder after discharge.⁸

The current study, is generally aimed at estimating the incidence of SSI and it's relation to factors such as patient, operation and hospital and specifically, to determine the incidence of SSI in clean, clean contaminated, contaminated and dirty operations. Moreover, to correlate SSI with patient's factors (age, sex, presence of medical diseases or drugs and type of operation), duration of intervention, length of preoperative hospitalization and number of stitches.

Methods. This is a cross-sectional comparative study, which includes 601 patients who were subjected to surgical intervention in Al-Kuwait University Hospital (KUH), Sana'a, Republic of Yemen, during the period 1st August 2000 through to 30th November 2000. They were followed up until discharge. The investigators collected data with regards to patient's age, data regarding patient's sex, number of stitches, site of operation and signs of inflammation were recorded after observation. Surgical site infection was defined according to Moriss and Malt.⁹ Types of surgery were classified to clean, clean contaminated, contaminated and dirty as cited by Howard.¹⁰ Length of intervention was calculated by the surgeon, and prophylactic antibiotic use by observing the therapeutic sheet. Statistical analysis was carried out using statistical package for social sciences (SPSS) 10.0 to calculate proportions and means. Differences between proportions were calculated using Chi Square and differences in means were calculated by T test. Differences were considered significant at P value less than or equal to 0.05.

Results. Mean age of the patients (N=601) was 33.66 ± 10.66 years, ranging from 1.5 to 90 years. Males comprised 51.2% with mean age of 31.35 ± 18.47 years and females constituted 48.8% with mean age of 36.06 ± 11.85 years. Rate of infection among males (1.6%) was statistically comparable with that (2.7%) among females (Chi square=0.85 and P= 0.36). The study revealed that the lowest rate of infection (0.5%) was found in clean interventions, whereas the highest rate (9.1%) was found in the contaminated operations (**Table 1**). It was found that the longer the duration of intervention, the higher the rate of SSI (**Table 2**). The study unveiled that the mean number of stitches among infected subjects was 9.11 ± 4.11 whereas among not infected was 4.28 ± 2.84 . This difference was found statistically significant (T= 3.00, P= 0.017). Pre-operative stay in the hospital was found statistically not associated with SSI (**Table 3**). Although the rate among elderly patients was greater than among patients less than 60 years, the difference was found statistically insignificant as shown in **Table 4**.

Table 1 - Surgical site infection according to type of operation in Al-Kuwait University Hospital, Sana'a, Republic of Yemen, 2000.

Type of operation	Infected N (%)	Not infected N (%)
Clean	1 (0.5)	192 (99.5)
Clean contaminated	10 (2.8)	344 (97.2)
Contaminated	1 (9.1)	10 (90.9)
Dirty	1 (2.3)	42 (97.7)
N - number Likelihood ratio - 5.6 P - 0.132		

Table 2 - Surgical site infections according to duration of operation in Al-Kuwait University Hospital, Sana'a, Republic of Yemen, 2000.

Length of operation	Infected N (%)	Not infected N (%)
< 1 hour	2 (0.7)	272 (99.3)
1-2 hours	6 (2.4)	242 (97.6)
> 2 hours	5 (6.8)	66 (93.2)
N - number Fisher Exact Test P - 0.015		

Table 3 - Surgical site infections according to pre-operative period in Al-Kuwait University Hospital, Sana'a, Republic of Yemen, 2000.

Pre-operative stay (Days)	Infected N (%)	Not infected N (%)
≤ 2	4 (1.2)	332 (98.8)
> 2	9 (3.4)	256 (96.6)
N - number Fisher Exact Test P - 0.089		

Table 4 - Surgical site infections according to age in Al-Kuwait University Hospital, Sana'a, Republic of Yemen, 2000.

Age in Years	Infected N (%)	Not infected N (%)
< 60	10 (1.8)	536 (98.2)
≥ 60	3 (5.5)	52 (94.5)

N - number
Fisher Exact Test
P - 0.107

Discussion. The study revealed an overall incidence of SSI of 2.2%. This rate did not vary greatly from that found in Italy (1.6%),⁷ but differed substantially from the rates found in Poland (8.9%)⁵ and Australia (10.1%).⁸ The rate found in Yemen may indicate to one 3rd of the case only,⁸ as they were followed up until discharge rather than 30 days according to the definition.⁹ Also, post-discharge wound infection surveillance is recommended. Within the type of operation, the incidence of SSI in clean surgeries (0.5%) was found lower than (7.6%) previous study conducted in the Republic of Yemen⁴ without the use of antibiotic prophylaxis. The incidence was also lower than that reported from the USA (0.8% with antibiotic use).¹ This low incidence may be attributed to the small sample size and early discharge of clean surgeries.

The significant positive association between SSI and duration of operation may be attributed to the procedure itself, tissue handling, exposure to airborne infections, decreased blood flow and suppressed immunity due to prolonged anesthesia. The positive correlation found between number of stitches and SSI may be due to the action of sutures as nodes for

infection especially at the knot, allowing bacteria to lodge themselves in its substance. Therefore, surgeons should stick to recommended pre and intra-operative measures and decrease number of stitches as reasonably practicable. Older ages, sex of the patient, type of operation and pre-operative admission period were not found risk factors. Larger sample size would elucidate this relationship.

In conclusion, SSI, with antibiotic use, was found low. Higher number of stitches and longer duration of operation were the risk factors.

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