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Microbiology

Surgical Wound Infections: A Prospective Hospital Based Study

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ABSTRACT

A prospective study of 916 surgeries were conducted. All the wounds were examined for the presence of infection in all the 916 surgeries, out of which 840 normal surgeries and seventy six infected surgical wound infections were studied.

The overall infection rate was 8.29%. The surgical infection rate in the wounds following clean surgery (class I) was 3.4%, that in clean contaminated surgeries (class II) was 7.77%, that in contaminated surgeries (class III) was 16.49% and that in dirty (class IV) surgeries was 24.67%.

In the present study, the rate of infection in the emergency surgeries was not significantly higher than that in the planned and elective surgeries. The infection rate was seen to be the maximum when the duration of the pre-operative hospitalization was increased. There was a significant increase in the rate of infection as the duration of the surgeries increased. This study shows that the infection rate was higher in patients (9.98%) in whom prophylactic antibiotics were not given. The infection rate was highest in post appendicectomy wounds and lowest in wounds following hydrocele surgeries. The commonest isolates from the surgical wound infections was *Staphylococcus aureus* and *E.coli*, followed by *Pseudomonas aeruginosa* and *Klebsiella pneumoniae.*

Key Words: Surgery, Morbidity, Emergency, Antibiotics

INTRODUCTION

Despite an improved understanding of the patho-physiology and improved methods of prevention and prophylaxis, surgical wound infections remain the most common cause of post operative morbidity and mortality [1].

A surgical wound may get infected by the exogenous bacterial flora which may be present in the environmental air of the operation theatre or by the endogenous flora [2]. Surgical wound infection remains one of the most important post-operative complications, accounting for 10 to 20% of the hospital costs. Although total elimination is not possible, a reduction in the infection rate to a minimal level could have significant benefits in terms of both the patient comfort and the medical resources which are used [3]. The rate of infection of the surgical wounds is influenced by the duration of the pre-operative hospitalization administration of the prophylactic antibiotics, the duration of the surgery and by the fact as to whether the surgery was emergency or elective, patient factors and environmental factors, both local and general, like age and nutritional status; preexisting illnesses also determine the final outcome. The present study was aimed at obtaining the incidence of the surgical wound infections, determining the antibiotic susceptibility pattern of the micro-organisms which were isolated and determining the factors which were influencing the infection rate.

MATERIALS AND METHODS

The present study was conducted at the Kesar Sal Medical College and Research Centre, Ahmedabad, Gujarat, between September 2010 and May 2011. The study group included all the clean and clean contaminated surgeries and the contaminated and dirty surgeries which were conducted in this hospital during that period. The samples were collected from those patients who showed an evidence of surgical wound infections like a serous, sanguinous or purulent discharge, soaked dressings or gaping wounds.

The swabs were collected from the infected wounds and were processed without delay by using standard microbiological methods [4].

The CDC criteria were used for defining the type of the wounds [5]. The details of the surgeries, including the preoperative hospitalization, the duration of surgery, whether it was emergency or elective and the antibiotic therapy which was received, were recorded.

The CDC criteria for defining the type of the surgical wounds are as follows: [5]

Class I: Operative wound, clean. Non-traumatic wound in which no inflammation was encountered, no break technique occurred and the respiratory, alimentary and genitourinary tracts were not entered into.

Class II: Operative wound, clean contaminated. done Traumatic wound in which a minor break occurred in the technique or in which the gastrointestinal, genitourinary or the respiratory tracts were entered into without significant spillage. It includes the transaction of the appendix or the cholecystic duct in the absence of acute inflammation and entrance into the genitourinary or the biliary tracts in the absence of infected bile or urine. Hysterectomy was included in this category.

Class III: Operative wound, contaminated. Any fresh trauma wound from a relatively clean source or an operative wound in which there was a major break in the technique, gross spillage from the

gastrointestinal tract or entrance into the genitourinary or the billiary tracts in the presence of infected urine or bile. This included the incisions which encountered acute, non purulent inflammation.

Class IV: Operative wound. dirty. Traumatic wound from a dirty source or delay in the treatment, faecal contamination or foreign body or retained devitalized tissue. Also included operative wounds in which an acute bacterial inflammation or a perforated viscus was encountered or in which clean tissue was transected to gain access to a collection of pus.

RESULTS

In all, 916 surgical wounds were studied. The overall infection rate in these wounds was 8.29%. The infection rate in the wounds following dirty class (24.05%) surgeries was significantly higher, followed by the contaminated (16.49), clean contaminated (7.77%) and clean surgeries (3.4%) respectively [Table/Fig-1]. The infection rate was directly proportional to the preoperative hospitalization.

Type of surgery	Surgeries performed	No of infected cases	% infection rate
1. Clean	382 (41.7%)	13	3.4%
2. Clean contaminated	360 (30.45%)	28	7.77%
3. Contaminated	97 (19.21%)	16	16.49%
4. Dirty	77 (8.62%)	19	24.67%
Total surgeries	916	76	8.29%

[Table/Fig-1]: Analysis of Infection rate related to wound type

The maximum infection rate was observed in patients who were hospitalized for more than 3 days i.e. (19.65%) [Table/Fig-2]. The infection rate was less (6.17%) in those who received the antibiotics prophylactically in the form of parenteral administration than in those who did not receive them (9.98%) [Table/Fig-3].

Preoperative hospitalization	Surgeries performed	No of infected cases	% infection rate
Up to 1 day	295 (32.2%)	17	5.76%
1-2 days	504 (55.02%)	36	7.14%
> 3days	117 (5.34%)	23	19.65%

[Table/Fig-2]: Preoperative stay and infection rate

Preoperative administration of antibiotics	No of patients	No of Infected	Infected No
Antibiotics not administered	511 (55-78%)	51	9.98%
Antibiotics administered	405 (44.21%)	25	6.17%
Total	916	76	

[Table/Fig-3]: Preoperative Antibiotic therapy and infection arte

The infection rate in the surgeries of more than 2 hrs duration was highest (10.30%) than in the surgeries of 1 hr duration [Table/Fig-4].

Duration of surgery in hours	Surgeries performed	No of infected cases	% infection rate
0-1	169 (18.44%)	8	4.73
1-2	525 (57.31%)	45	8.57
>2hrs & more	222 (24.23%)	23	10.36
	916	76	

[Table/Fig-4]: Duration of surgeries and infection rate

The infection rate was more in the wounds following the emergency surgeries (8.58%) than those following the planned, elective surgeries (7.9%) [Table/Fig-5] but this rise was insignificant. The infection rate was highest in the post-appendicectomy wounds, while it was lowest in the wounds following the surgeries of the hydrocele [Table/Fig-6] *Staphylococcus aureus* was the commonest isolate which caused the surgical wound infections, followed by *E coli*, *Pseudomonas* and *Klebsiella* [Table/Fig-7]. All the isolates were resistant to the commonly used antibiotics.

Type of surgery	Surgeries performed	No of infected cases	% infection rate
Emergency	524 (57.2%)	45	8.58%
Elective	329 (42.79%)	31	7.9%

[Table/Fig-5]: Incidence of infection rate inflective and Emergency surgeries

Surgery	Total no of surgeries performed	No of infected	%
L.S.C.S.	264	9	3.40%
Mastectomy	94	9	95.7%
Amputation	55	6	10.1%
Hepatobiliary	51	6	11.76%
Hernia surgeries	61	6	9.83%
Sympathectomy	37	4	10.81%
Hydrocele surgeries	49	1	2.04%
Laporatomy	66	8	12.12%
Appendicectomy	125	19	15.2%
Prostatectomy	78	6	7.69%
Renal surgeries	36	2	2.77%
Total		76	

[Table/Fig-6]: Infection rate in various surgeries

Organisms	No of isolated	%
Staphylococcus aureus	19	21.59%
E coli	19	21.59%
Pseudomonas aeruginosa	15	17.04%
Klebsiella pneumoniae	13	14.77%
Acinetobacter	6	6.81%
Coagulase-negative Staphylococci	5	5.68%
Non-haemolytic Streptococci	4	4.54%
Klebsiella oxytoca	3	3.4%
Citrobacter fruendi	2	2.27%
Yeast	1	1.13%
Diphtheroids	2	2.27%
Total	88	

[Table/Fig-7]: Frequency of various pathogens causing surgical wound infections.

No of organisms	No of cases
No growth	12
One	42
Two	19
Three	3
Total	76

[Table/Fig-8]: Twelve cases shows no growth: 64 showed culture positive One isolate in 42 cases, two in 19 and 3 were grown in 3 cases.

DISCUSSION

916 Surgeries were studied, which included 840 normal surgeries and 76 infected surgical wound infections. The overall infection rate in the present study was 8.29%. This was in agreement with the overall infection rate which ranged from 2.8% to 20.19% in other studies [6], [7], [8]. The rate of infection for clean surgeries (class I) was 3.4%, for the clean contaminated (class II) surgeries, it was 7.77%, for the contaminated (class III) surgeries, it was 16.49% and for the dirty (class IV) surgeries, it was 24.67%. These results were similar to those of Anvikar et al and Olsen Marry et al [6],[7],[8],[9]. In the present study, the maximum number of surgeries which were performed was emergency surgeries (57.2%) and the infection rate was found to be 8.58% in the emergency surgeries, which was slightly more than those in the elective surgeries. This was similar to the findings from the studies of Anvikar A.R. 1999 (4.66%) and Jim Ko G Moodley (14.6%) [7].

The pre-operative infection rate in the present study in less than one day was 5.76%, in one to two days, it was 7.14% and in more than 3 days, it was 19.65% i.e. the highest. This was found to correlate with those from the studies of Shrivastava et al (1969) ie. 33% for more than 3 days, of P L Nandi et al (1999) ie. 18% and of Cruise and Foord et al [6],[9],[10],[11] respectively.

In the present study, it was seen that the infection rate was higher (9.98%) in patients in whom the prophylactic antibiotic was not given. This study concludes that the administration of prophylactic antibiotics had an effect on the decrease in the surgical wound infection rate, as the infection rate in patients who were given the prophylactic antibiotics was 6.17%. The findings of this study correlated with the findings of Polk HC, et al (1969) [12], and those of P.L. Nandi et al (1999) [11]. The rate of infection in the surgical wounds was directly related to the duration of the surgeries [13]. The present study showed that a maximum number of cases were infected when the surgery was prolonged for 2 hrs or more than two hours (10.36%). The infection rate when the duration of the surgery was less than one hr, was 4.73% and when it was less than two hrs, it was 8.57%. Similar findings were reported by S.P. Srivastara et al [10] and Anviker et al [7].

Staphylococcus aureus (21.5%) and *E coli* (21.5%) were the commonest pathogens which were isolated, followed by Pseudomonas aeruginosa (17.04%) and *Klebsiella pneumoniae* (14.77%). Similar findings were recorded by S.P. Srivastava et al and S.V.Bhatia et al [14].

The infection rate was highest in the post-appendicectomy wounds (18.4%). An additional risk factor for wound sepsis following appendicectomy was the inflammatory process in the appendix [15]. Various studies have described infection rates from 9.7 to 33.3% in the post appendicectomy wounds [16],[17].

All the isolates were resistant to the commonly used antibiotics.

CONCLUSION

Surgical wound infections are common and they consume a considerable pattern of the health care finances. Although the infection rate can be reduced by the judicious use of antibiotic prophylaxis, the use of organized systems of wound surveillance and reporting is an effective means to reduce the wound infections.

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