Surgical Wound Infections in Patients of Tribhuvan University Teaching Hospital

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Abstract

Introduction Surgical wound infection, a common post-operative complication, which causes significant postoperative morbidity and mortality, prolongs hospital stay and adds extra hospital costs.

Objective To isolate, identify & study the antibiotic sensitivity pattern of the microorganisms from surgical wounds of patient admitted in different wards of Tribhuvan University Teaching Hospital.

Methods A total of 189 wound swab samples were collected and processed at Microbiology Laboratory Tribhuvan University Teaching Hospital, during June 2001 to June 2002. The microorganisms were isolated, identified and antibiotic sensitivity pattern of the isolates was performed, using standard methodology.

Results The study found that rate of surgical wound infection was 4.7% (189/3988). The highest infection rate was found in male surgical ward and lowest in post- operative ward. The predominant isolates were *Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, Acinetobacter* spp., *Citrobacter fruendii* and *Proteus mirabilis*.

Conclusion Male surgical ward was found to be ward with high incidences of nosocomial infection; hence hospital disinfection & treatment protocols should be practiced vigorously & monitored regularly by hospital infection control committee to keep the incidences in control.

Keywords Surgical site, Mortality, Morbidity, Infection, Microorganisms.

Introduction

Any purulent discharge from a closed surgical incision, together with signs of inflammation of the surrounding tissue should be considered as wound infection, irrespective of whether microorganisms can be cultured. Infection can occur at an incision site within 30 days of an operation, but wounds that are closed and primarily healed are not considered infected[1]. There are many factors that are thought to affect the susceptibility of any wound to infection, some of which strongly predispose to wound infection. These factors include pre-existing illness, length of operation, wound class and wound contamination. Other factors such as extremes of age, malignancy, metabolic diseases, malnutrition, immuno-suppression, cigarette smoking, remote site infection, emergency procedures and long duration of preoperative hospitalization are not considered as independent risk factors for wound infection.[2]

Surgical wound and skin infections account for one third of the nosocomial infections among surgical patients. Gram-negative organisms are more prevalent than gram-positive organisms. A nosocomial surgical wound infection lengthens the hospitalization by an average of 7.4 days and raises the cost of hospitalization by more than 800 dollars.[3]

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The study conducted in Bir Hospital, Nepal in 1994 to find out the nature of organisms responsible for wound infection in post-operative patients and their antibiotic sensitivity. The study revealed that majority of the organisms causing wound infection were gram negatives.[4]

Resistance emerges from imprudent over-utilization of antibiotics trying to sterilize the environment. Under treatment can also be responsible. Excessive and inappropriate use of antibiotics is reported even in countries where antibiotics are available only on prescription. In many developing countries, antibiotics use is unregulated and prescribing is often inappropriate. Free availability and self medication of antibiotics, lack of or difficult access to health facilities, inadequate public awareness, uncontrolled antibiotics use in agriculture, lack of adequate AMR surveillance and lack of updated national antibiotic policies and guidelines are added worries. Antibiotics are commonly used in animals for prophylaxis or as performance enhances. Such usage doesn't attain therapeutic levels and is likely to increase the development of resistance. Human Factors such as international Travel, movement of patients from hospitals to community, improper disposal of infectious wastage and unhygienic behaviors contribute to fast spread of AMR as well as infectious diseases.[5]

Methodology

The swab/pus samples from infected surgical wound were collected from post-operative ward, male surgical ward, female surgical ward, and Neuro-ward. Altogether 189 infected surgical wound swab were collected during June 2001 to June 2002 and tested for the presence of bacterial pathogens. Clinical samples were tested in Clinical Microbiology Laboratory, Tribhuvan University Teaching Hospital.

The swabs were inoculated in blood agar, MacConkey agar and cooked meat medium. The inoculated blood agar plates and Mac Conkey agar plates were incubated at 37^0c for 24 hours. Inoculated cooked meat mediums were incubated at 37^0c upto 72 hours.

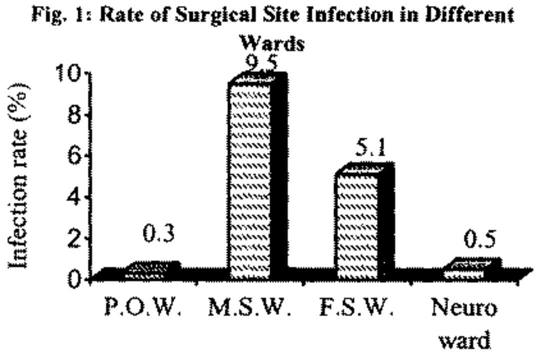
Blood agar, Mac Conkey agar and cooked meat medium were observed for growth of micro-organisms. The cooked meat medium was observed for growth of anaerobes. The cooked meat medium was incubated upto 72 hours and if there was no growth, that was reported growth negative. The isolates were identified by standard diagnostic procedure.[6] The antibiotic sensitivity pattern of isolates was performed by NCCLS recommended Kirby-Bauer disc diffusion method.[7]

Results

Table 1. Rate of surgical site infection in different wards

S.N.	Wards	No. of patients admitted	No. of infections	Infection rate	Average days spent in ward
1	P.O.W.	2017	6	0.3%	1
2	M.S.W.	1021	97	9.5%	6.9
3	F.S.W.	1498	76	5.1%	9
4.	Neuro-ward	1469	8	0.5%	14.9

Fig. 1: Rate of Surgical Site Infection in Different Wards



Among the studied wards, the rate of hospital acquired wound infection were 0.3%, 9.5%, 5.1% and 0.5% in post-operative ward, male surgical ward, female surgical ward and Neuro-ward respectively. The patients on average spent 1 day in P.O.W., 6.9 days in M.S.W, 9 days in F.S.W. and 14.9 days in Neuro-ward.

In the post-operative ward, 6 surgical wound infections were recorded including 3 from males and 3 from females. One sample contained mixed infection where as other included single isolates. *Pseudomonas aeruginosa* was found predominant 3/7 (42.9%) followed by *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae* and *Acinetobacter* spp, each of 1 isolate.

In male surgical ward, 97 cases of surgical wound infection were noted. 103 organisms were isolated including double isolates from 5 specimens. The surgical wound infective microorganisms in male surgical ward were found *Staphylococcus aureus* and *Pseudomonas aeruginosa* as predominant each contributing 25 (24.3%) infections. *Escherichia coli* was second dominant pathogen causing 24 (23.3%) infections followed by *Klebsiella pneumoniae* 10 (9.7%) and *Acinetobacter* spp 7 (6.8%). Other causative agents of surgical wound infection were *Citrobacter* spp., *Proteus mirabilis, Staphylococcus epidermidis, Aeromonas hydrophila* and *Streptococcus faecalis*.

From the Female surgical ward, 76 cases of surgical site infection were detected throughout the study period including 79 bacterial isolates. *Escherichia coli* was found predominant pathogen 21 (26.6%) followed by *Staphylococcus aureus* 19 (24.1%), *Pseudomonas aeruginosa* 10 (12.7%), *Klebsiella pneumoniae* 10 (12.7%), *Acinetobacter* spp. 7 (8.9%), *Citrobacter fruendii* 5 (6.3%), *Proteus mirabilis* 3 (3.8%), *Klebsiella oxytoca* 2 (2.5%), *Proteus vulgaris* 1 (1.3%) and *Citrobacter diversus* 1 (1.3%). 3 specimens were found containing double isolates.

In Neuro-ward, total 8 cases of surgical wound infection were observed throughout the study period. Those cases included 7 from males and 1 from female. *Staphylococcus aureus* was found predominant 4 (50%) followed *Klebsiella pneumoniae* 2 (25%) and *Escherichia coli, Pseudomonas aeruginosa* 1/1 each 12.5%.

Table 2. Microorganisms involved in surgical site infections

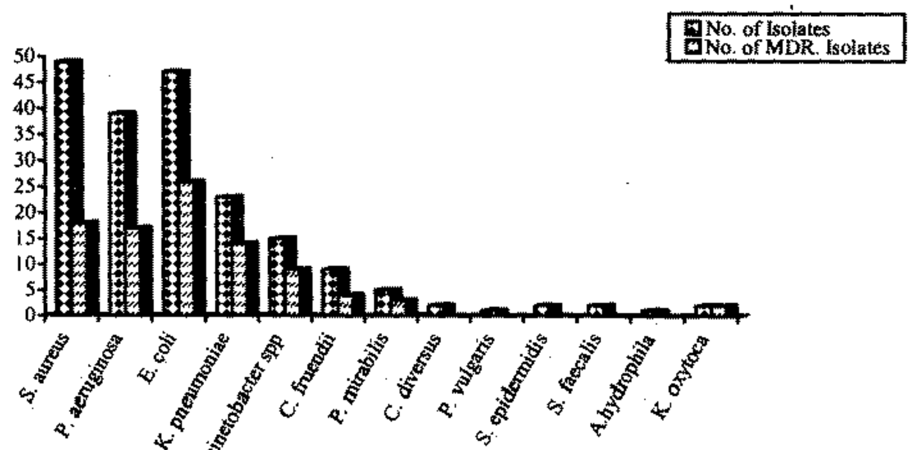
S.N.	Microorganisms	No. of isolates	No. of MDR isolates
1	*Staphylococcus aureus*	49 (24.9%)	18 (36.7%)
2	*Pseudomonas aeruginosa*	39 (19.8%)	17 (43.6%)
3	*Escherichia coli*	47 (23.9%)	26 (55.3%)
4.	*Klebsiella pneumoniae*	23 (11.7%)	14 (60.9%)
5.	*Acinetobacter* spp.	15 (7.6%)	9 (60.9%)
6.	*Citrobacter fruendii*	9 (4.6%)	4 (44.4%)
7.	*Proteus mirabilis*	5 (2.5%)	3 (60.0%)
8.	*Citrobecter diversus*	2. (1.0%)	0 (-)
9.	*Proteus vulgaris*	1 (0.5%)	0 (-)
10.	*Staphylococcus epidermidis*	2 (1.0%)	0 (-)
11.	*Streptococcus faecalis*	2 (1.0%)	0 (-)
12.	*Aeromonas hydrophila*	1 (0.5%)	0 (-)
13.	*Klebsiella oxytoca*	2 (1.0%)	2 (100%)
	Total	197	93 (47.2%)

The *Staphylococcus aureus* isolated from post-operative ward was found MDR and sensitive to only vancomycin. Gentamicin was found effective against gram negative isolates. Among *Staphylococcus aureus* isolated from Male surgical ward, ceftriaxone and cloxacillin were found effective. *Pseudomonas aeruginosa* were 100% sensitive to imipenem and polymixin B. 70% isolates were sensitive to ceftazidime. Gentamicin and amikacin were found effective against *Escherichia coli*.

Among bacterial isolates from Female surgical ward amikacin, imipenem were found effective against *Escherichia coli, Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Vancomycin was effective against *Staphylococcus aureus*. Cloxacillin and cefotaxime were also effective against *S. aureus*.

Among Neuro-ward isolates *Staphylococcus aureus* were sensitive to cloxacillin and cephalexin.

Fig. 2: Microorganisms involved in surgical site infections



One hundred ninety seven microorganisms were isolated from 187 infections of surgical wound. *Staphylococcus aureus* (49/197;24.9%) was found dominant followed by *Escherichia coli* 47/197 (23.9%), *Pseudomonas aeruginosa* 39/197 (19.8%), *Klebsiella pneumoniae* 23/197 (11.7%), *Acinetobacter spp* 15/197 (7.6%), *Citrobacter fruendii* 9/197 (4.6%), *Proteus mirabilis* 5/197 (2.5%), *Citrobacter diversus* 2/197 (1.0%), *Proteus vulgaris* 1/197 (0.5%), *Staphylococcus epidermidis* 2/197 (1.0%), *Streptococcus faecalis* 2/197 (1.0%), *Aeromonas hydrophila* 1/197 (0.5%) and *Klebsiella oxytoca* 2/197 (1.0%).

The microorganisms resistant to four or more than four commonly used antibiotics were considered Multidrug resistant (MDR). The MDR isolates were *Staphylococcus aureus* 18/49 (36.7%), *Pseudomonas aeruginosa* 17/39 (43.6%), *Escherichia coli* 26/47 (55.3%), *Klebsiella pneumoniae* 14/23 (60.9%), *Acinetobacter* spp 9/15 (60.0%), *Citrobacter fruendii* 4/9 (44.4%), *Proteus mirabilis* 3/5 (60.0%) and *Klebsiella oxytoca* 2/2 (100.0%).

Discussion

Surgical wound infection is a common post-operative complication and causes significant
Post-operative morbidity and mortality, prolongs hospital stay and adds between 10% and 20% to hospital costs. Although the total elimination of wound infection is not possible, a reduction in the infection rate to a minimal level could have significant benefits in terms of both patient comfort and medical resources used.[8]

Among 3988 patients undergo surgery, 187 (4.7%) were found infected at surgical site. The result of surgical site infection were found 2.6% in West Indies[9], 3.4% in volunteer general surgical units in Northern France.[10] In two urban hospital in Hanoi in Vietnam, SSI rate was found 10.9%[11] which were found higher than that our study.

The surgical site infection recorded in post-operative ward was 0.3%. The low infection rate in post-operative ward may be due to short period of stay in this ward. The surgical site infection rate was 9.5% on males and 5.7% on females. The higher rate of infection in males than in females was also observed in Beijing Hospital, China.[12] The surgical site infection rate was also found low in Neuro-surgery ward, however, average days spend on hospital by these patients was 14.9 days. The ward-wise study indicates in which medical disciplines, the problem of infection, are most serious, and where the control should be strengthened. It also provides a good basis for further detailed studies of hospital-acquired infections.

The SSI is caused by endogenous flora (normal flora) of human or by exogenous flora. The normal flora can become opportunistic pathogen in immunocompromised patients. They have high frequency to develop antimicrobial resistance since they are subjected to several antibiotic therapies. The pre-operative and post-operative antibiotic treatment may be responsible to develop MDR bacteria if the treatment is inappropriate. The exogenous flora present in hospital environment such as in air, water, and equipments may also be source of infection. The sterilization of equipments before and after use is much more important otherwise it can lead to cross-infection. The disinfection of hospital water supply before distribution is also essential.

Among the total microorganisms causing hospital acquired surgical site infections, gram negative (73%) were predominant than gram positives (27%). *Staphylococcus aureus*, a gram positive cocci was predominant. *Escherichia coli* and *Pseudomonas aeruginosa* were also frequent isolates of surgical wound infection. This result is consistant with the result of a similar study carried at Bir hospital during 1994.

Multiple drug resistant (MDR) bacterial infections are being increasingly reported from all parts of the world. Multi resistant microbes are an important cause of hospital-acquired infections. Infections associated with such organisms can pose a serious threat to vulnerable patients such as neonates, cancer patients and those who are immuno-compromised. Intensive care units (ICUs), burn units, high dependency units and infectious diseases care centers generally make frequent use of antimicrobial agents, resulting in great likelihood of resistance and multi drug resistance. In current study 47.2% of the isolates were found multi drug resistant to antibiotics.

Conclusion

The hospital acquired surgical site infection is alarming. It is essential to give specific attention in reducing SSI. Hospital disinfection & treatment protocols should be practiced vigorously & monitored regularly by hospital infection control committee to keep the incidences in control.

The development of multi drug resistance may be reduced by appropriate pre and post-operative antibiotic therapy.

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