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Surgical antibiotic prophylaxis in a teaching hospital in western Nepal

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Background: Inappropriate prophylaxis favours the emergence of resistant organisms. In a previous study many parameters were not explored. Hence the present study was carried out to obtain information on the common antibiotics used for surgical prophylaxis, assess the appropriateness of antibiotic use for different procedures, calculate the mean cost of antibiotics used for prophylaxis.

The prospective study was carried out over a four-month period (01.04.2004 to 31.07.2004) Manipal Teaching Hospital, Pokhara, Western Nepal.

Materials and Methods: Inpatients undergoing surgery in the departments of General Surgery, Obstetrics and Gynaecology, Otorhinolaryngology and Orthopaedics. The surgeries were classified as clean, clean-contaminated, contaminated and dirty. Appropriateness of prophylaxis was assessed. The percentage of patients receiving inappropriate prophylaxis was calculated.

Results: Antibiotics were used in 367 of the 371 patients who underwent surgeries. 241 surgeries (65%) were clean-contaminated, 65 (17.5%) were clean while 48 (12.9%) were contaminated. Internal fixations of fractures, circumcision, tympanoplasty, appendicectomy were common surgeries performed. Antibiotics were used for prophylaxis in 322 patients (86.8%) and for treatment in others. The fixed-dose combination of ampicillin and cloxacillin, metronidazole, gentamicin, ampicillin and cefotaxime were most commonly prescribed. The use of antibiotics was according to guidelines in 68 of the 322 patients (21.1%). The mean cost of antibiotics for prophylaxis was 11.2 US$. If a standard guideline had been followed the cost would have been reduced to 1.6 US$.

Conclusions: Problems were noted in the use of antibiotics for surgical prophylaxis. Framing of antibiotic use guidelines are required.

Key words: Antibiotics, Guidelines, Surgical antibiotic prophylaxis

Introduction

A major proportion (30-50%) of the antibiotics prescribed in hospital practice is used for surgical prophylaxis to prevent postoperative wound (surgical site) infection.[1] Surgical site infections (SSIs) have an enormous impact on patients' quality of life and contribute substantially towards the cost of medical care.[2] Up to 2-5% of patients undergoing clean extraabdominal operations and up to 20% undergoing intrabdominal operations will develop an SSI.[3] The reduction of SSI during the last 25 years has been attributed to improvements in aseptic and surgical techniques and to the use of prophylactic antibiotics.[4]

Surgical antibiotic prophylaxis (SAP) is defined as the use of antibiotics to prevent infection at the surgical site.[5] Appropriate antibiotic prophylaxis can reduce the risk of SSI but additional use also increases the selective pressure favouring the emergence of resistant organisms.[5] An ideal drug for SAP should prevent postoperative infection of the surgical site, prevent postoperative morbidity and mortality due to infection, reduce the duration and cost of health care, produce no adverse effects and should have no adverse consequences for the microbial flora of the patient

or the hospital.[6]

Antibiotic prophylaxis for surgery is a common reason for excessive prescribing in many hospitals.[7] Inappropriate prophylaxis is widely used and the use of prophylactic antibiotics is continued well beyond the required 12 to 24 hour post-surgical period.[7]

Previous studies in developed countries had shown non-adherence to the principles governing SAP.[8] Surgeons were reminded of the adverse effects of prolonged chemoprophylaxis in a review.[9] The medical fraternity administers antibiotics haphazardly, often ignoring evidence based guidelines and disregarding the boundaries between prophylactic and therapeutic administration.[10]

Studies in developing countries have documented inappropriate use of antibiotics for prophylaxis.[10,11] A previous study had looked at regimens used for SAP at the Manipal Teaching hospital and the Western Regional hospital, Pokhara, Nepal.[12] However analysis of the appropriateness and economic impact of the regimens and recommendations to improve prophylactic prescribing was not carried out in the previous study. The presence of SSI was not looked into and the culture and sensitivity patterns of isolated microorganisms were not studied.

Hence the present study was carried out to obtain

a) information on the common antibiotics prescribed for prophylaxis, and assess whether the use for prophylaxis was in accordance with the American Society of Hospital Pharmacists (ASHP) guidelines

b) calculate the average cost of antibiotics and the average cost if standard regimens of prophylaxis were followed and

c) obtain information on surgical site infection, the causative organisms and their sensitivity patterns

Materials and Methods

The hospital-based, prospective study was carried out over a four-month period (01.04.2004 to 31.07.2004) at the Manipal Teaching hospital, a 700-bedded tertiary care teaching hospital attached to the Manipal College of Medical Sciences, Pokhara, Nepal. The departments of General Surgery, Obstetrics and Gynaecology, Otorhinolaryngology and Orthopaedics were included in the study. Due to the low number of procedures performed the departments of Ophthalmology and Dental Surgery were excluded.

Case sheets of patients admitted to the departments included in the study during the four-month study period were analysed. Discharged case sheets of patients were analysed from the medical record department.

The inclusion criteria were all patients undergoing surgery after admission in the hospital in the departments of General Surgery, Obstetrics and Gynaecology, Otorhinolarynology and Orthopaedics were included. The exclusion criteria were patients undergoing outpatient surgical procedures and ophthalmic or dental surgery.

The age and sex of the patient, the condition for which they were operated on and the operation performed was noted. The presence of comorbid conditions which were likely to influence the clinical course was recorded. The address of the patient was noted. The common diagnoses and operative procedures carried out were recorded.

The use of antibiotics in dirty surgeries, for the treatment of SSI and to treat co-existing infections before and after the surgery was taken as use for treatment and not for prophylaxis.

The antibiotics prescribed for surgical prophylaxis were noted. The mean ± SD number of antibiotics was calculated. The percentage of patients receiving inappropriate prophylaxis was calculated. The proportion of patients who had parenteral antibiotic prophylaxis initiated within 1 hour before the surgical incision and the proportion of patients whose prophylactic therapy was discontinued within 24 hours after the end of the surgery was calculated. The presence of SSI during the period of hospitalization was noted. The mean ± SD number of days of hospitalization was calculated. The duration of prescribing of antibiotics was recorded.

The regimens used for the commonly performed surgeries were elucidated. The regimens followed for surgical prophylaxis were evaluated critically against various published guidelines.[2,13,14,15] The appropriateness of prophylactic regimens was evaluated against American Society of Hospital Pharmacists ASHP guidelines.[13] The choice of antibiotic was assessed based on the resident flora of the surgical site. The surgeries were classified as clean, clean-contaminated, contaminated and dirty according to the risk of infection[16] and the necessity for prophylaxis was assessed for each type of surgery. We analyzed whether pre-operative prophylaxis was given within one hour before the surgery and the dose of the drug used. The ASHP guideline recommends that post-operative prophylaxis for most procedures should be for 24 h or less following the completion of the surgery.[13] Failure to follow any of these criteria was taken as inappropriate prophylaxis.

The information was entered into a specially designed proforma. The analyses were carried out manually. The age and sex distribution of patients, timing and duration of pre-

and post-operative antibiotic use was analysed. The regimens used were noted. Descriptive analysis was carried out. The results were presented as percentages and mean.

The mean ± SD cost of antibiotic was calculated. The mean cost if the ASHP guidelines for surgical prophylaxis were followed was calculated. The organisms isolated from pus and other specimens sent for culture and sensitivity testing in the postoperative period was noted. The sensitivity patterns of the isolated organism were studied.

Results

Three hundred and seventy-one inpatients were operated on in the selected departments during the study period. One hundred and eighty were males. The maximum number of patients were admitted under the department of General Surgery [154 (41.5%)]. Ninety-one patients (24.5%) were admitted under the department of Otorhinolaryngology, 88 patients (23.7%) were admitted under Obstetrics and Gynaecology and 38 patients under Orthopaedics.

The age distribution of the patients is shown in Table 1. The maximum number of patients [102 (27.5%)] were in the age group of 20 to 30 years. One hundred and eighteen patients (31.8%) were from Pokhara city while 87 patients (23.4%) were from other areas of Kaski district. Thirty-three (8.9%), 28 (7.5%) and 22 (5.9%) patients were from the neighbouring districts of Syangja, Baglung and Tanahun respectively. The mean ± SD duration of hospitalization was 7 ± 3.7 days.

Table 1: Age distribution of inpatients who underwent surgery during the study period

Age group (in years)	Number of patients (Percentage)(n= 371)
< 1	0
1-5	16 (4.3)
5-10	33 (8.9)
10-20	71 (19.1)
20-30	102 (27.5)
30-40	56 (15.1)
40-50	44 (11.9)
50-60	25 (6.7)
≥ 60	24 (6.5)

Antibiotics were used in 367 of the 371 surgeries (98.9%) carried out during the study period. Two hundred and forty-one surgeries (65%) were clean-contaminated, 65 (17.5%) were clean while 48 (12.9%) were contaminated. Seventeen surgeries (4.6%) were dirty. Twenty-four surgeries were emergency procedures, the rest were elective surgeries.

Fractures (33 patients), chronic suppurative otitis media (31 patients), deviated nasal septum (24 patients) and problems with the progression of labour (23 patients) were common indications for surgery. The common surgeries performed were open reduction and internal fixation (ORIF) of fractures (32 patients), circumcision (18 patients), tympanoplasty (13 patients), appendicectomy (12 patients), lower segment caesarean section (LSCS) (12 patients), tonsillectomy (11 patients) and abdominal hysterectomy (11 patients).

The mean ± SD number of antibiotics prescribed was 2.9 ± 2.3. Antibiotics were used for prophylaxis in 322 patients (86.8%) and for treatment in 49 patients. The commonest antibiotics prescribed for surgical prophylaxis were metronidazole, the fixed-dose combination (FDC) of ampicillin and cloxacillin, gentamicin, ampicillin alone, cefotaxime and ciprofloxacin. The commonest antibiotics used for treatment were the FDC of ampicillin and cloxacillin, metronidazole, gentamicin and cefotaxime.

The commonest prophylactic antibiotic regimens used for commonly performed surgeries in our hospital are shown in Table 2. In many surgeries the use of antibiotics for prophylaxis varied depending on the operating surgeon. Antibiotics were used in 64 of the 65 clean procedures (98.5%), 239 of the 241 (99.2%) clean-contaminated procedures and 47 of the 48 (97.9%) contaminated procedures. All the dirty surgeries received antibiotics.

The timing of the first prophylactic antibiotic dose in the seven commonest surgeries carried out in the hospital is shown in Table 3. The duration of prophylactic antibiotic use in the same surgeries is shown in Table 4. The mean duration of antibiotic use for prophylaxis was 8.6 days and for treatment was 9.4 days. Antibiotics were prescribed on discharge from the hospital in 265 patients of the 371 patients (71.4%).

The use of antibiotics for prophylaxis was according to the ASHP guidelines in 68 of the 322 cases (21.1%). We did not assess the use of antibiotics for treatment for appropriateness.

The use of antibiotics for prophylaxis was inappropriate in 254 patients. The common reasons for inappropriateness are shown in Table 5. Only 68 of the 322 patients (13%) given antibiotics for prophylaxis received antibiotics postoperatively for a time duration less than 24 hours while 86 patients (26.7%) received prophylaxis for less than 48 hours. The use of prophylaxis beyond 24 hours postoperatively, improper choice of the antibiotic and no pre-operative prophylaxis were the common problems observed. Only 165 patients received parenteral antibiotics within 1 hour before the incision.

Table 2: Antibiotic regimen used in commonly performed surgeries

Surgery	Antibiotic regimen
Episiotomy	Cap. Ampiclox 500 mg 6 hrly. x 3d. Soframycin ointment LA BD x 7d
Lower segment Cesaerean section	Inj. Cefotaxime 1 g I/V BD x 2d, Inj. Metronidazole 500 mg I/V 8 hrly. x 2d, Inj. Gentamicin 80 mg I/V 12 hrly. x 5d T. Metronidazole 400 mg 8 hrly. x 3d, T. Cefotaxime 200mg BD x 3d
Tympanoplasty	Cap. Ampicillin 250 mg + Cloxacillin 250 mg QID x 1d (Pre-op)Cap. Ampicillin 250 mg + Cloxacillin 250 mg QID x 7d
Abdominal hysterectomy	(Inj. Cefotaxime 1 g + Inj. Metronidazole 500 mg + Inj. Genta 120 mg) I/V st. half an hour before surgery. Inj. Metronidazole 500 mg I/V 8 hrly. x 5d, Inj. Cefotaxime 1 g I/V 12 hrly. x 5d, Inj. Gentamicin 80 mg I/V BD x 5d.
Dilatation and evacuation	(Inj. Ciprofloxacin 200 mg + Inj. Metronidazole 500 mg) I/V st. half an hour before surgery. Inj. Ciprofloxacin 200 mg I/V BD x 2d, Inj. Metronidazole 500 mg I/V TID x 2d. T. Ciprofloxacin 500 mg BD x 5d, T. Metronidazole 400 mg TID x 5d
Circumcision	Inj. Ampicillin 500 mg I/V st. Inj. Ampicllin 500 mg I/V 6 hrly. x 1d, Inj. Cloxacillin 500 mg. I/V 6 hrly. x 1d. Cap. Ampiclox 500 mg 6 hrly. x 3d.
Open Reduction and Internal Fixation	Inj. Cloxacillin 500 mg I/V 6 hrly. x 3 d, Inj. Gentamicin 120 mg I/V OD x 3 d. Cap. Cloxacillin 500 mg 6 hrly. x 4 d

The mean ± SD cost of antibiotics used for prophylaxis in our study was 826.8 ± 323.4 Nepalese rupees (11.2 ± 4.3 US$). If the ASHP guidelines for antibiotic prophylaxis had been followed, the mean ± SD cost would have been reduced to 117.9 ± 84.2 Nepalese rupees (1.6 ± 1.1 US$).

SSI was reported in 24 patients during the period of hospitalisation. Pus was sent for culture and sensitivity testing in 12 cases while wound swab was sent in 3, high vaginal swab in 2 and drain fluid in one patient. *S.aureus*, *E,coli* and *P.vulgaris* were the common organisms isolated. The organisms were resistant to some of the commonly used antibiotics.

Table 3: Timing of the first prophylactic antibiotic dose in common surgeries

Surgery	Number of patients			Total
	Preoperative before 1h	Preoperative within 1 h	Post operative	
ORIF	1	5	20	26
Episiotomy	0	1	18	19
Circumcision	0	6	11	17
Dilatation & Evacuation	1	5	7	13
Tympanoplasty	7	2	2	11
Appendicectomy	6	0	6	12
LSCS	1	3	8	12
Tonsillectomy	10	0	2	12
Abdominal hysterectomy	5	7	1	13
Total	**31**	**29**	**75**	**135**

Table 4: Duration of prophylactic antibiotic use in common surgeries

Surgery	Number of patients					Total
	None	Single dose	Up to 24 h	Up to 48 h	> 48 h	
ORIF	0	1	2	0	23	26
Episiotomy	0	1	1	3	14	19
Circumcision	0	0	0	3	14	17
Dilatation & Evacuation	0	1	2	0	10	13
Tympanoplasty	0	0	1	0	10	11
Appendicectomy	0	0	0	0	12	12
LSCS	0	1	1	0	10	12
Tonsillectomy	0	0	0	0	12	12
Abdominal hysterectomy	0	0	2	0	11	13
Total	**0**	**4**	**986**	**116**		**135**

Table 5: Common reasons for inappropriateness of prophylactic regimens

Reason for inappropriateness	Number of patients (Percentage)*
Wrong choice of antibiotic	166 (44.7)
Long duration of post-operative use	236 (63.6)
No pre-operative prophylaxis	97 (26.1)
Long duration of Pre-operative prophylaxis	58 (15.6)
Prophylaxis not required	26 (7)
Inadequate dose given for prophylaxis	18 (4.8)
Pre-operative prophylaxis given before 1 h	3 (0.8)

* A single person may have had more than one problem

Discussion

Appropriateness of antibiotic prophylaxis is determined by the choice of antibiotics, route and timing of administration, duration of coverage and cost of the regimen.[10] Antibiotic prophylaxis for surgical procedures is a common reason for excess prescribing in many hospitals. The antibiotics are continued well beyond the required 12 to 24 hour post surgical period without clear indication other than the opinion of the surgeon.[7]Such prescribing patterns result in high rates of antibiotic exposure and can potentially lead to high colonization rates of resistant nosocomial microorganisms.[7]

In our hospital 6.5% of surgeries were emergency surgeries. 65% of surgeries were clean-contaminated, 17.5% were clean, 12.9% were contaminated and 4.6% were dirty. In a Turkish study, 4% of surgeries were emergencies, 70.7% were clean and 25.3% were clean-contaminated.[17] In our study 98.9% of the patients received antibiotic prophylaxis. This is higher than that reported in a Lebanese study where 84% of patients received antibiotics.[18] In our study 32 of the 65 clean procedures involved insertion of fixation devices and prophylaxis was recommended in these cases.

In our study the mean duration of hospitalization was 7 days and 2.88 antibiotics were prescribed per patient. Antibiotics were given for treatment in 49 patients (13.2%). In a study in four Dublin hospitals antibiotics were given in therapeutic courses in 29% of cases who received an antibiotic.[19] In an Indian study, the extent of use of antibiotic prophylaxis was 90%.[11]

Metronidazole, the FDC of ampicillin and cloxacillin, gentamicin, cefotaxime, ampicillin alone and cloxacillin alone were commonly prescribed. In a study in Africa, ceftriaxone followed by augmentin and cefotaxime were most commonly used for prophylaxis.[20] In Lebanon, cefazolin was most commonly prescribed (49%) followed by betalactamase inhibitor/penicllin (18%), cefuroxime (17%) and ceftriaxone (7%).[18] In our hospital only 10.5% of the antibiotics used for prophylaxis were cephalosporins which is less than that reported.[17,18] The number is less than the 22.2% reported previously.[12] The FDC of ampicillin and cloxacillin was used in 100 patients for prophylaxis and in 20 patients for treatment. A problem was the use of an inadequate dose of each individual drug (ampicillin, cloxacillin) in the FDC in 18 patients.

The mean duration of antibiotic use for prophylaxis was 8.6 days and only 68 and 86 patients received post-operative antibiotics for a time period less than 24 and 48 hours. The mean duration was comparable to a Spanish study where the duration was 8.4 days.[21] Published evidence demonstrates that antibiotic prophylaxis after wound closure in unnecessary and studies comparing single-dose prophylaxis with multiple-dose prophylaxis has not shown benefit of additional doses.[22]

A panel of experts has developed three performance measures for antibiotic prophylaxis in surgery.[23] They are a) the proportion of patients who have parenteral antibiotic prophylaxis initiated within 1 h before surgical incision b) the proportion of patients who received prophylaxis consistent with currently published guidelines and c) the proportion of patients whose prophylactic antibiotic was discontinued within 24 h after the end of the surgery.[23] Only 63.7% of patients in our hospital received parenteral antibiotics within one hour before incision and the antibiotics were discontinued after 24 h in only 13% of patients. In a Turkish study, in 39% of procedures the first dose was not administered during induction of anaesthesia and duration of prophylaxis was longer than 24 h in 80%.[24]

The common regimens used for prophylaxis in our study were different from those used in a previous study.[12] In the absence of standard guidelines for prophylaxis, the choice is often left to the individual surgeon. In a study in Malaysia a combination of cefoperazone plus metronidazole was most commonly used for prophylaxis in colorectal surgery and cholecystectomy.[10] Coamoxiclav was most commonly used in inguinal hernia repair.[10] In our study only 13% of patients received treatment according to the published guidelines. The choice of the antibiotic not according to the resident flora at the site of surgery, inadequate dose and long duration of postoperative prophylaxis were the problems observed.

The mean ± SD cost of antibiotics used for prophylaxis and treatment were 11.2 ± 4.4 US$ and 16.1 ± 4.8 US$ respectively. If the use for prophylaxis was according to the published guidelines the mean ± SD cost would be 1.7 ± 1.1 US$. There can be substantial cost savings on switching over to standard regimens.

SSI was reported in 24 cases (6.5%) during the period of hospitalisation. The organisms studied were low but resistance was reported to the commonly used antibiotics. We plan to study SSI in detail in a future study.

Our study had many limitations. The departments of Dentistry and Ophthalmology were not included due to the low number of surgeries performed. The number of surgeries covered was low. The organisms isolated on culture and sensitivity testing was low and it would be difficult to extrapolate the results. SSI was documented only during the period of hospitalization and the patients were not followed up for a period of 30 days as recommended by the SIGN guidelines.[14]

Conclusions

Formulation of guidelines for surgical antibiotic prophylaxis for the hospital is urgently required. A multidisciplinary team of surgeons, microbiologists, infection control specialists, pharmacologists and pharmacists should be involved in framing, adapting or adopting the guidelines. The guidelines should be widely disseminated within the hospital and a committee should be formed to monitor adherence to the guidelines.

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