

# Perioperative Prophylactic Antibiotics in Orthopaedic Surgery.

Bikram Prasad Shrestha<sup>1</sup>, Surya Raj Niraula<sup>2</sup>, Parvin Nepal<sup>1</sup>, Guru Prasad Khanal<sup>1</sup>, Navin Karn<sup>1</sup>, Pashupati Chaudhary<sup>1</sup>, Raju Rijal<sup>1</sup>, Rajiv Maharjan<sup>1</sup>.

<sup>1</sup>Department of Orthopaedics, B.P.Koirala Institute of Health Sciences, Dharan, Nepal; <sup>2</sup>School of Public Health and Community Medicine, B.P.Koirala Institute of Health Sciences, Dharan, Nepal

## ABSTRACT

**Introduction:** In our country, various institutes have different protocols for postoperative antibiotics. Many western literature have mentioned that administration of prophylactic antibiotics for longer than 24 hours has no advantage and may actually lead to superinfection with drug-resistant organisms. Because of environmental and theater condition most of the surgeon here are very reluctant to use prophylactic antibiotics for only 24 hours. The objective of the study was to find out the effect of duration of prophylactic antibiotics on the rate of surgical site infection in clean elective orthopaedic surgeries.

**Methods:** This was a randomized controlled trial involving 207 clean elective orthopaedic patients undergoing surgery. The patients were divided into three groups which received intravenous prophylactic antibiotics for 24 hours, 48 hours and 48 hours followed by 7 days of oral antibiotics respectively. The patients were followed up for three months postoperatively.

**Result:** There was no significant difference in the rate of surgical site infection among the three groups.

**Conclusion:** We conclude that there is no benefit in prolonging prophylactic antibiotics beyond 24 hours.

**Keywords:** antibiotics; prophylactic antibiotics; surgical site infection.

## INTRODUCTION

Surgical site infection is one of the most dreaded complications faced by an orthopaedic surgeon<sup>1</sup>. There are multiple studies which support prophylactic antibiotic administration for 24 hours postoperatively rather than multiple days<sup>2-4</sup>. We conducted a survey which showed that most of the surgeons use antibiotics (Intravenous and Oral) for two weeks. There is indeed a resistance to minimize the duration of Intravenous (IV) antibiotics to 24 hours among Nepalese surgeons in spite of its advocacy in the orthopaedic literature.

The concern to limit the use of perioperative antibiotics to 24 hours is not just for economic reasons (Rs 15,00,000 extra per 10,000 patients if cheapest antibiotic is used for 48 hours in stead of 24 hours postoperatively). Continuing antibiotics for longer than 24 hours after wound closure may contribute to the development of antimicrobial resistance<sup>5-7</sup>. Administration of prophylactic antibiotics for longer than 24 hours has not been demonstrated to be effective and may actually lead to superinfection with drug-resistant organisms<sup>5-13</sup>.

Most of the operation theatre conditions in Nepal are not as ideal as in more affluent countries from where most of the literature abound. Most of us feel more assured against infection by administering antibiotics for a longer period.

It had become absolutely necessary to validate in our conditions what the surgeons in the developed countries have been advocating. This study was performed to see if there was any difference in the rate of infection among patients who received 24 hours of IV antibiotics and those who received the same for longer duration, in our setting.

## Correspondance

**Dr Bikram Prasad Shrestha**

Department of Orthopaedics, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

Email: bkrmstha@gmail.com

## METHODS

This was a randomized controlled trial conducted in the Department of Orthopaedics, B.P. Koirala Institute of Health Sciences, Dharan, Nepal. The study population included a total of 240 clean elective cases operated by the authors with or without using implants from 1<sup>st</sup> March 2009 to 8<sup>th</sup> November 2009. The 240 patients were randomized into 3 groups using the random number generated by the software available at <http://www.randomization.com>.

Patients belonging to Group A were administered two gm of inj. cephazolin and 80 mg inj. gentamicin within 60 minutes before incision. Postoperatively, inj. Cephazolin one gm and inj. Gentamicin 80mg was repeated eight hourly for 24 hours. It was not followed with oral antibiotics. When the duration of surgery exceeded two hours or when there was excessive bleeding, one dose of each antibiotic was repeated intraoperatively.

Patients belonging to Group B were administered the same antibiotics as in Group A but postoperatively, it was continued for 48 hours. No oral antibiotics were administered after 48 hours.

Group C patients were administered antibiotics as in Group B but was followed with oral cephadroxyl 500mg twice daily for 7 days. In all cases doses were adjusted in pediatric patients.

The study was approved by the Ethical Review Board of the Research Committee of B.P.Koirala Institute of Health Sciences. Informed consent was taken from all patients.

The pro formas for each patient included information about age, gender, duration of surgery (incision to closure), associated medical illness, preoperative haemoglobin level, preoperative albumin level, blood loss during surgery and preoperative admission days. The patients were discharged 48 hours after the surgery after wound inspection and change of dressing. The patients were followed up at 14 days, six weeks and at three months to look for signs of surgical site infection.

Our criteria for judging whether or not a wound infection occurred were as follows which has been modified from that of Alan et al.<sup>14</sup>

1. If a wound drained purulent material irrespective of whether an organism was cultured or not it was considered infected.
2. When a wound became red, painful or tender, swollen and hot for more than 48 hours, the wound was considered infected.
3. When the patient had fever for more than 48 hours and no other cause could be traced, the wound was considered infected.

4. If the patient had a stitch abscess with a small amount of purulence directly around a suture, but without any signs of inflammation or fever, the wound was not considered infected.

Data were entered into Microsoft Office Excel program and analyzed using SPSS (Statistical Package for Social Sciences) version 17.0 software. Preliminary analysis was performed by calculating percentage, mean and standard deviation to get an idea about the proportion, central tendency and dispersion respectively. Chi-square and Mann-Whitney tests were applied to find the association of surgical site infection with duration of antibiotic administration after adjusting the rest of explanatory variables. A p value <0.05 was considered significant.

## RESULTS

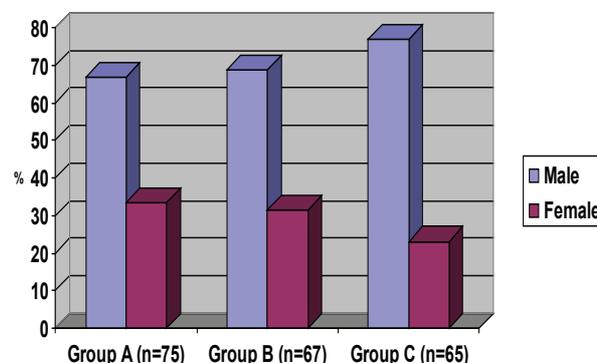
Of the 240 patients we included in the study, 33 were lost to follow up. So the pro formas of 207 patients were analyzed. There were 75 patients in Group A, 67 in group B and 65 in group C. Out of the 207 patients, 146 were males and 61 were females.

The proportion of infection among males is nearly twice as those in females. However, there is no statistical association between infection and gender ( $p > 0.05$ ) (Table 1 and figure 1).

**Table 1. Relation of infection to gender**

Gender	Infection		Total	P value
	Absent	Present		
Male	137 (93.8%)	9 (6.2%)	146	0.399
Female	59 (96.7%)	2 (3.3%)	61	

Figure 1. Sex distribution among participants in three groups



The variables such as age, duration of surgery, preoperative haemoglobin, blood loss during surgery, preoperative

Table 2. Measures of different variables in three different groups

Variables	Group A (n=75)	Group B (n=67)	Group C (n=65)	P value*
Age	39.36±21.59	34.30±21.55	34.52±19.18	0.270
Duration of surgery (min)	83.07±48.45	83.66±52.09	85.38±46.38	0.822
Preoperative Haemoglobin (gm/dl)	12.42±2.08	12.360±2.00	13.812±8.56	0.501
Blood loss (ml)	177.27±166.61	154.40±140.01	232.92±217.21	0.060
Preoperative albumin (gm/dl)	4.324±0.71	4.467±1.0327	4.31±0.769	0.796
Preoperative admission days	4.53±4.37	3.10±3.631	3.18±3.14	0.063

\* Probabilities based on Kruskal Wallis test

albumin level and preoperative admission days were compared among the three groups and was found to be statistically insignificant showing that randomization was successful (Table 2).

The means of above variables were also compared among those who had infection and those who did not. All the variables were found to have no association with infection except the duration of surgery (Table 3). The mean duration of surgery among those who did not have infection was 82.70 minutes whereas it was 106.82 minutes in those with infection ( $p < 0.05$ ). The most common medical illness that we encountered was hypertension followed by diabetes mellitus. The association of presence of associated illness in the three groups were not significant (Table 4). The proportion of infection present among those with or without medical illness was almost homogenous ( $p > 0.05$ ) (Table 5).

The percentages of infection in all groups were uniformly high. Four (5.3%) out of 75 were infected in Group A. Similarly there were three out of 67 (4.5%) in Group B and 4 out of 61 (6.2%) infection in Group C. The mean percentage of infection was 5.3% (Table 6).

The most important question that this study sought to answer was: 'Does administering antibiotics for prolonged periods decrease the chance of surgical site infection?' Logistic regression test, after adjusting other variables performed to examine the relationship of infection to the three groups answered that there was no difference of significance in the rate of infection between any groups ( $p > 0.05$ ).

Postoperative infections have been shown to significantly increase morbidity, extend the patient's hospital stay, drastically increase the cost of the medical system and cause severe physical limitations that diminish the quality of life<sup>15</sup>. Decreasing the incidence of surgical site infection is a matter of utmost interest to both the patients and surgeons.

Literature is flooded with articles that relate surgical site infection to a variety of factors of which some are modifiable, some are not. The use of prophylactic antibiotics is one of the most important factors in decreasing infection and one that all surgeons are concerned about.

The clinical use of prophylactic antibiotics in orthopaedic surgery was not always supported. Early poorly designed studies found that perioperative use of antibiotics in clean orthopaedic cases was associated with increased infection rates<sup>16,17</sup>. Despite these unfavourable results, investigations continued into the use of prophylactic antibiotics in orthopaedic surgery<sup>6</sup>.

All orthopaedic surgeons in Nepal believe in using prophylactic antibiotics but there is discrepancy in the duration of their use. Available literature recommends the use of prophylactic antibiotics for 24 hours only and advise against using them for longer periods. It was necessary to find out whether longer use of antibiotics decreased the incidence of infection in our setting which is less than ideal.

Factors like duration of surgery, associated medical illness, preoperative haemoglobin status, preoperative serum albumin level, amount of blood loss during surgery and preoperative admission days would be expected to influence the incidence of infection. Malnutrition is a known risk factor for deep infection after a variety of

**Table 3.** Relation of age, duration of surgery, preoperative haemoglobin level, blood loss during surgery, preoperative albumin level and preoperative admission days to infection.

Infection	Age	DOS (in min)	Preop. Hb level (in gm/dl)	Blood loss (in ml)	Preop. Alb. level (in gm/dl)	Preop. admission days
<b>Infection Present</b>						
Mean	33.64	106.82	13.091	204.55	4.582	3.55
Std. Deviation	15.468	45.071	1.9481	178.12	0.4535	2.911
<b>Infection Absent</b>						
Mean	36.35	82.70	12.824	186.38	4.353	3.65
Std. Deviation	21.173	48.794	5.2258	179.20	0.8592	3.871
<b>Total</b>						
Mean	36.20	83.99	12.838	187.34	4.365	3.65
Std. Deviation	20.888	48.803	5.1028	178.76	0.8431	3.821
P value	0.868	0.042	0.344	0.628	0.274	0.797

DOS- Duration of surgery, Preop Hb-Preoperative Haemoglobin, Preop. Alb- Preoperative Albumin

**Table 4.** Associated medical illness (ASM) with infection according to the three groups

INFECTION	ASSOCIATED MEDICAL ILLNESS	GROUP			Total	P Value
		A	B	C		
PRESENCE	PRESENCE	1 (25.0%)	1 (33.3%)	0 (0.0%)	2 (18.2%)	NA*
	ABSENCE	3 (75.0%)	2 (66.7%)	4 (100.0%)	9 (81.8%)	
	Total	4 (36.36%)	3 (27.27%)	4 (36.36%)	11 (100.00%)	
ABSENCE	PRESENCE	16 (22.5%)	9 (14.1%)	8 (13.1%)	33 (16.8%)	0.271
	ABSENCE	55 (77.5%)	55 (85.9%)	53 (86.9%)	163 (83.2%)	
	Total	71 (36.22%)	64 (32.65%)	61 (31.12%)	196 (100.00%)	

orthopaedic surgical procedures<sup>18,19</sup>. A serum albumin level of less than 3.5 g/dl has been associated with an increase in wound complications<sup>20</sup>. In our study 11% of the patients had serum albumin less than 3.5 g/dl. We found only the duration of surgery had a statistical association with the incidence of infection. Longer the duration of surgery, more was the chance of surgical site infection. Perhaps our sample size was not large enough.

The mean infection rate in our study was 5.3% which must be considered high. We do not know the infection rate of

other institutions in Nepal. The infection rate in a study by Pavel et al.<sup>13</sup> in which the patients received cephaloridine was 2.85% and the study by Henley et al.<sup>21</sup> in which the patients received cefamandole was 1.6%. Postoperative infection has been estimated to occur following 1% to 2% of all total hip arthroplasties and 2% to 4% of all total knee arthroplasties in the United States<sup>22,23</sup>. In our study there was no statistical difference between the rate of infection among those who received 24 hours of antibiotics and those who received the same for longer durations. This shows the futility of administering antibiotics for longer

\* $\chi^2$  test is not applicable**Table 5** The relation of associated medical illness to infection

ASSOCIATED MEDICAL ILLNESS		INFECTION		TOTAL	P value
		PRESENT	ABSENT		
AMI	Count	9	163	172	0.908
Absent	% within the infected group	5.2%	94.8%	83.1%	
AMI	Count	2	33	35	
Present	% within the infected group	5.7%	94.3%	16.9%	
Total	Count	11	196	207	
	% within the infected group	100.0%	100.0%	100.7%	

AMI: associated medical illness

**Table 6.** The percentages of infection among the three groups

GROUP		INFECTION		TOTAL	P value
		ABSENT	PRESENT		
GROUP A	Count	71	4	75	0.912
	% within group	94.7%	5.3%	100%	
GROUP B	Count	64	3	67	
	% within group	95.5%	4.5%	100%	
GROUP C	Count	61	4	65	
	% within group	93.8%	6.2%	100%	
TOTAL	Count	196	11	207	
	percentage	94.7	5.3	100%	

than 24 hours.

## CONCLUSION

We conclude that in clean elective orthopaedic surgeries, administering prophylactic antibiotics for more than 24 hours postoperatively provide no additional advantage.

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