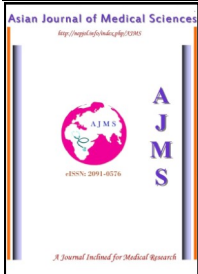


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## Need of Improvement in Timing of Prophylactic Antibiotic in Elective Surgery

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### Abstract

**Objective:** Infections in surgery are major concern of morbidity, mortality, and costs. Timely antibiotic prophylaxis (AP) before incision ensures optimum concentration of AP in blood and tissues to prevent surgical site infections (SSIs). However, proper timing of AP remains problematic as reported by various studies, though none so far from local institutions in Nepal. Aim of this cross sectional observation study was to assess and address the issues of timing of AP and need for improvements.

**Material & Methods:** Convenient sample target of 100 cases of preoperative AP were studied from Oct 1 to Oct 30, 2010. Data were prospectively entered in predesigned 'AP form' for all major elective surgeries, except obstetric cases, who received AP of intravenous Cefazoline 1 g as per existing hospital protocol. Time of AP administration in respect to incision time was analyzed.

**Results:** There were 125 cases during study period. Majority, 81% received AP before incision, while 19% had AP after the incision. Only 1% of patients received AP within recommended period within 60 to 30 minutes before incision.

**Conclusion:** Current practice of antibiotic prophylaxis (AP) at our institutions needs improvement as per standard guidelines of AP within 60 to 30 minutes before incision.

**Key Words:** antibiotic prophylaxis; guidelines; protocol; surgical site infection

### 1. Introduction

Surgical site infections (SSIs) adversely affect the quality of life by prolonged hospital stay, readmission, excess cost, increased morbidity and mortality.<sup>1-3</sup>

The effectiveness of antibiotic prophylaxis (AP) before skin incision in prevention of SSIs is well established. Nearly 50% of SSIs can be prevented with proper administration of AP on time. Timing of AP is critical as studies and guidelines have shown. The AP should be administered within 60 to 30 minutes before incision to achieve therapeutic levels.<sup>4-6</sup>

Despite various guidelines the timing AP is often not optimal and frequently given only seconds prior to the surgical incision.<sup>6-10</sup> We undertook this prospective study to evaluate and address the issue of timing of AP at our

institution. There is lack of published data on existing practices in major institutions. Also, there is no published recommendation and guidelines of AP from concerned societies or academic institutions locally. We hope this study will provide insight and prompt institutions and academia to look into the issue of AP, and hopefully come up with necessary effective measures to ensure proper use of AP.

### 2. Material and Methods

A prospective cross sectional study was conducted in department of Surgery, Patan Hospital for one month from October 1 to October 30, 2010 with convenient sampling of collecting at least 100 cases of major surgery scheduled to receive AP as per existing practice in the hospital.

We have four major operation theaters in one complex which are common to all the departments. Pre-designed data sheet was kept in each operation theater to be

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filled in by anesthetist colleagues to minimize biasness. One of the coauthor was designated to collect the data sheet for analysis. The date, type of surgery, time of induction, AP administration and incision times were recorded on predesigned 'AP form'.

The study included all the elective major cases from general surgery, urology, orthopedic and gynecology procedures that received AP as per existing protocol. Floor nurse were not aware of the study to decrease biasness as currently they are designated to administer the AP. Intravenous Cefazoline 1 g was administered in all the major surgeries unless differently demanded by situation. This observational study was discussed within the department of surgery and anesthesia and endorsed by hospital authority. As this was an observational study of existing practice in the hospital, only verbal consent was taken from patients.

The emergency surgeries and obstetric cases were excluded from the study. Timing of administration was analyzed in intervals before and after incision. Microsoft excel 2007 was used for data analysis.

### 3. Results

There were total of 125 cases during the study period of one month who received AP as per existing hospital practice. Male were 45 (36%).

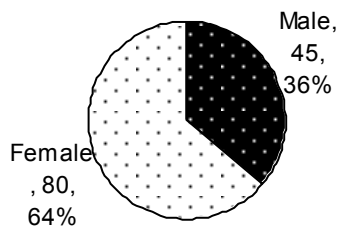


Figure-1: Sex ratio of patients (n=125) who got antibiotic prophylaxis (AP) in elective major surgeries.

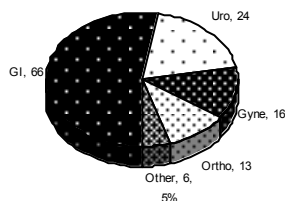


Figure 2. Types of elective major surgeries in patients (n=125) who got antibiotic prophylaxis (AP).

GI= gastrointestinal surgery, Uro= urosurgery, Gyne= gynecological surgery, Ortho=orthopedic surgery

Figure 1. Gastrointestinal/biliary surgeries accounted for 66%. Figure 2. AP was administered before incision in 101 (81%) and 24 (19%) after the incision (Table 1).

Table-1: Timing (minute) of antibiotic prophylaxis (AP) in 125 elective major surgeries.

Timing of AP (minutes)	N	%
<b>Before incision</b>	<b>101</b>	<b>80.8</b>
<5	64	51.2
6-15	25	20.0
16-30	11	8.8
31-60	1	0.8
<b>After incision</b>	<b>24</b>	<b>19.2</b>
<5	11	8.8
6-15	7	5.6
>15	6	4.8

Most of the patients got AP immediately before incision, within 5 minutes (n=64) and 15 minutes (n=25). Only 1 (1%) patient received AP within the recommended period of 60 to 30 minutes before incision. There was no anaphylactic reaction or complications due to AP in this series.

### 4. Discussion

Surgical site infections (SSIs) cause significant morbidity, mortality and add to the cost of care. Aseptic techniques alone do not eliminate bacteria, and *S. aureus* are often found at surgical sites. Antimicrobial treatment begun prior to contamination is called antibiotic prophylaxis (AP) which is an important adjunct to control bacterial growth and SSIs.

Proper timing of AP is important. Recommended guidelines of AP administration is within 30 minutes to 2 hours before incision to achieve adequate tissue levels of drugs and effective prophylaxis.<sup>10</sup> However, the drugs are frequently given only seconds prior to the surgical incision. This is inappropriate as we observed in this study. Even though 101 (81%) of APs were administered before incision, only 1 (1%) got AP within recommended time. Administration of AP within the 2 hours period, ideally 30-60 minutes before surgical incision is associated with the lowest risk of SSIs. This was observed in a randomized control trial in large number of patients (n=2847) with 'clean, clean-contaminated' surgical wound.<sup>4</sup>

Most of the research has been targeted towards determining which antibiotic is most effective as AP. Little emphasis has been given on appropriate timing of AP. In

this study we have focused on important aspect of 'timing' of AP administration. A number of guidelines are available for selection, timing, and duration of AP in various types of surgeries.<sup>11</sup> However; there is often lack of effective system to ensure this simple task, leading to increased morbidity and health care costs.

Health care-associated infection (HAI) is part of life-saving interventions. Failure of system and inadequate use of resources increases HAIs. This is an ethical problem involving patients' rights. This is obligation of health care institutions and individual health care provider to minimize HAIs. Possible cause for failure to maintain proper timing of AP despite existing guidelines may be adequate knowledge, workflow, role perception, priority and organizational commitment.<sup>12</sup>

Guidelines, regulations, and recommendations are modified frequently. Some valuable resource for the up-to-date information on issues of infection prevention and control are internet web sites of CDC (Centers for Disease Control and Prevention), APIC (Association for Professionals in Infection Control and Epidemiology) and SHEA (Society for Healthcare Epidemiology of America).<sup>13</sup>

Timely administration of AP before surgery continues to be a difficult challenge. Circulating floor nurses in operation theater (OT) play important role in administration of AP. The anesthesiologists are not usually responsible for AP even though they are closely involved in planning and outcome of surgery. Anesthesia department can play important role by assuming responsibility for the goal of ensuring that patients receive AP within 60 to 30 minutes before incision. This change in role and responsibility was found to improve timing of AP from 69% to 92% a year later.<sup>14</sup>

Incidence of SSI in relation to timing of AP in a consecutive series of 3836 surgical procedures found that drug given within 60 to 30 minutes before incision was most effective.<sup>15</sup> In national retrospective cohort study with medical record review from 2965 US hospitals involving random sample of 34133 cases revealed that only 55.7% of patients received AP within 1 hour before incision.<sup>11</sup> In a large prospective cohort study with Cefuroxime given at 15-minute intervals found that AP within 60 to 30 minutes period before incision was most effective.<sup>15</sup>

There is significant increase in SSIs when AP is given after incision. Prolonged prophylaxis after the surgery has no benefit as observed in a multi-centric study of 1922

patients with elective total hip arthroplasty. The study concluded that intervention programs should focus on timely administration of AP.<sup>16</sup> In our study 19% of APs were given after the incision. Timing is often related to tourniquet application in orthopedic surgeries. A randomized, double-blind, placebo-controlled study in 908 patients concluded that administration of AP just before tourniquet release was not inferior to standard antibiotic prophylaxis.<sup>17</sup>

When surgery is prolonged for more than four hours, re-administration of antibiotic should be considered. Similarly, in special circumstances with different pharmacokinetics and drug delivery (like rapid increase in the volume at the initiation of cardiopulmonary bypass or decreased circulation to the surgical site in patients with diabetes or arteriosclerosis) the timing of AP may not be suitable for as close to incision time as possible.<sup>18</sup>

Recommendations of CDC include timely intravenous administration of AP in indicated cases before incision for effective concentration of drug against most common pathogens causing SSI. Therapeutic levels of drug should be maintained in serum and tissues throughout the operation and until a few hours after the incision is closed.<sup>19</sup>

Evidence-based practice from the level of individual, team, and organization should be considered to ensure proper timing of AP.<sup>12,20-22</sup> The 'AP form' is an effective tool to decrease the inappropriate use of antibiotics.<sup>23</sup> Similarly, auditing and raising the awareness of surgeons and nurses about the regimen, importance of the timing with better documentation are helpful in ensuring intended administration of AP.<sup>24</sup>

After this observational study, we have discussed with anesthesiologists and operating room nurses, to change the current practice of floor nurse being solely responsible for AP. After the result of this study we plan to let anesthetic team assume overall responsibility in collaboration with floor nurse and operating surgeon. Our plan includes periodical audit by surgical team to give feedback to increase awareness and importance of AP timing.

## **5. Conclusion**

Our result shows we are not following the standard guidelines of antibiotic prophylaxis (AP) administration within 60-30 min before incision. We need to improve our current practice of AP by team work among nurses, anaesthetics and surgeons.

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