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Original Research Article

Surgical Site Infection and Preoperative Antibiotic Prophylaxis in The Prevention Among Hospitalized Patients

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Abstract: ***Introduction*:** Surgical site infection (SSI) is defined as an infection related to an operative procedure that occurs at or near the surgical incision within 30 days of the procedure. Most common cause of post-operative morbidity is surgical site infection (SSI) in planned cases accounting nearly 65% to 80% of all cases in our population. This study was conducted to know the need for antibiotic prophylaxis in clean, clean-contaminated surgical wounds and whether prophylactic antibiotic is itself sufficient to minimize surgical site infection. ***Methods*:** This was a prospective study was carried out at Dept. of Surgery, Enam Medical College Hospital, Savar, Bangladesh from July 2022 to June 2023. During this period, 150 cases were selected for our study. The cases were grouped in to two categories; Group A and Group B of 75 cases each. Group A comprises patients who received a pre-operative single dose of ceftriaxone a broad spectrum cephalosporin. Group B received no such prophylactic antibiotic. All were subjected to surgeries done under meticulous surgical technique. ***Results*:** Were divided equally into two groups, Group A included 75 cases who received single prophylactic dose of 1 gm of cefotriaxone given intravenously half an hour before surgery and Group B included 75 cases who did not receive any such antibiotic prior to surgery. The incidence of age varied from 5 to 60 years but maximum number of patients belonged to 21 to 30 years age group. Six patients in group B were infected; one belonged to 41-50 years age group three belonged to the 51-60 years age group and other two in the 61-70 years age group. Group A had 50 clean surgical cases and 20 clean contaminated cases, out of which none of them were infected. In group B out of 50 clean cases, 2 cases were infected and out of 30 clean contaminated cases 10 were infected. Our study showed that there is no need for prophylactic antibiotics in cases of clean surgeries. We recommend antibiotic prophylaxis in clean contaminated cases. The incidence of surgical site infection depends on various factors like old age (27.1%), anaemia (30.5%), Diabetes mellitus (25.4%) and prolonged duration of surgery more than 2 hours (14.2%). ***Conclusions*:** From this study we can conclude that, in cases of clean surgeries there is no need for prophylactic antibiotics, as there is no statistical significance, whereas in clean contaminated cases antibiotic prophylaxis is recommended as it reduces SSI statistically significant.

Keywords: Prophylactic Antibiotic, Risk Factors, Surgical Site Infection.

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INTRODUCTION

Surgical site infection (SSI) is defined as an infection related to an operative procedure that occurs at or near the surgical incision within 30 days of the procedure [1, 2]. Most common cause of post-operative morbidity is surgical site infection (SSI) in planned cases accounting nearly 65% to 80% of all cases in our population [3]. Prior to the use of prophylactic antibiotic, the incidence of surgical site infection was more, which has been drastically reduced by the use of antibiotics. The antibiotic era which began more than 5 decades ago has revolutionized the treatment of surgical infection particularly during post-operative period. To reduce the incidence of post-operative surgical site infection wide spread of use of antibiotics has frequently resulted in unrealistic use of antibiotics, over use of antibiotics and development of resistance to antibiotics. This has resulted in increase in the cost of post-operative treatment and violation of established surgical principles and the breakdown of isolation procedures. Strachan in 1977 compared a single preoperative dose of Cefazolin with regime of Cefazolin given for a period of 5 days post operatively. The infection rate seen in single dose was 3% and in multiple post-operative dose was 5% [4]. Hence prophylactic antibiotic therapy is clearly more effective when began preoperatively and continued through the intra operative period with the aim of achieving therapeutic blood levels throughout the operative period [5]. In the present study we want to emphasize on the role of antibiotic prophylaxis administration in clean and clean- contaminated surgical cases in this institution. Only 55.7 percent of surgical patients received prophylactic antibiotics within one hour of incision, and the antibiotic was discontinued within the 24 hours after surgery in only 40.7 percent of patients [6]. Other studies show that approximately 80 to 90 percent of surgical patients received antibiotic prophylaxis, but the choice of regimen, timing of administration, or duration of prophylaxis were inappropriate in approximately 25 to 50 percent of patients [7]. As an incentive to reduce rates of surgical site infections, CMS reduced reimbursement to hospitals for some of these infections [8]. Because primary care physicians are involved in pre- and postoperative care and some perform or assist in surgical procedures [9], they have the opportunity to impact the incidence of surgical site infections by understanding which surgeries call for prophylactic antibiotic administration, which antibiotic is appropriate, and when the antibiotic should be administered and discontinued.

MATERIALS & METHODS

This was a prospective study was carried out at Dept. of Surgery, Enam Medical College Hospital, Savar, Bangladesh from July 2022 to June 2023. During this period, 150 cases were selected for our study. The cases were grouped in to two categories; Group A and Group B of 75 cases each. Group A comprises patients who received a pre-operative single dose of ceftriaxone a broad spectrum cephalosporin. Group B received no such prophylactic antibiotic. The groups were split randomly into two groups taking into consideration the type of surgeries, the age of the patient, the presence or absence of risk factors for development of SSI, and associated medical conditions, all of which were represented in both the groups almost equal and a comparative clinical study was made. All were subjected to surgeries done under meticulous surgical technique.

On admission to the hospital, a detailed proforma was filled with details like the diagnosis, preoperative investigations and meticulous pre-operative patient preparation. All the patients were followed up to thirty days post operatively. Data were entered in the proforma. Wound swabs were sent for culture and sensitivity and the patients were treated according to culture and sensitivity reports. Patients were categorized as clean or clean contaminated cases depending on their complaints, clinical examination and diagnosis. Patients with infections like respiratory tract infections or urinary tract infections were treated prior to admission on out-patient basis and taken up for surgery after 2 weeks. All patients were admitted 2 days prior to surgery. Preoperative hospital stay was minimized to prevent the patient from getting the access to hospital infections. Patients with diabetes mellitus were treated appropriately with injectable insulin under precaution.

Preoperative skin preparation was done meticulously. Patients allowed to take a through scrub bath after which parts were prepared with povidone iodine and was isolated from the surrounding by covering operative site by sterile gauze [10]. Patients were brought to the waiting room next day morning and were given single dose of IV ceftriaxone 1gm under aseptic precaution half an hour before the surgery. All the cases were done in the morning hours. Patients were anesthetized under aseptic precaution. Surgery was performed by senior staff, use of cautery was minimized. Movement in the operating room was restricted. Whenever necessary closed suction drain was introduced and wound was closed with sterile dressings.

Patients were isolated in the postoperative ward for at least 3 days. Drains were removed on 3rd or 4th postoperative day depending upon the secretions. Wounds were inspected on third day for

any signs of inflammation, infection was noted down and findings were entered in the proforma. In cases where soakage of dressing and abnormal smells suggestive of infection dressings were inspected earlier than 3 days. If infected, wound swab was taken and sent for culture and sensitivity and antibiotic was started immediately in all infected cases. Sutures were removed on the seventh postoperative day. Patients were followed up to thirtieth postoperative day on OPD basis after discharged from hospital. All the data were entered in the proforma. The available results and outcomes in both groups were studied and analyzed.

RESULTS

Were divided equally into two groups, Group A included 75 cases who received single prophylactic dose of 1 gm of cefotriaxone given intravenously half an hour before surgery and Group B included 75 cases who did not receive any such antibiotic prior to surgery. The incidence of age varied from 5 to 60 years but maximum number of patients belonged to 21 to 30 years age group. Six patients in group B were infected; one belonged to 41-50 years age group three belonged to the 51-60 years age group and other two in the 61-70 years age group. Group A had 50 clean surgical cases and 20 clean contaminated cases, out of which none of them were infected. In group B out of 50 clean cases, 2 cases were infected and out of 30 clean contaminated cases 10 were infected.

Table 1: Infection rates in all cases

	Number of cases		Number of cases which got infected		Rate of infection	
	Clean	Clean contaminated	Clean	Clean contaminated	Clean	Clean contaminated
Group A	50	20	-	-	-	-
Group B	50	30	2	10	4%	33.3%
Total	**100**	**50**	**2**	**10**	**2%**	**20.0%**

Table 2: Showing distribution of risk factors in the affected group

Risk Factors	Group A	Group B	Total	Percentage (%)
Anaemia	8	10	18	30.5%
Diabetes Mellitus	6	9	15	25.4%
Prolonged duration of surgery	0	10	10	16.9%
Old age	7	9	16	27.1%
Total	**21**	**38**	**59**	**100**

Out of 150 cases taken up for the study 59 patients were identified to have risk factors for development of surgical site infection. The incidence and distribution of risk factors is as follows. In our study 18 patients were suffering from mild anemia with Hb% between 9-10 gr %, 8 patients in group A and 20 in group B. The 15 patients with diabetes mellitus, 6 in group A and 18 in group B, their sugar levels were controlled prior to surgery, none of them developed SSI. 18 patients with anemia which was corrected prior to surgery did not develop SSI. Out of 16 patients with old age 6 developed SSI, these 6 had other associated risk factors.

Table 3: Showing duration of surgery affecting infection rate

Duration in hours	Number of cases		Number of infected cases	Percentage of infection
	Group A	Group B		
<1 hour	52	45	-	-
1-2 hours	23	21	3	14.28%
>2 hours	0	9	6	66.66%

All the cases in this study were clean and clean contaminated elective surgeries conducted by senior staff. Care was taken to complete the surgery as early as possible and efficiently. The average duration of the surgery in our study from the time of skin incision to the time of closure was 1 hour 40 minutes. The minimum time was 45 minutes and maximum time was two hours fifteen minutes. Six patients in our study who got infected the duration was 1 hour and 55 minutes and the other 6 patients who got infected the duration was more than two hours. No patients whose surgery was done below one hour got infected in both the groups.

Table 4: Showing infection rate with and without prophylactic antibiotics in clean and clean contaminated cases

Type of case	Groups	Number of cases	Number of infected cases	Percent age
Clean	Group A	50	-	-
	Group B	50	2	2%
Clean Contaminated	Group A	20	-	
	Group B	30	8	16%

In the present study 45 patients were provided with closed suction drainage and none of them got infected, contributing to the use of closed suction drainage to prevent surgical wound infection rather than the open drainage method.

Antibiotic and Timing of Antibiotic Prophylaxis

In the present study a third generation cephalosporin's single dose of IV ceftriaxone 1 gm was administered half an hour before the incision under aseptic precaution to all the patients in group A and no patients in group A got infected when compared to the group B, where no such antibiotic was given and there was an infection rate of 2% (2 patient) in clean cases and 16% (8 patients) in clean contaminated cases. There were no reports of any allergy and adverse effects to the prophylactic drug chosen.

Figure 1: Showing mild infection with redness on the 3rd day of operation

DISCUSSION

Determination of surgical antibiotic prophylaxis outcome is essential for the reduction of morbidity; unnecessary hospital stays and related costs by revealing the level of evidence required to avoid inappropriate use of drugs during the management of a patient undergoing surgery with prophylaxis [11]. Surgical site infection is well known thing. This has been documented since origin of surgery. Strict asepsis, meticulous surgical techniques, less handling of tissues, reducing the use cautary and use of prophylactic antibiotic have drastically reduced the incidence of SSI. Surgical site infection affects all the age groups and its incidence increases with the age. In our present study age incidence varied from 5 to 60 years but the maximum number of cases were represented in age group 21-30 years. Older age group is considered a risk factor for development of SSI, in the present study all the 10 infected cases were 50 years and above age group and two cases in 41-50 years' age group. Rao *et al.,* showed in their study that SSI incidence doubled in older age group 50-70 years [10]. Out of 150 cases taken up for the study 59 patients were identified to have risk factors for development of surgical site infection. The incidence and distribution of risk factors is as follows. In our study 18 patients were suffering from mild anemia with Hb% between 9-10 gr %, 8 patients in group A and 20 in group B. The 15 patients with diabetes mellitus, 6 in group A and 18 in group B, their sugar levels were controlled prior to surgery, none of them developed SSI. 18 patients with

anemia which was corrected prior to surgery did not develop SSI. Out of 16 patients with old age 6 developed SSI, these 6 had other associated risk factors. Cruise and Ford have demonstrated that presence of obesity as a single independent risk factor for development of SSI and the prolonged time of surgery also increase the incidence of surgical site infection [12]. Hence anemia when corrected preoperatively does not pose a risk for development of surgical site infection. The average duration of the surgery in our study from the time of skin incision to the time of closure was 1 hour 40 minutes. The minimum time was 45 minutes and maximum time was two hours fifteen minutes. Six patients in our study who got infected the duration was 1 hour and 55 minutes and the other 6 patients who got infected the duration was more than two hours. No patients whose surgery was done below one hour got infected in both the groups. In the present study, 15 patients were diabetic (group A- 6, Group B-9) their blood sugar level was well controlled prior, during and after surgery. Funary AP *et al.,* in their study showed that when blood glucose level were kept strictly below 200 mg/dl during the perioperative period by continuous intravenous infusion of insulin reduced the incidence of SSI from 24% to 6.06% which was statistically significant [13]. In the present study 45 patients were provided with closed suction drainage and none of them got infected, contributing to the use of closed suction drainage to prevent surgical wound infection rather than the open drainage method. All the patients in group A and no patients in group A got infected when compared to the group B, where no such antibiotic was given and there was an infection rate of 2% (2 patient) in clean cases and 16% (8 patients) in clean contaminated cases. There were no reports of any allergy and adverse effects to the prophylactic drug chosen. As none of the patients developed SSI and hence it is said that infection rate can be reduced with the proper control of diabetic status. Many other studies reported the association of SSI with, comorbidity, cigarette smoking, alcohol use, older age, contaminated and dirty wound class, failure to receive antibiotic prophylaxis or delayed initiation of antibiotic prophylaxis, prolonged preoperative hospital stay, previous hospitalization or surgery, and emergency surgical cases [6, 8, 9, 14, 15]. Advances in surgical techniques are continually reshaping the landscape of SSI prevention. Minimally invasive and robotic-assisted surgery techniques have gained recognition for their potential to minimize tissue trauma and reduce infection risk. These approaches often result in smaller incisions, decreased blood loss, and shorter hospital stays, all contributing to a reduced risk of SSIs [16]. Integrating data analytics and surveillance into SSI prevention efforts offers a data-driven approach to identifying high-risk patients and implementing targeted interventions.

CONCLUSION

From this study we can conclude that, in cases of clean surgeries there is no need for prophylactic antibiotics, as there is no statistical significance, whereas in clean contaminated cases antibiotic prophylaxis is recommended as it reduces SSI statistically significant. In an era of increasing antibiotic resistance, maintaining a delicate balance between effective prophylaxis and judicious antibiotic use is paramount. Surgeons, infection control specialists, and researchers should collaborate to refine existing protocols and explore novel methods to safeguard patient safety during surgical procedures.

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