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Research Article

RESULTS OF SHORT-TERM VERSUS LONGER-TERM ANTIBIOTIC PROPHYLAXIS (ABP) IN PATIENTS WITH DIABETES MELLITUS ENDURING CORONARY ARTERY BYPASS GRAFT

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Abstract:

Objective: To compare the results of short-term (24-hour) antibiotic prophylaxis (ABP) in diabetic patients undergoing coronary bypass surgery (CABG) and its impact on the incidence of in-hospital deep Sternal Wound Infection (DSWI) / mediastinum infections.

Patients and Method: We conducted a cross-sectional comparative study of 160 diabetic patients undergoing CABG in the Cardiac surgery department of Jinnah Hospital Lahore for one-year duration from May 2019 to May 2020. We compared 80 diabetic patients who had received prophylactic antibiotics for less than 24 hours with 80 other diabetic patients who had received more than 24 hours of prophylactic antibiotics undergoing isolated CABG. Surgical site infection (SSI) was assessed daily during the patient's stay. The diagnosis of the identified SSI was based on fever, pain, redness, discharge, purulent drainage, positive cultures, and marked dehiscence of the wound after sternotomy.

Results: The incidence of in-hospital deep wound sternum infections (DSWI) / mediastinitis was 7.50% in the 24-h ABP group, and the difference was statistically significant ($p = 0.042$). The proportion of patients with deep end organ involvement (mediastinitis) and sepsis requiring cable replacement was in 7 patients (8.75%) for 24 hours ABP ($P = 0.030$). Similar results were observed in terms of mortality (8.75% vs 1.25%). However, the isolated microorganisms showed a similar distribution in both groups. Morbidity, infections, and complex outcomes were more common in patients with diabetes.

Conclusions: Diabetes mellitus is an important risk factor of mortality and morbidity among people undergoing CABG. The present study documents a higher incidence of deep sternal wound infections (DSWI) / mediastinitis associated with ABP therapy lasting less than 24 hours, suggesting the need for prolonged ABP in diabetic patients undergoing CABG.

Keywords: antibiotic prophylaxis, coronary artery bypass graft, diabetes, surgical site infections

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INTRODUCTION:

Sternal wound dehiscence is a serious and potentially life-threatening complication following middle sternotomy, especially in patients with diabetes. It is connected with the extension of the hospitalization time, hospitalization costs and the necessity of a new surgical intervention. The risk of infection is approximately 6 times higher in diabetic patients, increased by 30% each day with mechanical ventilation, approximately 9 times higher in ICU return patients, and approximately 20 times higher in patients who report other non-related complications. with infection. Several pre- and intraoperative risk factors have been associated with an increased incidence of DSWI. Superficial infections of the sternum wound are observed in approximately 2% to 6% of patients after cardiac surgery. Recent studies show that the incidence of deep sternal infections associated with cardiac surgery ranges from 0.25% to 4%. In-hospital mortality associated with mediastinitis ranges from 7% to 20%, and the mortality in patients with superficial sternotomy infections may exceed 5%. Antibiotic prophylaxis is used to avoid SSI. However, overuse of antibiotics is associated with increased costs and the development of antimicrobial resistance. There is general agreement that postoperative prophylactic antibiotics should be discontinued within 24 hours of most major surgery. However, longer duration of antibiotic use is associated with the risk of drug toxicity, the emergence of resistant organisms, and increased costs. It is clear that antibiotic resistance is a progressive problem with serious clinical implications. It is unclear that the problem is directly related to the long-term use of prophylactic antibiotics in cardiac surgery. The primary prophylactic antibiotic used in cardiac surgery in adults is the first-generation cephalosporin, which is usually cefazoline in populations where there is no high incidence of methicillin-resistant *Staphylococcus aureus* (MRSA). In our facility, most serious sternum infections (70%) had methicillin-resistant *staphylococcus aureus*, so we use vancomycin and amikacin as a preventive measure. The optimal duration of antibiotic prophylaxis in adult diabetic patients undergoing CABG is unknown and guidelines are inconsistent. In light of this lack of local or institutional guidelines for antimicrobial prophylaxis, we conducted a prospective, randomized comparative trace to compare the results of short-term (<24 hours) with long-term (> 24 hours) antibiotic prophylaxis (ABP) in diabetic patients undergoing coronary artery bypass surgery (CABG) and its impact on the incidence of deep sternum wound infection (DSWI) / mediastinitis in the hospital.

PATIENTS AND METHODS:

We conducted a cross-sectional comparative study of 160 diabetic patients undergoing CABG in the Cardiac surgery department of Jinnah Hospital Lahore for one-year duration from May 2019 to May 2020. Diabetes was defined as the need for oral medications or insulin prior to CABG. Patients without prior diagnosis of DM who had HbA1c \geq 6.5% before surgery were also included. We compared 80 diabetic patients who had received prophylactic antibiotics for less than 24 hours with 80 other diabetic patients who had received prophylactic antibiotics for more than 24 hours. ICU patients due to prolonged ventilation, patients requiring long-term inotropic support, active preoperative infection were excluded from the study protocol.

Intervention:

Prior to surgery, diabetic patients were started with a standard sliding scale for subcutaneous insulin injection. Our goal was to maintain the blood glucose level in diabetic patients at the level of 120-160 mg / dl. Patients with blood glucose levels above 160 in the operating room and in the ICU received continuous intravenous insulin infusions. They then switched back to subcutaneous insulin injection with a sliding scale until discharge, even after resuming their preoperative glycemic control regimen. In non-diabetic patients, the use of insulin infusion on a sliding scale was triggered by blood glucose levels above 180 mg / dL. The patients were shaved the night before the surgery, and in the operating room, their skin was painted with povidone iodine. No routine nasal swabs or urine cultures were collected. Shortly before the first incision, each patient was given prophylactic intravenous antibiotics (mainly vancomycin 1 g and Amikacin 500 mg). None of the patients received topical antibiotics at the time of surgical wound closure. The wounds were painted with povidone-iodine ointment and covered with a sterile dressing. The study consisted of two arms: one group received prophylactic antibiotics for less than 24 hours; the second group received prophylactic antibiotics for more than 24 hours. No further intravenous or oral antibiotics were administered.

Assessment:

All data was collected in a specially designed Performa. The sternum incision site was assessed daily during the patient's stay (5-6 days). Diagnosis of diagnosed sternal infections was based on positive cultures, marked dehiscence of sternotomy, fever, pain, redness, discharge, purulent drainage, and instability of the sternum. Operating room logs were reviewed to identify all surgical revisions. Patients

were monitored for surgical site infection and any wound discharge was stained and plated using the Gram method. The cultured organisms were also susceptible to antibiotics. Each patient with a culture-confirmed wound infection received further antibiotics depending on the organism sensitivity to the antibiotic.

Final parameters:

The main evaluation criterion was the presence of deep sternum wound infections (DSWI) / mediastinitis in the hospital.

Statistical analysis:

The collected information was transferred to the computer program SPSS (Statistical Package for Social Sciences) version 16.0 and analyzed accordingly. Continuous or interval-related variables are expressed as mean + SD. The comparison of continuous variables between groups was performed using the Student's t-test. The comparison of discrete variables between groups was performed using the χ^2 test and Fisher's exact test. The alternative test was used when the re-measurement assumption was not met. $P \leq 0.05$ was considered to indicate a statistically significant difference.

RESULTS:

Table: Diabetes associated morbidity and mortality in CABG

Diabetic patients	<24 hours of prophylactic antibiotics (n=80)		>24 hours of prophylactic antibiotics (n=80)		P value
SSI	9	11.25%	2	2.50%	0.029
DSWI/Mediastinitis	6	7.50%	1	1.25%	0.042
Rewiring	7	8.75%	1	1.25%	0.030
Mortality	7	8.75%	1	1.25%	0.030

DISCUSSION:

The routine administration of prophylactic antibiotics to patients undergoing cardiac surgery is a well-accepted assumption in modern practice; however, the length of time antibiotics should be administered to a diabetic patient is not fully established. The duration of a prophylactic antibiotic regimen is directly related to the likelihood of developing resistant microorganisms. Therefore, the duration of antibiotic therapy should be limited to the shortest possible time necessary to effectively minimize the likelihood of postoperative infection. In addition, cardiac surgery patients invariably leave the operating room with indwelling thoracic catheters

The mean age in both groups was 51.62 ± 3.62 and 50.05 ± 4.24 years, respectively (<24 h vs. > 24 h). The incidence of comorbidities and operative diseases was similar in both groups. Both groups were comparable in terms of age ($p = 0.05$), sex ($p = 0.816$), performed surgery ($p = 0.214$), selection of antibiotics ($p = 0.499$) and re-exploration for bleeding ($p = 0.326$). During the study period, 11 patients developed surgical infection (SSI), the infection rate was 11.25% in the ABP group <24h and 2.5% in the group receiving ABP> 24h, and the difference was statistically significant ($p = 0.029$). The incidence of inpatient deep sternum wound infections (DSWI) / mediastinum was 7.50% in the <24 h ABP group and 1.25% in the > 24 h ABP group, and the difference was statistically significant ($P = 0.042$). In patients with deep organ space involvement (mediastinitis) and sepsis requiring cable replacement, there were 7 patients (8.75%) for <24 hours and 1 patient (1.25%) at> 24 hours ABP ($P = 0.030$). Similar results were seen in terms of mortality, 7 patients (8.75%) for <24 hours and 1 patient (1.25%) for > 24 hours ABP ($P = 0.030$). However, the isolated microorganisms showed a similar distribution in both groups. Morbidity, infections, and complex outcomes were more common in patients with diabetes.

and central venous and arterial lines, which may be potential pathways for bacterial entry and increase the risk of infection. Moreover, post-operative mediastinitis is associated with a very high hospital mortality and is also associated with reduced long-term survival. According to some studies, diabetes is associated with a higher DSWI rate. It is well known that DM patients undergoing CABG have poorer early and late outcomes than CABG patients without DM¹⁴. Intraoperative and postoperative blood glucose (BG) control has also been shown to have a significant impact on complications such as infections and mortality. Compared with nondiabetic subjects, diabetics undergoing coronary CABG have

poorer outcomes, including higher mortality and morbidity of severe wrist instability, wound infections, stroke, kidney dysfunction, and respiratory problems. Moreover, longer stays in intensive care units and hospitals, poorer postoperative physical functioning and a lower quality of life are also visible¹⁵. Glucose control during CABG is another controversial issue. A recent randomized trial showed a significantly higher rate of stroke and a slightly higher mortality with intensive glycemic control targeting normoglycemia (100 mg / dl) during CABG. The incidence of diabetes and glucose intolerance, and thus habitual hyperglycemia, is higher among CABG patients (37% in our cohort) compared to critically ill patients assessed in studies that showed an advantage over intensive glycemic control. As most of our patients have poor diabetes management and do not take oral hypoglycemic drugs or insulin regularly, unless they are hospitalized, this likely contributes to the higher incidence of diabetes-related complications. The data suggest that the risk of poor outcomes is higher in people with diabetes who are undergoing CABG. The significance of this is not yet known, but warrants further research. This evidence, along with many other related recent studies, warrants the initiation of large prospective studies assessing the duration of antibiotic prophylaxis in diabetic patients undergoing CABG.

CONCLUSION:

The data show that the higher incidence of deep sternum wound infections (DSWI) / mediastinitis associated with ABP treatment less than 24 hours suggests the need for prolonged ABP in diabetic patients undergoing CABG.

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