COMPARISON OF POSTOPERATIVE WOUND INFECTION IN CONTROLLED DIABETIC AND NON-DIABETIC PATIENTS IN ELECTIVE OPERATIONS

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Abstract

Background: *Diabetes mellitus (DM) is a systemic disease that alters the metabolism of blood sugar. Poorly controlled diabetes or hyperglycaemia is associated with an array of micro-vascular, macro-vascular, and neuropathic complications. There is a widely held belief that infections are usually more frequent and severe in diabetic patients. Diabetes prevalence is increasing in the developed & developing countries, and the appropriate management of patients with diabetes has become increasingly important for the prevention of hospital-acquired infections. Postoperative wound infection continues to be a major source of morbidity and mortality in developing countries despite recent advances in aseptic techniques. There is little information regarding postoperative wound infection in controlled diabetic patients undergoing elective operation.*

Objectives*: The aim of our study was to evaluate the postoperative wound infection in controlled diabetic and non-diabetic patients in elective operations.*

Materials & method: *This cross sectional comparative study was conducted in Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, during the period of October 2011 to March 2012. A total seventy three patients with controlled diabetics and seventy three non-diabetics were selected. Inclusion criteria were patients undergoing clean and clean-contaminated elective operations. Un-controlled diabetes, patient undergoing contaminated and dirty operation, patient with tuberculosis, jaundice, uraemia, having cortico-steroids /chemo-radiation and operated for malignancies were excluded. After preoperative preparation specific operation was done. All patients were followed up for 30 days of post operative period for development of any postoperative wound infection. All information recorded in data collection sheet. Data was processed and analysed with the help of computer program SPSS-16 and Microsoft excel. Quantitative data expressed as mean and standard deviation and qualitative data as frequency and percentage.*

Result*: The patients of diabetic group [31 male, 42 female; mean age, 44.5 (SD 8.2) years] and non-diabetic group [40 male, 33 female; mean age, 43.1 (SD 9.4) years] were similar in age and sex (p>0.05 each). The rate of postoperative wound infection after elective abdominal surgery was 7.5% [in controlled diabetic group was 12.3% and that of non-diabetic group was 2.7% (p<0.05)] and the patients of diabetic group were 5.0 times more likely to develop wound infection as compared to that of non-diabetic group (OR=4.992; 95% of CI=1.040–23.971) in clean and clean contaminated elective abdominal surgery. The length of postoperative hospital stay was significantly more in diabetic group than that of non-diabetic group (8.2 (SD ± 2.9) vs 6.8 (SD ± 3.2) days; p<0.01).*

Conclusion*: Postoperative wound infection was higher in controlled diabetic patients than that of non-diabetic. These results support the consideration of diabetes as an independent risk factor for SSIs after elective surgery. Continued efforts are needed to improve surgical outcomes for diabetic patients.*

Key words: *Postoperative wound infection, Diabetes mellitus, Elective operation*

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Introduction

Postoperative wound infection or surgical site infections (SSI) constitute a large burden of disease globally. Worldwide, wound infection occur in 2%–20% of patients after operation, and the rate differs according to the environment in which operations are performed, local resources, and a number of patient- and surgery-related factors[1]. Rates are likely higher in Low- and Middle-income Countries (LMICs). Surgical site infections are the most common infectious complications among hospitalized patients in developing countries, with a pooled cumulative incidence of 5.6 infections per 100 surgical procedures[2]. The incidence differs depending on the mode of surgery, degree of contamination and patient's factors like diabetes mellitus, malnutrion, anemia.

Postoperative wound infection (SSI) can be defined as infections that occur within one month of post operative period and within one year after implant or prostheses surgery and involving surgical site. It is considered as a major problem in post operative patient leading to prolonged hospital stay and excess economic burden to patients[3]. Despite the improvement in surgical technique and infection control protocols SSI still considered as a major problem in any hospital settings[4]. These infections are usually occur as primary infection during surgery or as secondary infection after surgery by both exogenous and endogenous microorganisms that enter the operative wound either during the surgery (primary infection) or after the surgery (secondary infection).

Many factors are responsible for development of SSI which can be categories patient related factors such as old age, nutritional status, co-morbid condition (diabetes, hypertension etc) and procedure related factors such as poor surgical technique, prolonged operative time, inadequate sterilization of surgical instruments can increase the risk of SSIs significantly[4]. Besides this factors, virulence and invasiveness of microorganism also considered as important factor.

Risk of wound infection varies with the type of surgery and surgical operations have been classified into, clean, clean-contaminated, contaminated and dirty [5, 6]. A clean wound is an incision through un-inflamed tissue in which the wound is primarily closed. In this wound type only closed drainage systems are used and there is no breach in aseptic technique and the viscus is not opened. A clean-contaminated wound is one (that is otherwise clean) created at emergency surgery and in which the un-inflamed upper gastrointestinal tract, normal gall bladder and urinary bladder are opened but there is no spillage of contents and there is minor break in aseptic technique. Contaminated wounds are traumatic wounds less than 6 hours old and wounds in which the inflamed upper gastrointestinal tract and obstructed urinary bladder are opened or spillage of contents occurs. In these wounds there are major breaks in sterile technique. Dirty wounds are associated with presence of pus and may include intra-peritoneal abscess formation or visceral perforation and traumatic wounds more than 6 hours old[5, 6.]

Numerous studies have found a strong association between diabetes mellitus and SSI, even when controlling for other risk factors[7, 8]. Recent evidence suggests that hyperglycemia plays a significant role in the development of postoperative infections.[9, 10] This increased infection risk in diabetic patients can be attributed in part to physiologic alterations precipitated by inadequate glucose control. Impairment of neutrophil chemotaxis, phagocytosis, and adherence as well as glycosylation of collagen matrix proteins contribute to weakened antibacterial defenses as well as delayed wound healing.[11] Moreover chronic hyperglycemia results in small vessel vasculopathy, leading to local tissue hypoxia and ischemia, potentially impaired penetration of prophylactic antibiotics to the surgical ûeld, and diminished production of oxygen-free radicals necessary for phagocytosis of invading bacteria.[12] All these factors help contribute to an increased risk of SSI in diabetic patients. The aim of the present study was to compare the rate of documented SSI in controlled diabetics with that of non-diabetics of same age group.

Objective

To find out the rate and pattern of wound infection between controlled diabetic and non-diabetic patients undergoing and clean contaminated elective operations.

Methodology

This cross sectional comparative study was conducted in Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka from October 2011 to March 2012. Patients those got admitted in hospital and were undergone clean and clean contaminated elective operations during the study period were enrolled for study. Sample was selected by purposive sampling technique. For this purpose 73 patients with controlled diabetics (Group-A) and 73 non-diabetics (Non-diabetic group) were selected according to inclusion and exclusion criteria. Patient within 18-60 years of age, irrespective of sex undergoing clean and clean-contaminated elective operations were included and patients with un-controlled diabetic undergoing contaminated operation, emergency operations, reoperation, tuberculosis, jaundice were excluded. Informed written consent was taken from the patient. Detailed history of each patient, important and relevant findings on thorough physical examination was recorded and in all cases relevant investigations were done. Diabetes was considered controlled when fasting blood sugar level within 4.72 to 7.2 mmol/dl, blood sugar two hours after breakfast >10 mmol/dl, HbA_1C in level ≤7%. The diagnosis of wound infection was based on developing fever and pain at operation site, wet dressing and appearance of discharge of pus. Collection of swab was sent for bacteriological culture and sensitive. The patient information was recorded and included in data collection sheet. The demographic indices, for example, age, sex, and residence, along with clinical data, including the associated symptoms, vital signs, and general and systemic examination, were recorded. The data were collected and statistical analysis was performed using SPSS software version 22. The results were represented as categorical data, and chi-square test was used. We reported statistically significant *P* values ($P \leq 0.05$) and their 95% confidence intervals.

Result & Observation

According to the questionnaire, history of all the selected cases were taken, the clinical examination was carried out meticulously. Result & observations are given below,

Table-I

Demographic profile of Study population (n=146)

Variables	Group-A (n=73)	Group-B (n=73)	p value
Age			
21-30 years	8 (11.8)	10 (13.7)	
31-40 years	16 (21.9)	16 (21.9)	
41-50 years	36 (49.3)	35 (47.9)	
51-60 years	13 (17.8)	12 (16.4)	
Total	73 (100.0)	73 (100.0)	
Mean (SD)	44.5 (8.2)	43.1 (9.4)	0.862
Sex			
Male	31 (42.5)	40 (54.8)	0.048
Female	42 (57.5)	33 (45.2)	
BMI (mean±SD)	20.9±1.7	21.1±1.5	0.593

Table I shows the age distribution of the patients. The mean age of the patients was 44.5 (SD 8.2) years in diabetic group; whereas 43.1 (SD 9.4) years in non-diabetic group. In diabetic group, 36 (49.3%) patients were aged between 41 to 50 years. It was 35 (47.9%) in the non-diabetic group. There were 31 (42.5%) male and 42 (57.5%) female in diabetic group; whereas 40 (54.8%) male and 33 (45.2%) female in non-diabetic group. The mean BMI was 20.9 (SD 1.7) Kg/M^2 in diabetic group; whereas the BMI of the non-diabetic group was 21.1 (SD 1.5) Kg/M^2. The age, sex and BMI of the patients of diabetic group and non-diabetic group did not show any statistically significant difference (p>0.05).

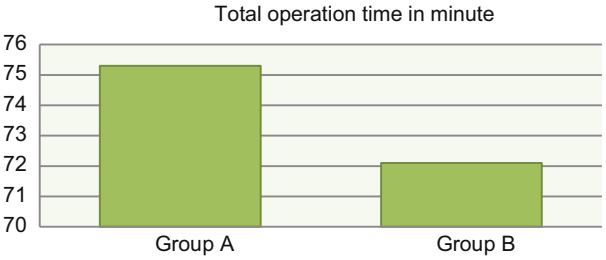

Fig.-1: *Comparison of total operation time (n=146)*

The mean operation time was 75.3 (SD 30.0) minutes in diabetic group; whereas the mean operation time of the non-diabetic group was 72.0 (SD 30.6) minutes. The mean operation time in both groups was almost identical (Z=0.670; p>0.05). (Figure 1)

Table- II

Distribution of patients by wound infection (n=146)

Wound infection	Group-A (n=73)	Group-B (n=73)	Total (n=146)	p value
Yes	9 (12.3)	2 (2.7)	11 (7.5)	
No	64 (87.7)	71 (97.3)	135 (87.3)	0.021
Total	73 (100.0)	73 (100.0)	146 (100.0)	

Table- III

Risk of wound infection between the groups (n=146)

Risk of Wound infection	Group-A (n=73)	Group-B (n=73)	Total(n=146)	Odds Ratio (95% of CI)
Yes	9	2	11	4.992
No	64	71	135	(1.040–23.971)
Total	73	73	146	

Table- IV

Distribution of patients by length of postoperative hospital stay (n=146)

Postoperative hospital stay in days	Group-A (n=73)	Group-B (n=73)	p value
Mean	8.2	6.8	0.054
SD	2.9	3.2	

Postoperative wound infection developed in 9 (12.3%) patients of diabetic group and 2 (2.7%) patients of non-diabetic group. Postoperative wound infection was significantly more common in diabetic group than that of non-diabetic group (χ^2=4.818; p<0.05). Distribution of patients by wound infection was shown in table-II.

The patients of diabetic group were 5.0 times more likely to develop wound infection as compared to that of non-diabetic group (OR=4.992; 95% of CI=1.040–23.971). Risk of wound infection between the patients of diabetic group and non-diabetic group was shown in table-III.

The mean length of postoperative hospital stay was 10.0 (SD ± 3.5) days in diabetic group; whereas the mean length of postoperative hospital stay of non-diabetic group was 8.8 (SD ± 1.9) days. Length of postoperative hospital stay was significantly more in group A than that of non-diabetic group (Z=2.092; p<0.05). Distribution of the patients by length of postoperative hospital stay was shown in table IV.

Discussion

The present study was conducted among 146 patients and allocated in to two groups: 73 patients with controlled diabetics (Group-A) and 73 non-diabetics (Group-B) were selected according to inclusion and exclusion criteria. In this study mean age of the patients was 44.5 (SD 8.2) years in diabetic group; whereas 43.1 (SD 9.4) years in non-diabetic group. In diabetic group, 36 (49.3%) patients were aged between 41 to 50 years. It was 35 (47.9%) in the non-diabetic group. There were 31 (42.5%) male and 42 (57.5%) female in diabetic group; whereas 40 (54.8%) male and 33 (45.2%) female in non-diabetic group. The mean BMI was 20.9 (SD 1.7) Kg/M^2 in diabetic group; whereas the BMI of the non-diabetic group was 21.1 (SD 1.5) Kg/M^2. The age, sex and BMI of the patients of diabetic group and non-diabetic group did not show any statistically significant difference (p>0.05).

The result in this study was similar to the result of other few studies. There are male predominance as found in study by Negi et al

(2015) with male: female ratio of 2.9:1[13]. Acceding to Dessie et al (2016) reported that median age of the study population was 30 years (8–80 years), and most of (56 (52.3%) of the study cases were females[14]. There was higher incidence of SSI (51.8%) in patient above 50 years of age comparison to an incidence of 12.4% in patients below 30 years of age[13]. Older age is an important risk factor for the development of post operative wound infection, as in aged patients there is delayed healing rate, lack of immunity and presence of co-morbid illness like diabetes, hypertension, ashma, HIV, etc.

In the present study mean operation time was 81.6 (SD 32.3) minutes in diabetic group; whereas the mean operation time of the non-diabetic group was 74.6 (SD 30.9) minutes. The mean operation time in both groups was almost identical (p>0.05). Similar duration of operative time reported by Rahman,[15] and Mowla.[16]

The rate of postoperative wound infection in the current study was 11 (7.5%). There was similar rate of postoperative wound infection by Saito et al[17] in Japan that rate of SSI was 7.6%. In other study in Iran, estimated rate of SSI according to one study was found to be 9.9%,[18] and in another study it was 8.4%.[19] Reported rates of post operative wound infection from African countries ranges from 16.4% to 38%,[20] while estimated rates of SSI in two studies in Italy were 5.2%,[21] and 5.9% [22] respectively. But in other study conducted in the United states, the SSI rate was 2.8%.[23] They also suggest that the actual range of rate of SSI lies between 15% and 20% depending mainly on the type of surgical procedure and the wound classification. Although the rate of wound infection (7.5%) in this study was slightly higher as compared with results from developed countries, by comparison, our results are not discouraging, keeping in mind the operation theatre conditions and operation load in the current study place.

This study also showed that the patients of diabetic group were 5.0 times more likely to develop wound infection as compared to that of non-diabetic group (odds ratio OR=4.992; 95% of confidence interval CI=1.040–23.971). This result was consistent with the study of Ata et al.[24] that patients diabetes mellitus had 4.28 times increased risk of development of post operative wound infection in general surgery patients [OR=4.28; 95% of CI=2.83-6.46]. Vilar-Compte et al.[25] found diabetes mellitus increased the risk of infection by 2.6 times [OR=2.61; 95% of CI=1.53-4.48]. Olsen et al.[26] reported chance of postoperative wound infection in diabetes was 8.4 times more than that of non-diabetics [OR=8.4; 95% of CI=3.5-19.8].

The increased infection risk in diabetics can be attributed to the impaired neutrophil chemotaxis, phagocytosis, the adherence and glycosylation of collagen matrix proteins, all of which lead to weakened antibacterial defenses and delayed wound healing.[11] However, a recent study reported similar rates of deep surgical site infection in both diabetic and non-diabetic cardiothoracic patients.[27] Moreover, the level of glucose dysfunction and its control at the point of surgery and in the postoperative period are highly predictive of wound infection.

Conclusions

The rate of post operative wound infection in controlled diabetic patient was significantly more the that of non diabetic patient. So the chance of development of post operative wound infection is still more even in controlled status of diabetic patient. As evident in this study more prospective data are needed to reproduce an recommendation.

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