Print ISSN: 2958-3675 | Online ISSN: 2958-3683
International Journal of Medical and Pharmaceutical Research
Available Online at https://ijmpr.in/
ORCiD ID: 0000-0002-3849-6959
Volume 4, Issue 1; (2023); Page No. 157-164
Original Article
Open Access

Comparative Study of Post-Operative Wound Infection in Controlled Diabetic Patients with Non-Diabetic Patients in Elective Surgery Under Cover Of Prophylactic Antibiotics

Sayem Al Monsur Faizi[1*]; Aklima Parvin[2]; Chittaranjan Das[3]; Iftakhar Al Mamun[4]; AK Al-Miraj[5]
[1]Medical officer, Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
[2]Medical officer, OSD, DGHS, Mohakhli, Dhaka, Bangladesh
[3]Associate professor, Department of Surgery Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
[4]Medical officer, Department of Surgery Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
[5]Research Assistant, Department of Vascular Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

ABSTRACT

Introduction: Diabetes mellitus (DM) is a systemic disease that alters the metabolism of blood sugar. Patients with DM incur risk of numerous systemic and complication-related micro angiopathies and neuropathies. **Objective**: To assess Post-Operative Wound Infection in Controlled Diabetic Patients with Non-Diabetic Patients in Elective Surgery Under Cover Of Prophylactic Antibiotics. **Methods**: A Prospective study was conducted at Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from January to Jun 2010. Total no. of patients in the study was 200. 100 of them are diabetic and other 100 are non-diabetic. Prophylactic cover of broad-spectrum antibiotic is given. Therapy is continued when there is unexpected contamination. Adult patients undergoing elective surgery. **Results**: Total 100 cases of diabetic patient and 100 case of non-diabetic patient of nearly same age group undergoing elective surgery under cover of prophylactic antibiotic. After operation blood glucose level in controlled diabetic group was significantly higher compared to their non-diabetic counterpart ($p < 0.001$ level of significance is 0.05). The mean hospital stay of controlled diabetic group and non-diabetic group was not statistically different (8.50 ± 5.53 vs. 7.48 ± 3.41, $p = 0.270$). In case of controlled diabetic group post-operative hospital stay was slightly higher for controlling blood sugar level which became uncontrolled after operation. Wound infection in controlled diabetic group was 9 and in non-diabetic was 7. The groups were not statistically different in terms of wound infection ($p > 0.05$, level of significance is 0.05). Other infections after operation were almost identically distributed between groups. Around 8% of the patients in both the groups developed other infections like urinary tract infection and respiratory tract infection ($p > 0.05$). So, surgical complications (wound infection, others infection and hospital stay) in diabetic and non-diabetic, after controlling blood sugar level and proper preoperative management were not significantly different. **Conclusion**: Post-operative wound infection rate of diabetic and non-diabetic are 9% and 7% respectively. The mean post-operative hospital stay of controlled diabetic group and non-diabetic group is not significantly different. A large number of diabetic patients present with uncontrolled glycaemic status at presentation of surgery. So they require control of diabetes before surgery. .

Keywords: *Post-Operative, Wound Infection, Diabetic Patients, Prophylactic Antibiotics*

***Corresponding Author**
Sayem Al Monsur Faizi
Medical officer, Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

INTRODUCTION

Diabetes mellitus (DM) is a systemic disease that alters the metabolism of blood sugar. Patients with DM incur risk of numerous systemic and complication-related microangiopathies and neuropathies.[1] During surgery, excessive lipolysis and ketogenesis with suppression of insulin secretion have deleterious effects on the patients of diabetes.[2] There is a widely held belief that infections are more frequent and severe in diabetic patients after surgery. Di Palo et al. demonstrated that diabetic patients had considerably higher rate of septic complications in clean surgical procedures.[3] Hjortrup et al. reported on 224 controlled match DM and non- DM cases who received vascular surgery or abdominal surgery, and found no difference in wound infection rates between these two groups [4]. Dr. Clare Heal investigated the infection rates among 857 patients who had undergone minor surgical procedures with their own practices. Seventy-four (8.6%) of the patients who underwent surgery developed postoperative wound infections. The investigators identified several factors that had a significant impact on the risk of wound infection. Patients with diabetes were more likely to

develop an infection (18.2% vs.8.4%) [5]. An improvement in the mortality rates following surgery among persons with diabetes was noted in the original textbook of the treatment of diabetes mellitus, published in 1916 by Dr. Ellliot P. Joslin, who based his observations on 1000 surgical interventions in patients with diabetes[6]. This allowance for exercising less conservatism in selecting patients with diabetes for surgical intervention predates the discovery and widespread use of insulin. The infection of most surgical wound is referred to as superficial surgical site infection (SSSI). The other categories include deep surgical site infection (infection in the deeper musculofascial layers) and organ space infection. (Such as abdominal abscess after an anastomatic leak). A major SSI is as a wound that either discharges significant quantities of pus spontaneously or needs, a secondary procedure to drain it. The patients may have systemic signs such as tachycardia, pyrexia and a rise of white cell count. Minor wound infection may discharge pus or infected serous fluid but should not be associated with excessive discomfort, systemic signs or delay in return home.[7] In the past, diabetes was considered to be a major cause of increased mortality during surgery. Along with the advancement in antibiotic therapy, the development of insulin led to a significant improvement in operative mortality. Despite controlling the blood glucose level, other factors may play some role in the development of complication like postoperative infection in diabetic patients. This study is intended to detect post operative wound infection and duration of hospital stay after operation in control diabetics and to compare with that of non-diabetic patients in our country.

MATERIALS AND METHODS

Study design: Prospective study.

Study population: Adult patients undergoing elective surgery.

Sample size: To determine the sample size, the following formula is being used. Considering the nature of the study length of time, the sample size was 100 in each side to make a compromise between what is desirable and what is feasible.

Sample technique: Convenient sampling; every consecutive patient who was fulfill the inclusion criteria was included in the study.

Inclusion criteria for cases:

1. Adult patients undergoing elective surgery
2. Diabetic patient where diabetes mellitus is controlled pre- operatively at a satisfactory level either by diet or by hypoglycemic drugs or by insulin.
3. Willing to give consent.
4. Age 18 – 60 years.

Exclusion criteria for cases:

1. Patients undergoing emergency surgery.
2. The patient whose diabetes is not controlled at a satisfactory level.
3. The patient with severe multiple complications. (e.g. IHD, Neuropathy, Peripheral vascular disease).

Study Procedure: Total no. of patients in the study was 200. 100 of them are diabetic and other 100 are non diabetic. Prophylactic cover of broad-spectrum antibiotic is given. Therapy is continued when there is unexpected contamination. Suggestive prophylactic regimens are second generation cephalosporin with metronidazole. Post-operative wound infection is diagnosed by the unit chief. Established surgical infection treated on the basis of the principle that antibiotics do not replace surgical drainage of infection. I myself examine all the patients preoperatively & follow-up postoperatively up to discharge. I have checked the dressing in 4th operative day of all the patients. In case of infection it is categorized major surgical site wound infection & minor surgical site wound infection with the help of unit chief and my guide. Wounds are managed by cleaning & dressing or delayed primary or secondary closure where necessary.

Data collection: Patient's information was obtained by using predefined patients information sheet, which comprises structured questionnaire pre operative and postoperative observation and follow up of the patients.

Data Processing: Data are processed, edited and analyzed.

Data analysis: Findings of the study have compiled and calculated quantitative data are described accordingly and some qualitative data are coded and analyzed.

RESULTS

It is necessary to what measure were required to control diabetes before surgery: 1. Diabetics in whom metabolism are adjusted by merely diabetic measures. 2. Diabetics who require additional oral hypoglycaemic agents for metabolic

adjustment. 3. Diabetics requiring insulin treatment. It is essential for planning the different approaches. Non insulin dependent diabetic patients, having minor surgery, need observation only.

Table-1: Nature of diabetic control before surgery (n=100)

Nature of diabetic control before surgery	No (%)
Diet and exercise	24 (24.0)
Diet and oral agent	43 (43.0)
Insulin	33 (33.0)

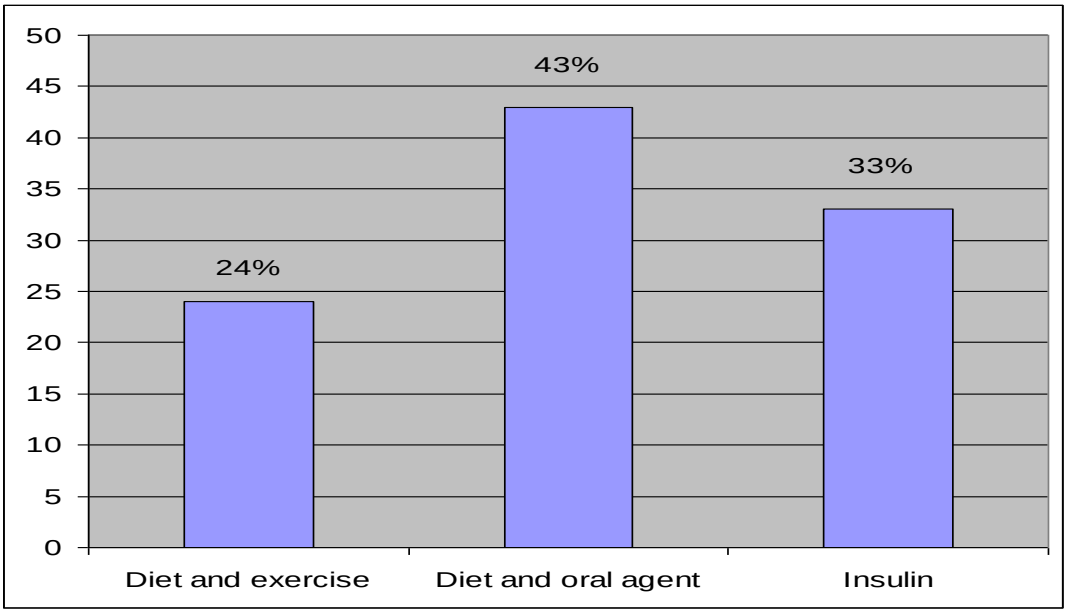


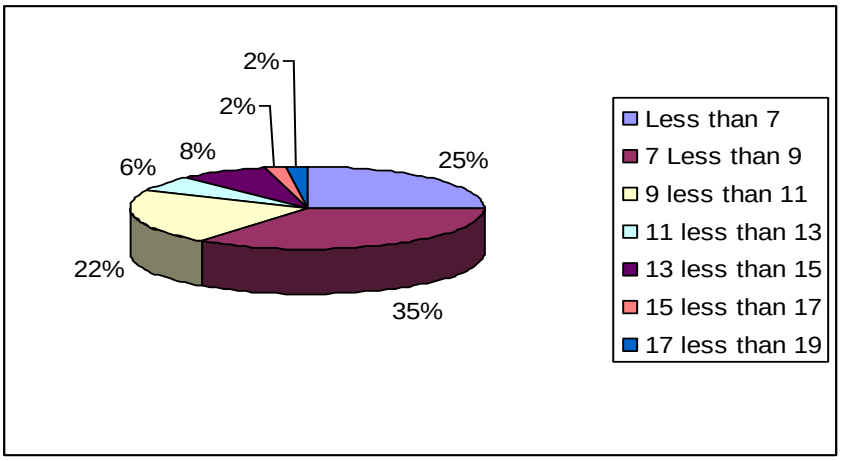
Fig-1: Observation of all diabetic patients.

About one fourth of all diabetic patients managed in our country by only by dietary manipulation. Maximum diabetic patients (43%) in our country are taking oral anti-diabetic agents for their glycaemic control.

Many patients presenting for elective surgery have previously poorly controlled diabetes. Any patients with pre-operative hyperglycaemia should be treated before for normalization of blood sugar level and must be constantly monitored during and surgery.

Table-2: Glycaemic status of diabetic and non-diabetic on admission (Two hours after breakfast)

Blood glucose level 2hr after breakfast mmol/L	Diabetic patient No (%)	Non diabetic patient No (%)
Less than 7	15 (15.0)	100 (100.0)
7 Less than 9	36 (36.0)	
9 less than 15	39 (39.0)	
More than 15	10 (10.0)	



Observation: 51% of diabetic patients undergoing surgery are well controlled (2hAFB below 10mml/L) on admission in hospital either with diet of oral hypoglycemic agent or insulin. Remaining 49% diabetic patient need control of diabetes before, because their glycaemic status is poorly controlled on admission.

Table-3: Blood Glucose level on Diabetic patient on admission (Two hours after Breakfast)

Blood glucose level 2hr AFB mmol/L	Diabetic patient	Non diabetic patient
Less than 7	36 (36.0%)	100
7 Less than 9	15 (15.0%)	
9 less than 11	10 (10.0%)	
11 to less than 13	5 (5.0%)	
13 to less than 15	7 (7.0%)	
15 to less than 17	1(1.0%)	
17 to less than 19	1 (1.0%)	
More than 19	25(25.0%)	

Observation: 51% of Diabetic patients undergoing surgery are well controlled on admission in hospital either with diet or oral hypoglycemic agent or insulin. Remaining 49% diabetic patient need control of diabetic before surgery because their gylcaemic status is poorly controlled on admission.

Table-4: Age distribution

Age in Years	Diabetic (n=100) No (%)	Non diabetic (n=100) No (%)
20-29 years	2 (2.0)	18 (18.0)
30-39 years	18 (18.0)	25 (25.0)
40-49 years	31 (31.0)	37 (37.0)
50-59 years	49 (49.0)	20 (20.0)

Observation: Diabetic patients are older than non-diabetic. In this study 80% of diabetic are more than 40 years age. On the other hand only 57% of the non-diabetics are above 40.

Table-5: Comparison of baseline variables between groups.

Base line variables	Group		P value
	Control diabetics (n=100)	Non Diabetic (n=100)	
Age (years)	45.68±9.61	46.06±10.17	0.848
Hospital stay before operation (days)	9.23±6.44	6.15±4.05	0.007
Duration of operation (minutes)	45.48±27.34	50.54±25.12	0.369

Data was analyzed using Student's T-Test.

The baseline variables like age and duration of operation were almost alike in both controlled diabetics and non diabetics (P = 0.848, p = 0.369). However, the mean hospital stay in controlled diabetic was significantly higher before operation (9.23±6.44 days) than that in non diabetic (6.15±4.05 days) (P = 0.007).

Table-6: Comparison of risk factors between groups.

Risk factors	Controlled diabetics (n=100), No (%)	Non diabetic (n=100), No (%)	P value
Peripheral vascular disease	5 (5.0)	3 (3.0)	5
Ischaemic heart disease	7 (7.0)	3 (3.0)	0.309
Chronic renal failure	2(2.0)	00 (0.0)	0.500
Hypertension	11 (11.0)	9 (9.0)	0.500

Observation: All risk factors like hypertension, ischemic heart disease, renal failure, peripheral vascular disease were almost identically distributed between controlled diabetics and non diabetis.

Table-7: Comparison of nature of operation between groups.

Nature of operation done	Group		P value
	Control diabetics (n=100), No (%)	Non Diabetic (n=100), No (%)	
Gastric out let obstruction	15 (15.0)	19 (19.0)	0.752
Thyroidectomy	17 (17.0)	25 (25.0)	
Cholecystectomy	29 (29.0)	24 (24.0)	
Carcinoma Breast	16 (16.0)	13 (13.0)	
Carcinoma colon	23 (23.0)	19 (19.0)	

#Data were analyzed using chi-square (x^2) test.

The nature of operation performed on patients were almost similar in both controlled diabetics and non diabetics (p=0.752)

Table-8: Comparison of RBS level after operation between groups.

RBS after operation mg/dl		
Control diabetics n = 100	Non Diabetic (n = 100)	P value
7.68±3.04	5.67±0.76	< 0.001

Data were analyzed using unpaired student's t-test.

The random blood sugar level in controlled diabetic was significantly higher (7.68±3.04 mg/dl) compared to their non-diabetic counterpoint (5.67±.076 mg/dl) (p< 0.001).

Table – 9: Comparison of post-operative hospital stays between groups.

Post-operative hospital stay (Days)		P value
Controlled diabetics (n = 100)	Non diabetics (n= 100)	
8.50±5.53	7.48±3.41	0.270

Data were analyzed using unpaired student's t test and were presented an (Mean± SD): level of significance was 0.05.

The mean hospital stay of controlled diabetic groups and non diabetic group was not statically different (8.50±5.53 VS 7.48±3.41, p = 0.270)

Table-10: Comparison of wound infection between groups

Wound infection	Groups		
	Controlled diabetic n = 100	Non Diabetic n = 100	`P Value#
Yes	9	7	0.500
No	91	93	

#Data were analyzed using Chi-square (x^2) test.

In controlled diabetic group 9% and in non diabetic 7% encountered wound infection after operation. The group were not statistically different in terms of wound infection (P>0.05).

Table – 11: Comparison of other infection between groups

Other infection	Group		
	Controlled diabetics (n = 100)	Non diabetics (n = 100)	P value
No infection	91	93	
Respiratory infection	5	4	

Urinary tract infection	4	3	0.926

Data was analyzed using Chi-square (x^2) -test.

Other infections after operation were almost identically distributed between groups. Around 8% of the patient in both the groups developed other infection like urinary tract infection and respiratory tract infection (P>0.05).

Table – 12: Comparison of nature of post-operative around infection between groups.

Nature of infection	Controlled diabetics	Non diabetics
Major surgical site wound infection	4	3
Minor surgical site wound infection	5	4

Major surgical site wound infection and minor surgical site wound infections in between diabetic patient and non diabetic patient were all most identically distributed.

DISCUSSION

Diabetes mellitus is the most common endocrine disease. Diabetic patients frequently need surgery. In a study it is shown that every other diabetic, at least once in his life require surgery[8]. This clearly indicates the importance of peri–operative management of a diabetic in our country. In this study, we found that about half (51%) of the diabetic patients on admission into hospital for surgery were in good glycaemic control with diet, oral agents or insulin therapy. The rest 49% of patients were not well controlled diabetic. M. Grani and his colleagues [9] reported in a study that 49% of diabetic patients at presentation for surgery has well controlled blood sugar level .Remaining 51 % of diabetic patients has poorly controlled glycaemic status that need preoperative preparation to bring down the blood sugar level to normal level. In another study J. Ivanyi and his colleagues [10] reported that 42% of diabetic patients need close medical treatment for controlling diabetic before surgery. The baseline variables in this study were blood glucose level before surgery presence of different complication of diabetic mellitus, hospital stay before operation, duration of operation, nature of operation. Post operative out come variables were blood glucose level after surgery, hospital stay after surgery, wound infection and other infection. All risk factors like chronic renal failure. Ischemic heart diseases, peripheral were almost identically distributed between controlled diabetic and non-diabetic. Comparing the Random blood sugar level after operation. The random blood sugar level in controlled diabetic groups was significantly higher (7.68±3.04 mg/dl) compare to their non diabetic counterpart (5.67±0.7mg/dl) (P<0.001). Trauma in general and surgery in particular, induces a complex series of hormonal and metabolic changes [11]. Insulin secretion is suppressed and the production of counter regulatory or stress hormone (Particularly contisol and catecholamine) is greatly increased. The metabolic result of these changes is a strong catabolic flux, with increased hepatic glucose production and breakdown of protein and fat. Normally, these changes are of little clinical significance, but in the diabetic patient, compromised by absolute or relative insulin deficiency, catabolism is enhanced and dangerous glycaemic instability and ketosis may result. These problems may be compounded by the period of starvation which accompanies surgery [12] Nature diabetic controlled in our country mainly by diet and exercise or diet and oral agents (67%). 33% of our diabetic patients present for surgery are on insulin therapy. In a study conducted in Hungary in 1989 reported that 48% of their diabetic patients are on insulin on admission.[10] In this study patients requiring insulin is administered according to “combined infusion” method. This method comprises glucose and insulin mixed in a single infusion bag usually with a small amount of potassium to prevent hypokalaemia. This is the so called glucose-potassium -insulin or GKI system [13], which has gained widespread acceptance due to its simplicity and effectiveness [14]. A vital aspect of care is adequate blood glucose monitoring. This is generally done by nursing staff at the bedside, using glucose –oxidase reagent strips read either visually or by meter Measurement are made 2 hourly on the day of surgery extending the interval later as necessary. Accuracy with these monitoring methods may be poor [15] and an occasional laboratory measurement may be advisable. Post-operatively diabetic patients have every chance of developing moderate to sever hyperglycaemia and ketosis. In this study we found 90 % diabetic patients can be managed without difficulty with GKI infusion system to keep blood sugar level below 10 mmol/L. In remaining 10 % diabetic patients show a tendency to develop moderate to sever hyperglycaemia post-operatively requiring close monitoring and insulin dosage adjustment. In a study conducted in zagrep in 1977 [(9)] showed that 12.75 % of diabetic patients had a tendency to develop sever hyperglycaemia. That study was also without any incidence of ketoacidosis. In another study conducted by J. Ivany and his colleagues [16] that post-operative ketoacidosis is relatively rare in diabetic with proper care. In that study only 0.3 % of total mortality is caused by ketoacidosis. One thing is that with appropriate monitoring and insulin adjustment ketosis does not occur in any diabetic patient post-operatively in this study Chance of developing hypoglycaemia during post-operative period was 12 % in this study To reduce the incidence of hypoglycaemia post-operative glycaemic targets not fixed to normoglycaemia or even near-norm glycaemia, as this has been shown to be unnecessary and outcome is not improved and the risks of hypoglycaemia are considerably increased. In this study if blood sugar level remains below 9 mmol/L no insulin is administered, only observation is the management of principle. A good number of diabetic patients have chronic complication which may influence anesthesia and post operative management. Therefore safe anesthesia and better peri-operative management, assessment of this chronic complication are essential. Duration of operation were almost alike in bath controlled diabetics and non diabetics (P = 0.369). However, the mean hospital stay in controlled diabetic was significantly higher (9.23±6.44 day) than in non diabetic (6.15±4.05 day) (P = 0.007). Hospital stay before operation was more for diabetic patients as some patient admitted in

hospital with uncontrolled blood sugar level so average hospital stay become more for controlling blood sugar level. Patient who took drugs suffer in uncontrolled blood sugar level but patient who took insulin had well controlled blood sugar level. Duration of operation (minutes) for controlled diabetic patient and non diabetic patients were nearly some as the nature of operation perform on patients were almost similar in both controlled diabetics and non diabetics (P = 0752). The mean post-operative hospital stay of controlled diabetic group and non-diabetic group was not statistically different (8.50 ± 5.53 vs. 7.48 ± 3.41, p 0.270) .In case of controlled diabetic group post operative hospital stay was slightly higher for controlling blood sugar level which became uncontrolled after operation. The post operative random blood sugar level in controlled diabetic group was significantly higher (7.68 ± 3.04 mg/dl) compared to their non-diabetic counterpart (5.67 ± 0.76 mg/dl) ($p < 0.001$).As for controlling blood sugar level patient blood sugar level were monitored two to four hourly and insulin dose was adjusted accordingly, so post operative hospital stay of controlled diabetic group and non-diabetic group as not statistically differ. Wound infection in controlled diabetic group was 9% and in non diabetic group was 7% after operation. The groups were not statistically different in case of wound infection ($p> 0.05$). Most of the wound infections were due to Staphylococcus Aureus and most of them were stitch infection. For find out weather any factor, other then diabetes mellitus influence the development of complication in diabetes patient. In my study I included base line variables were duration of operation, hospital stay before operation, nature of operation, chronic diseases such as chronic renal failure, ischemic heart disease, peripheral heart disease, hypertension but none of above had significant effect on wound infection and post operative hospital stay. In my study I omit theatre clothing, surgeon preparation, preparation of patient. Sterilization of instrument, surgical technique, so they may be affect wound infection. Around 8% of the patients in both the groups developed other infections like urinary tract infection and respiratory tract infection ($p > 0.05$) which were almost identically distributed between groups. For controlled diabetic patients urinary tract infection was 4%, respiratory tract infection was 5%. For non diabetic patients urinary tract infection was 3%, respiratory tract infection was 4%. Invasive procedure such as catheterization increased urinary tract infection both in diabetic and non-diabetic patient and intubations in case of general anesthesia increased respiratory tract infection both in diabetic and non diabetic patients.

CONCLUSION

Frequency and severity of post-operative wound infections are approximately similar between controlled diabetic and non-diabetic patients. Post operative wound infection rate of diabetic and non diabetic are 9% and 7% respectively. The mean post-operative hospital stay of controlled diabetic group and non diabetic group is not significantly different. A large number of diabetic patients present with uncontrolled glycaemic status at presentation of surgery. So they require control of diabetes before surgery.

Conflict of Interest: None.
Source of fund: Nil.

BIBLIOGRAPHY

1. Chung Liao-Jen , Jer-Chen Wen(2006) . Postoperative wound infection rates after posterior instrumented spinal surgery in diabetic patients. Chang Gung Med J;29;480-5
2. Isselbacher KJ, Braunwald(2001). EI Diabetes mellitus. In: Harrison's principles of Internal medicine. New York, Mc Graw Hill; 16th edition: 2152-2185.
3. Di palo S, Ferrari, G, Castolid R, Fiacco E(1988). Surgical septic complications in diabetic patients. Acta Diabetol Lat; 25:49-54
4. Hjorturp A, Sorensen C, Dyremose E, Hjortso NC(1985). Influence of diabeted mellitus on operative risk. Br J Surg; 72:783-5.
5. Medical Journal of Australia (2006); 185: 255-258.
6. Joslin EP(1916), the treatment of diabetes mellitus, Philadelphia.
7. Williams Norman's, But-stord J.K(2008). Christopher: Baily and Love's Short Practice of Surgery. Hodder Arnold:25th edition, 35.
8. Ronald Kahn C, Gordon C W(1994). Surgery and Diabeties. Joslin"s Diabetes Mellitus; 13th edition: 125-64. 111
9. M.Granic et al(1986). Preparation of Diabetics for Surgery. Diabetologia Jan; Vol 29:125-131
10. Ivany J, Gyimesi A, Banayi T. Surgical procedure on diabetiec patient internal aspect. Diabetologia Cortia 1989; 18-4:205-209.
11. Elliot M J, Albert KGMM(1983). Carbohydrate metabolism effects of pre-operative starvation and trauma. Cli. Anaesthesiology; 1: 527-50.
12. John Pick Up, Gareth Willium(1971). Surgery and diabetes mellitus. Text Book of Diabetes 1971; 1st edition: 820-825.
13. Alberti KGMM, Thomas DJB(1979). The management of diabetes during surgery. British Journal of anaesthiokogy: 51: 693-710.
14. Horst Bibergell(1986). Perisurgical care of the diabetic. Diabetologia; Vol 29: 123-33.
15. Marble A. et al(1971). Jostin"s Diabetes Mellitus; 11th edition: 539-79.

16. Walts L f, Moller J, Davidson M B, et al(1981). Peri-operative management of Diabetics mellitus. Anesthsiology; 55: 104-109.