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Original Article

Comparative Study of Operative Complications in Diabetic and Non-Diabetic Patients: A Prospective Study

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Islam MR[1], Mahalder MAA[2], Raman MS[3], Abedin MJ[4], Karim R[5]

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ABSTRACT

Introduction: *Diabetes mellitus is the most common endocrine disease. Diabetes mellitus involved an impairment in the normal utilization of carbohydrates, it become common practice to 'prepare' a person with diabetes for surgery by instituting a sudden and severe restriction of dietary carbohydrates and fat in off on to suppress glycosuria up to 24 hours of fasting.* ***Aim of the study:*** *Aim of the study was to evaluate the operative complications in diabetic and non-diabetic patients.* ***Material & Methods:*** *This study represents a prospective analysis of two hundred operative cases, half of these are diabetics and half of these are non-diabetics. Diabetic patients are mostly taken from BIRDEM, Dhaka, and non-diabetic patients are mostly taken from Dhaka Medical College Hospital, from July '05 to July '06. Patients of both the groups are approximate of similar age, and sex and have undergone a similar type of operation. Diabetic patients are assessed pre-operatively regarding their duration of diabetes. This study is intended to detect different surgical complications in controlled diabetics and compare them with that of non-diabetic patients in our country.* ***Results:*** *Eighty-five percent of diabetics are more than 40 years of age, on the other hand only half of the non-diabetics are above 40. 52 % of diabetic patients undergoing surgery are well controlled (2h AFB blood sugar level below 10 mmol/L) on admission to hospital either with diet or oral hypoglycemic agent or insulin. Maximum diabetic patients (41%) are taking oral anti-diabetic agents for their glycaemic control. Every fifth diabetic patient (21%) has got some form of ischemic heart disease due to coronary atherosclerosis, and 3% of diabetics have a history of myocardial infarction. 6 % of diabetic patients develop hypokalemia during the post-operative period. Patients requiring a higher dose of insulin (around 50 units! per day) are prone to develop hypokalemia. In this study, we found 8 % in diabetic and non-diabetic 6%. Diabetics with peripheral vascular disease are more prone to the development of wound infection.* ***Conclusion:*** *We conclude that hyperglycemia, hypokalemia and wound infections are much more common in these emergency*

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1. *Assistant Professor, Department of Surgery, Jessore Medical College Hospital, Jessore, Bangladesh*
2. *Assistant Professor, Department of Surgery, Jessore Medical College Hospital, Jessore, Bangladesh*
3. *Assistant Professor, Department of Surgery, Jessore Medical College Hospital, Jessore, Bangladesh*
4. *Assistant Professor, Department of Surgery, Satkhira Medical College Hospital, Khulna, Bangladesh*
5. *Classified Gynecologist, Combined Military Hospital (CMH), Jessore, Bangladesh*

cases. Large sample size and multicenter study should be required.

Keywords: *Complications, Operative, Diabetic, Endocrine, Carbohydrate*

INTRODUCTION

Diabetes mellitus is the most common endocrine disease. Diabetes mellitus involved an impairment in the normal utilization of carbohydrates, it become common practice to 'prepare' a person with diabetes for surgery by instituting a sudden and severe restriction of dietary carbohydrates and fat in off on to suppress glycosuria up to 24 hours of fasting. Save for liquids in the form of coffee, tea, and water was included in this diabetic regimen both before and after the operation. Oral intake of a carbohydrate-restricted and fat-free diet following surgery was reinstituted only if the urine was free of glucose and ketones. Not infrequently, large doses of sodium bicarbonate were given postoperatively, causing stomach upset and preventing normalization of oral intake of nourishment. These measures favored the depletion of glycogen stores and subsequent development of ketoacidosis. The common use of chloroform ether anesthesia further complicated this risk with their potential to precipitate acid base disturbances[1, 2] given the metabolic consequences of these dietary manipulations, it is unlikely they were the reason for improved surgical outcomes. Diabetes is susceptible to two major acute metabolic complications: diabetic ketoacidosis and hyperosmolar non-ketotic coma. The former is a complication of insulin-dependent diabetes, while the latter usually occurs in the setting of non-insulin-dependent diabetes. Ketoacidosis rarely, if ever, develops in true type 2 diabetes[3]. With the use of insulin, the emphasis shifted to the provision of a large number of carbohydrates throughout the perioperative period. The incidence of acidosis following surgery declined considerably. Root speculated that the improved outcome of surgery in the diabetic patient that followed the discovery of insulin might well have been related to the abandonment of the practice of starvation before surgery[4]. The use of dietary carbohydrate as vegetable broths, gruel, orange juice, and custards along with the administration of small doses of crystalline before meals three to four times daily during the preoperative period, formed the basis of preparation for surgery. Glucose was monitored four times daily by urine testing and confirmed on 011 occasions with blood glucose analysis. The dosage of crystalline insulin with its rapid action and short duration(S to 7 hours) often was based on a 'sliding scale' determined by the results of glucose testing of these single urine specimens. Hagedorn's discovery that the action of insulin could be extended by combining it with protamine led to the development of protamine zinc insulin (I'ZI) in 1935, the first long-acting preparation of depot insulin. Most persons with diabetes for whom dietary therapy was inadequate were now free of multiple daily injections of crystalline insulin. This is especially true that the metabolism is not always well compensated or has even decompensated with all of the concomitant dangers with regard to the fluid and electrolyte balance, circulatory regulation, and protection from infection. This study is intended to detect different surgical complications in controlled diabetics and compare them with that of non-diabetic patients in our country.

METHODS

This study represents a prospective analysis of two hundred operative cases, half of these are diabetics, and half of these are non-diabetics. Diabetic patients are mostly taken from BIRDEM, Dhaka, and non-diabetic patients are mostly taken from Dhaka Medical College Hospital, from July '05 to July '06. The aim of the study was to evaluate the operative complications in diabetic and non-diabetic patients. Patients

of both the groups are approximate of similar age, and sex and have undergone similar types of operations. Diabetic patients are assessed pre-operatively regarding their duration of diabetes, nature of control (i.e. diet & exercise only, oral hypoglycemic agents or insulin), the status of glycaemic control on admission for operation, and complications of diabetes like ischemic heart disease, neuropathy, peripheral vascular disease, hypertension, etc. Diabetic patients who present with poor glycaemic control are pre-operatively treated to bring down the blood sugar level to an acceptable level. Poorly controlled NIDDM patients undergoing major surgery which requires prolonged starvation are best managed with a system of continuous glucose and insulin delivery as for TDDM patients. Patients requiring insulin and glucose during and after surgery are treated with a combined infusion. Post-operatively blood glucose level is monitored> by the nursing staff at the bedside using glucose - oxidase reagent strips. Measurements are made 2 hours on the day of operation extending intervals later on. Post-operatively patients of both groups are followed up till their discharge from the hospital. During this follow-up, particular attention is given to metabolic derangements, (hypoglycemia or ketosis, etc) electrolytes, imbalance, wound infection, and nature of healing. Finally, these findings are compared between the two groups.

RESULTS

Diabetic patients are older than nondiabetics, In this study, 85% of diabetics are more than 40 years of age, on the other hand only half of the non-diabetics are above 40 (Table I). 52 % of diabetic patients undergoing surgery are well controlled (2h AFB blood sugar level below 10 mmol/L) on admission to hospital either with diet or oral hypoglycemic agent or insulin. The remaining 48 % of diabetic patients need control of diabetes before surgery because their glycaemic status is poorly controlled (2h AFB blood sugar level above 10 mmol/L) on admission. Of 48% of poorly controlled diabetic patients, 18 cases (35 %) have an infection that needs emergency surgical intervention (Table II). About one-fourth of all diabetic patients are managed by only dietary manipulation. Maximum diabetic patients (41%) are taking oral anti-diabetic agents for their glycaemic control (Table III). Every fifth diabetic patient (21%) has got some form of ischemic heart disease due to coronary atherosclerosis, and 3% of diabetics have a history of myocardial infarction. Quite a good number of diabetics have hypertension, IHD both of which aggravates circulatory renal complications (Table IV). Post-operatively glycaemic status is well controlled in 91 % of cases (blood sugar level below 10 mmol /L) with glucose- potassium-insulin infusion. 9 % show a tendency to develop hyperglycemia (blood sugar level above 10 mmol/L), so requires close monitoring of blood sugar level. Those patients having a tendency to develop hyperglycemia i.e. 78 % (7 out of 9 cases) are mostly harboring some infective foci. In this study, we found 2 cases of a burst appendix and 2cases of severe diabetic foot infection. In this study, post-operatively patients are maintained with glucose insulin and potassium infusion until a normal diet is resumed. Then patients who were previously only on diet or had taken oral hypoglycaemic preparations were put back on the same therapy. 6 % of non-diabetic patients develop hyperglycemia post-operative to the level of diabetic patients but blood sugar level returns to normal within 1- 2 weeks (Table V). 12% of diabetic patients develop hypoglycemia once or twice during post-operative glycogenic management. 6% of non-diabetic patients develop hypoglycemia but blood sugar level returns to normal within 1-2 weeks spontaneously (Table VI). Post-operative serum potassium level in diabetic patients 94 (94%) and non-diabetic patients 100 (100%) (Table VII). 6 % of diabetic patients develop

hypokalemia during the post-operative period. Patients requiring a higher dose of insulin (around 50 units! per day) are prone to develop hypokalemia. Those with infective conditions (mostly foot infection) are vulnerable to the development of hypokalemia (Table VIII). The wound infection rate in diabetic and non-diabetics is more or less equal. In this study, we found 8 % in diabetic and non-diabetic 6%. Diabetics with peripheral vascular disease are more prone to the development of wound infection. In non-diabetics, generalized peritonitis due to gut perforation is the common cause. Gut perforation is interestingly uncommon in diabetic patients (Table IX).

Table I: Age distribution of the study participants

Age in years	Diabetic	Non-diabetic
Belo-20	01%	12%
20-29	02%	18%
30-39	12 %	21 %
40-49	28%	26%
50-59	30 %	13%
More than 60	27 %	10%

Table II: Glycaemic status of diabetic and non-diabetic on admission

Blood sugar level 2h AFB (mmol/L)	Diabetic	Non-diabetic
Less then 7	14 (14%)	100 (100 %)
7-10	38 (38%)	---
10--15	33 (33%)	---
15--20	09 (09%)	---
20--30	05 (05%)	---
More then 30	01 (01%)	---

(2h AFB: 2 hours after breakfast)

Table III: Nature of glycaemic control before surgery.

Management mode of diabetic	Percentage
Diet & exercise	24%
Diet & oral hypo Glycaemic agents	41 %
Insulin	35 %

Table IV: Frequency of different complications with diabetics

Complications	Frequency in %
Ischemic heart disease	21%
Hypertension	17%
Peripheral vascular disease	06 %
Nephropathy	05 %
H/O myocardial infarction	03%
Chronic heart failure	03 %

Table V: Postoperative glycemic status in diabetic and non-diabetic patients.

Blood sugar level (mmoll L)	Diabetic	Non-diabetic
Less than 7	59 (59 %)	94 (94 %)
7-- 10	32 (32 %)	06 (06 %)
10--15	05 (05 %)	--- ----
15--20	02 (02 %)	--- ----
20--30	02 (02 %)	--- ----
More than 30	00 (00 %)	--- ----
Total	100 (100 %)	100 (100 %)

• None of these patients develop ketosis.
• None of these patients develop Hyperosmolar coma.

Table VI: Post-operative hypoglycaemia

Blood suger level (mmol/L)	Diabetic	Non-diabetic
Below 3 i.e hypoglycaemia	12 (12%)	----------
3—7(Euglycaemic)	41(41%)	94%
ABOVE 7 i.e hypoglycemia	47(47%)	06%

Table VII: Serum potassium level in diabetic and non-diabetic post-operative patients:

Serum potassium Level (mmol/L)	Diabetic	Non-diabetic
3.3-5.5	94 (94%)	100 (100%)
Below 3 i.e. Hypokalaemia	06 (06%)	---------

Table VIII: Details of the 6 hypokalaemic patients

Serum potassium level	Disease	Insulin dose
2.5 mmol!L	Foot infection	16+ 10+ 12 units
2.3 mmol! L	Foot infection	20+12+12 units
2.7 mmol!L	Burst appendix	28+12+12 units
2.3 mmol! L	Feacal fistula	Neutralizing ins. info
2.5 mmoll L	Foot infection	24+20+ 12 units

Table IX: Post-operative wound infection rate in diabetics and non-diabetics.

Nature of operation	Diabetic	Non-Diabetic
Amputation due to P.V.D	5	2
Appendectomy	2	---
Generalized peritonitis due to gut perforation	---	3
Abdomino-Perineal resection	1	1
Total	8(8%)	6(6%)

DISCUSSION

In this study, we found that 97% of diabetics are above 30 years of age and 85% are above 40 years. On the other hand among non-diabetic patients only half of the patients are above 40 years. A similar picture in the western world is also, shown in a study conducted m Yugoslavia[5]. They found most of the diabetic cases were above 40 years of age.

In this study, we found that about half [52%] of the diabetic patients on admission to the hospital for surgery were in good glycaemic control with diet, oral agents, or insulin therapy. The rest 48% of the patients were not well-controlled diabetics .M. Grani and his colleagues[6] reported in a study that 49 % of diabetic patients at presentation for surgery have well-controlled blood sugar levels. The remaining 51 % of diabetic patients have poorly controlled glycaemic status that needs preoperative preparation to bring down the blood sugar level to normal level. In another study, J. Ivanyi and his colleagues[7] reported that 42 % of diabetic patients need close medical treatment for controlling diabetes before surgery. Nature of diabetes control in our country mainly by diet and exercise or diet and oral agents (65 %) and 35 % of our diabetic patients who presented for surgery are on insulin

therapy. A study conducted in Hungary in 1989 reported that 48 % of their diabetic patients are on insulin on admission[7]. A good number of diabetic patients have chronic complications and associated illnesses which may influence anesthesia and post-operative management. In this study, we found every fifth of diabetic patients may have ischemic heart disease (21%). 3 % of them have a history of Myocardial Infarction. 17 % of diabetic patients have associated hypertension thus complicating further its management. 6 % have peripheral vascular disease, 5 % have nephropathy and 4 % have bundle branch block on E.C.G. Therefore, assessment of these chronic complications is essential for safe anesthesia and better perioperative management. Patients the peripheral vascular disease are prone to developing wound infection, so they need better wound care than others. Hjortrup A et al[8] was similar to our study. Waren J H et al[9] and Schwartz Sf et al[10] are also comparable to our study. Cardiovascular disease is the leading cause of mortality among persons with diabetes, Assessment of cardiac risk; including appropriate test to detect significant coronary artery disease is essential in the preoperative evaluation of the patient with diabetes who is undergoing a major surgical procedure[11]. Post-operatively diabetic patients have every chance of developing moderate to severe hyperglycemia and ketosis. In this study, we found that 90 % of diabetic patients can be managed without difficulty with the OKI infusion system to keep blood sugar levels below 10 mmol. The remaining 10 % of diabetic patients show a tendency to develop moderate to severe hyperglycemia postoperatively requiring close monitoring and insulin dosage adjustment. Emergency infective cases, like diabetic foot infection, burst appendix, acute appendicitis, etc are the vulnerable groups who develop postoperative hyperglycemia. In this study, 80 % of patients developing postoperative hyperglycemia are constituted by these groups. A study conducted by Bačić M et al[6] showed that 12.75 % of diabetic patients had a tendency to develop severe hyperglycemia. That study was also without any incidence of ketoacidosis. Another study conducted by J. Ivany and his colleagues[7] showed that post-operative ketoacidosis is relatively rare in a diabetic with proper care. In that study, only 0.3 % of total mortality is caused by ketoacidosis. An important message is that with appropriate monitoring and insulin adjustment ketosis does not occur in any diabetic patient post-operatively in this study. The chance of developing hypoglycemia during the post-operative period is 12 % in this study. To reduce the incidence of hypoglycemia post-oper~tive glycaemic targets not fixed to normoglycaemia or even near-normoglycaemia, as this has been shown to be unnecessary and outcome is not improved and the risks of hypoglycemia are considerably increased. In this study if the blood sugar level remains below 9 mmol no insulin is administered, only observation is the management of principle. In this study, the postoperative serum potassium levels in diabetic patients were 94 (94%), and in non-diabetic patients 100 (100%). Insulin causes a shift of potassium into intracellular fluid and may cause hypokalemia during perioperative management of diabetic patients[12]. In this study, 6 % of diabetic patients develop hypokalemia during the post-operative period. Infective surgical patients requiring a higher dosage of insulin (around 50 units I day) are the most susceptible totients to developing hypokalemia. But peripheral vascular insufficiency in diabetics apparently increases the chance of infection in the lower extremity[13]. In this study, we found the rate of infection is 8 % in diabetics and 6 % in non-diabetics. In general wound healing and infection rates are approximately similar to those in non-diabetic patients with exception of ischemic diabetic foot. A study by Chazan et al[14] reported that with the use of insulin and efficient antibiotics post-operative

infection rates in diabetic patients are 8.5 %.

CONCLUSION AND RECOMMENDATIONS

In this study, It was found that diabetic patients requiring emergency surgery or having infective foci, peripheral vascular disease, and ischemic heart disease are prone to develop complications. But with adequate control of diabetes and proper pre-operative assessment and measurement, the frequency of different surgical complications in a diabetic and non-diabetic are approximately similar with the exception of a few metabolic complications like hyperglycaemic (9%), hypoglycaemic (12%), and hypokalemia (6%) episodes in diabetics. There was no incidence of ketosis or hyperosmolar cornu in this study. The wound infection rate for diabetics is 8% and for non-diabetics is 6% respectively. In this study, we conclude that hyperglycemia, hypokalemia and wound infections are much more common in these emergency cases. Large sample size and multicenter study should be required for robust data.

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