Comparison Of Early Postoperative Complications Of Laparotomies In Diabetics And Non-Diabetics - A Study On South Indian Population

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Citation

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Abstract

Diabetics undergoing surgery suffer an increased risk of peri-operative complications. Higher rate of infection, delayed wound healing, ischemic complications, autonomic neuropathy, difficulties in controlling glycemic levels and longer hospital stay burden the outcome of surgery. Yet a detailed study to look for the incidence of complications, its relation to glycemic levels and type of surgery was lacking especially in an Indian setup. In this study we have tried to access the effect of hyperglycaemia on post-operative complications of laparotomies in diabetic patients. A comparison with non-diabetic patients regarding the complications was drawn.

Aims:

To study the effect of hyperglycaemia on post-operative complications of laparotomies in diabetic patients, and correlate it with glycemic control.

Methods and Material:

All patients undergoing laparotomies were studied. A detailed history and laboratory data were obtained at presentation. Patients were followed through their hospital stay for glucose level and postoperative complications. Statistical analysis was done and results were compared between cases and controls. SPSS 13 was used for statistical analysis.

Results:

Diabetics had more complications, with electrolyte imbalance being the most common (28% v/s 14.4%); prolonged ileus (39.8% v/s 21.1%), wound infection (31.4% v/s 22%), wound dehiscence (7.6% v/s 1.9%), anastomotic leak (3.4% v/s 1.9%), lower respiratory tract infection (22% v/s 7.9%), and urinary complications (17.8% v/s 6.8%) were more frequent in diabetics, mortality also was higher in them (8.5% v/s 3.3%).

Conclusions:

This study portrays that the incidence of complications and mortality following surgery are augmented when associated with diabetes. Clinicians are encouraged to continue to give careful attention to peri-operative glycemic control in surgical patients with diabetes. Further studies are needed for formulating the guidelines in this area.

INTRODUCTION

Diabetes is the most common endocrine disorder in India and in the world. In addition, most estimates suggest a raising incidence in coming years, which is mainly attributed to a rise in type-2 diabetes. Incidence increases with age, and then pertains to a large percentage of patients admitted for surgical services. In patients with diabetes, electrolyte imbalances or metabolic derangements, immunological derangements may either pre-exist or develop during the course of surgical treatment. Diabetics undergoing surgery suffer an increased risk of peri-operative complications, mainly because of higher infection rate, compromised wound healing, ischemic complications, difficulties in controlling glycemic levels and longer hospital stay1,2. Left unattended, these problems may lead to significant mortality and morbidity. Early recognition, adequate diagnostic evaluation and strict peri-operative control are mainstays of successful surgical intervention in effective patient care3. Yet a detailed study to look for the incidence of complications, its relation to glycemic level and type of surgery was lacking especially in an Indian setup. In this study we have tried to access the effect of hyperglycemia on post-operative complications of laparotomies in diabetic patients and to correlate it with the glycemic level.

MATERIALS AND METHODS

Criterion for diagnosis:

American Diabetic Association/World Health Organisation (WHO) classification4:

Presence of classical symptoms of diabetes in combination with:

Random blood sugar: >200ml/dl (11.1mmol/l)

Fasting (8 hours) blood sugar: >125mg/dl (7mmol/l)

A prospective, case control study involving 118 patients of diabetes mellitus and 369 non-diabetics undergoing laparotomy was considered. Only adult patients above the age of 35 with type-2 diabetes mellitus, satisfying the above mentioned criterion, were included in our study. All the cases and controls were subjected to clinical evaluation in the form of detailed history, particularly of diabetes and its treatment and level of glycemic control, and physical examination. The laboratory investigations were carried out and the patient was followed up peri-operatively for glucose level. Postoperative complications were monitored for a period of 10 days, or till their first discharge from hospital. The following complications were studied:

Hypoglycemia: Documented glucose levels <55mg/dl with symptoms that are relieved promptly after the glucose level is raised5

Wound infection: Drainage of serosanguinous fluid from the incision or redness around the incision6,7

Wound dehiscence: Separation of the abdominal musculo-aponeurotic layers, evisceration8.

Leak/fistula: Sonologically diagnosed localised collection of fluid in the abdomen following surgery or presence of frank peritonitis was considered as leak. And drainage of bowel contents through the abdominal wall was considered as fistula9.

Postoperative urinary retention: Inability to pass urine after trial voiding following surgery/removal of catheter any day after surgery resulting in need for insertion/re-insertion of catheter10.

Urinary tract infection: Presence of documented bacteruria in urine culture or pus cells in urine routine11,12.

Prolonged ileus: Not passing stools/not appreciating flatus/absence of bowel sounds by 72 hours was considered prolonged ileus in our study13.

Fluid and electrolyte abnormality: Documented evidence of hypo/hypernatremia (normal range: 135-145meq/dl), hypo/hyperkalemia (normal range: 3.5-4.5)13.

Diabetic ketoacidosis (DKA): Documented raised sugar levels >250, acidic pH >7.3 and presence of urine ketones14,15,16.

Hypergycemic-hyperosmolar coma (HHS): Documented raised sugar levels >600, normal pH >7.3 and absence of urine ketones14,15,16.

Pulmonary complications13: Presence of fever, breathlessness and X-ray showing features of atelectasis were considered as postoperative atelectasis.

Pneumonia: Presence of three/more features among:

New or changing infiltrate on chest radiograph
Temperature >101°F
Purulent sputum or increased pulmonary secretions
White blood cell count >11,000 or 10% bands

Hypoxia

Aspiration pneumonia: X-ray features showing bilateral diffuse pneumonitis features.

Mortality: All cases of death following laparotomies during the study period irrespective of cause.

Complications were identified and the statistical significance was calculated. All the statistical analyses were done by SPSS 13 statistical software and a 'p'-value of less than 0.05 was considered significant.

RESULTS

487 patients undergoing laparotomy were studied for complications during the early postoperative period. The results were compared between diabetics and non-diabetics. Among the studied population, 76% (369) were non-diabetics and 24% (118) were diabetics.

Table 1

Complications and their frequencies

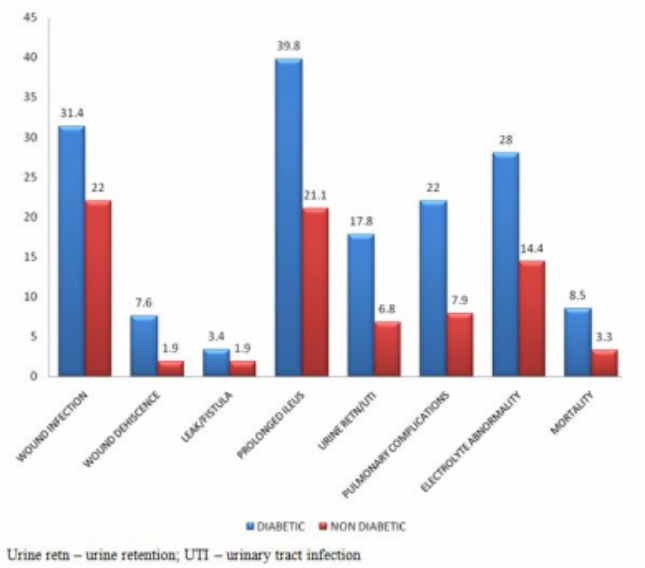
Wound Infection	24.2
Wound Dehiscence	3.3
Leak/Fistula	2.3
Prolonged Ileus	25.7
Urinary Retention/UTI	9.4
Electrolyte Abnormality	17.7
Pulmonary Complications	11.3
DKA/HHS	1.2
Hypoglycemia	2.3
Mortality	4.5

UTI - urinary tract infection; HHS/DKA - hyperglycemic hyperosmolar syndrome/diabetic ketoacidosis

The most common complication was prolonged ileus (25.7%), followed by wound infection (24.2%), electrolyte abnormality (17.7%) and pulmonary complications (11.3%).

Figure 1

Comparison of complications among diabetics and non-diabetics after laparotomy

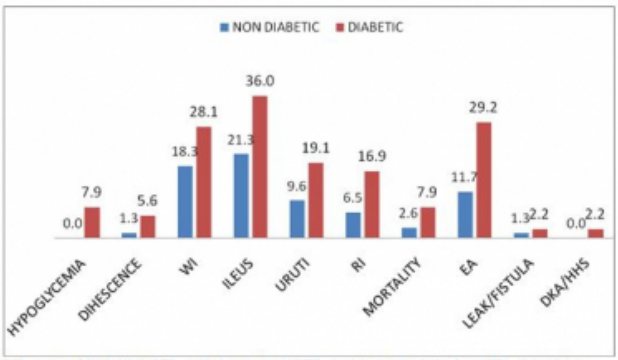


Urine retn – urine retention; UTI – urinary tract infection

As a whole, diabetics were prone to complications more often than non-diabetics. Dehiscence was significantly increased in diabetics as compared to non-diabetics. Ileus was present both in diabetics and non diabetics, but more often in diabetics. All studied complications were more frequent in diabetics.

Figure 2

Comparison of complications among diabetics and non-diabetics after elective surgeries

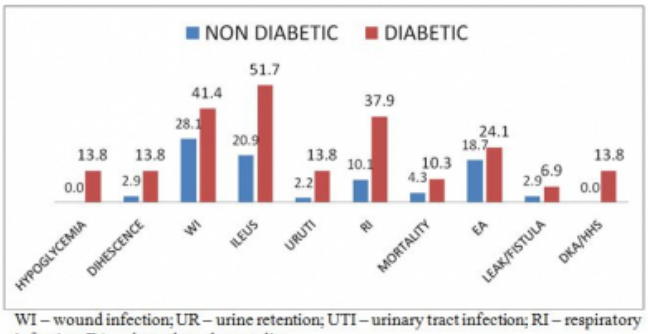


WI – wound infection; UR – urine retention; UTI – urinary tract infection; RI – respiratory infection; EA – electrolyte abnormality

Wound complications and infective complications were almost twice as frequent among diabetics even in elective cases.

Figure 3

Comparison of complications among diabetics and non-diabetics after emergency surgeries



WI – wound infection; UR – urine retention; UTI – urinary tract infection; RI – respiratory infection; EA – electrolyte abnormality

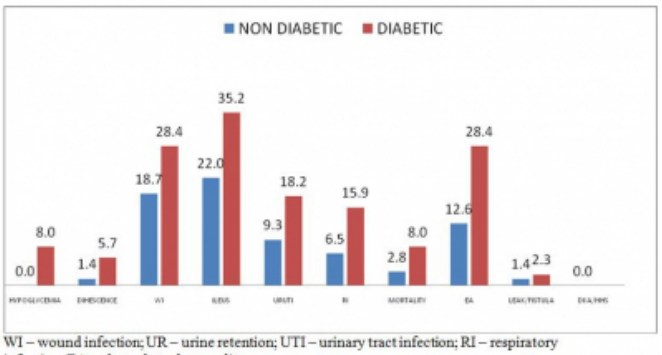
Most of the complications were more frequent in diabetics who underwent surgeries for emergency procedures. After emergency surgeries, wound complications like dehiscence were more than 4 times more frequent in diabetics and infective complications were also significantly (3-5 times) increased.

Bowel surgeries:

Among bowel surgeries done electively, infective and wound complications were still more frequent, showing the significance of the glycemic level in this complication.

Figure 4

Comparison of complications among diabetics and non-diabetics after bowel surgeries



WI – wound infection; UR – urine retention; UTI – urinary tract infection; RI – respiratory infection; EA – electrolyte abnormality

Table 2

Complications studied and their significance and 'p'-values

Parameters studied	X2-value	P-value	significance	Fisher's exact test p-value	Significance
Hypoglycemia				0.00	HS
Dehiscence	9.239	0.002	HS		
Wound infection	4.307	0.038	Sig		
Prolonged ileus	16.374	0.000	HS		
Urine retention/ UTI	12.698	0.000	HS		
Pulmonary Infection	17.932	0.000	HS		
Mortality	5.654	0.017	Sig		
Electrolyte abnormality	11.378	0.001	HS		
Leak/fistula	0.903	0.342	HS		
DKA/HHS				0.000	HS

UTI - urinary tract infection; HHS/DKA - hyperglycemic hyperosmolar syndrome/diabetic ketoacidosis

DISCUSSION

The incidence of diabetes is increasing in epidemic proportions especially in Asia and India. Diabetics are considered "high risk" for most surgical procedures regardless of whether they are major or minor. Many contemporary studies17 have shown that the mortality in diabetics undergoing surgery is about 1.5 times that of the non-diabetic population. Poor glycemic control is more prevalent in the underprivileged groups and regions. This study was aimed at identifying the complications of diabetes in the early postoperative period and determining their risk as against non-diabetics. The following complications were considered in this study:

1. Wound complications

2. Metabolic complications

3. Neuropathic complications

4. Infective complications

Association with age:

There was an increase in early postoperative complications among the diabetics with increase in age. An increased incidence was noted for wound dehiscence and urinary retention. The reason for this may be the long duration of the end organ damage like nephropathy and autonomic neuropathy in diabetics. The chances of wound infection, dehiscence (6.9% in patients of 35-40 years of age versus 12% in patients of 60-70) were higher in aged patients. In the study by Afzal and Bashire18 of Mayo Hospital, Lahore, age was a statistically significant risk factor for infective complications including wound dehiscence ($p < 0.01$). In our

study ileus was more frequent among aged patients (41% at 40-50 years and 62% in the age group of 70 years and above).

Association with sex:

Western studies have demonstrated an increased incidence of complications like wound infection and dehiscence among male diabetics. In our study, urinary complications were more frequent among females (24.5% in females versus 12.5% in males) and there were more respiratory complications among males (18.9% in females versus 24.6% in males). Increased incidence of bacteriuria has been demonstrated by various contemporary Western studies.11,19

Emergency versus elective surgery:

Most of the wound complications were more frequent among the emergency cases, mainly because of the nature of surgery done in emergency conditions (infected/contaminated). The risk of complications was higher among diabetics undergoing emergency surgery (wound infection 41.4% versus 28.1%, dehiscence 13.8% versus 5.6%). The same has been studied in the Study of the Efficacy of Nosocomial Infection Control (SENIC) and the National Nosocomial Infection Surveillance (NNIS) and in studies conducted by the Center for Disease Control and Prevention (CDC). In a study by Afzal and Bashire of Mayo Hospital18, the incidence of wound dehiscence in emergency surgeries was significantly higher ($p < 0.001$) as compared to elective cases ($p < 0.005$). As the control is suboptimal and disease as such would increase the insulin resistance and hence hyperglycemia, the chance of HHS/DKA (hyperglycemic hyperosmolar syndrome/diabetic ketoacidosis) (13.8% versus 2.2%) was higher among diabetics undergoing emergency procedures.

Bowel opened or not:

Whereever the bowel was sutured in surgeries like resection and anastomosis, cholecystectomies, or in patch repair for perforation, the risk for wound complications was higher, and the ileus was prolonged among diabetics. Prolonged ileus (35.2% versus 22% in elective and 51.8% versus23.8% in emergency surgeries) is more common in diabetics. This is probably because of the increased incidence of autonomic neuropathy.

Wound complications:

Wound infection: In our study, wound infection was more frequent among diabetics, especially in case of emergency surgeries where glycemic control tended to be suboptimal. In a study by Asher et al.20, sub-analysis revealed that a serum glucose level higher than140mg/dl was the only significant predictor of surgical site infection for colorectal surgery patients.

Lagoro Kitara et al.21, concluded that the risk of wound infection was higher among diabetics ($t=3.333$, $p=0.001$). According to Pomposelli et al.22, patients with blood glucose values 220 mg/dL had infection rates that were 2.7 times higher than the rate for patients with lower blood glucose values (31.3 % versus 11.5 %, respectively). The result of our study agrees with the findings of the above mentioned studies in finding that the rate of wound infection was higher among diabetics than non diabetics particularly in emergency settings.

Wound dehiscence:

In a study by Afzal and Bashir18, wound dehiscence was more frequent among emergency laparotomies (12.45%) compared to elective cases (1.73%). Diabetics had a relative risk of 1.06. In our study, the p-value was 0.02 for dehiscence which is highly significant. This may be explained by the higher incidence of infection and the derangements in collagen synthesis and maturation seen in diabetics.

Table 3

Wound dehiscence

Study	Percentage of dehiscence		'P'-Value
	Diabetes mellitus	Control	
van Ramshorst et al.[23]	9% (n=33)	9% (n=101)	0.917
Our study	7.6% (n=168)	1.9% (n=319)	0.002

Leak/fistula:

When it came to bowel healing, the chances of leak /fistula formation were higher in diabetics as compared to non-diabetics. In our study, risk of leak or fistula was higher among diabetics ($p=0.342$), which signifies the role of the glycemic level in gastrointestinal (GI) healing. The exact mechanism needs to be analysed at a molecular level, which is beyond the scope of this study.

Metabolic complications:

A total of 6 patients among the diabetic population had documented ketoacidosis, more in emergency cases than in elective ones (13.8 % versus 2.2 %).

Considering the increased incidence of mortality and morbidity among diabetics with poor glycemic control, it is desirable to achieve normoglycemia in this subset of people as far as feasible. However, post surgery, as the amount of stress decreases and sepsis subsides, insulin resistance will improve and insulin dosage requirement will drop with altered physiological stress response. If the glucose levels are not monitored regularly, hypoglycemia will be more frequent and this is the cause for mortality and significant morbidity. In our study, a total of 11 patients had documented hypoglycemia, among which 6 were uncontrolled diabetics coming with severe sepsis. The chances of hypoglycemia were higher in such emergency cases (13.8% versus 7.9%) than in elective cases where, prior to surgery, sugar levels were controlled.

Fluid and electrolyte abnormalities:

People with diabetes tend to have more electrolyte and acid-base abnormalities. In our study, 28 % of the diabetics had abnormalities, as compared to 14.4% of the non-diabetics. The p-value was 0.001 which is statistically highly significant.

Complications due to autonomic neuropathy:

Urinary retention:

A diabetic patient has voiding dysfunction and diabetic cystopathy. Postoperative urinary retention is a reversible abnormality resulting from discoordination of trigone and detrusor muscles, probably triggered by pain and discomfort. Urinary retention was found in 17.8% of diabetics as compared to 6.8% among non-diabetics.

Table 4

Urinary retention

STUDY	ODDS RATIO	95% CONFIDENCE INTERVAL
Dreijer et al.[24]	5.9	1.76-19.82
Our study	2.42	1.32-4.46

In a study by Dreijer et al.24, diabetes mellitus was a significant risk factor for urinary retention. (Odds ratio: 5.9; 95% confidence interval: 1.76-19.82). In a study on postoperative UTI and urinary retention in colonic surgeries by Kang et al.25, the incidences of UTI and UR were 5.91% and 2.52%, respectively. Multivariate analysis showed that diabetes is one of the independent risk factors for UTI.

Prolonged ileus:

Prolonged ileus may be due to many factors, like abnormal conduction in the neural pathway. In our study, prolonged ileus was noted in 25.7% of patients. It was found in 39.8 % of diabetics and 21 % of non-diabetics undergoing surgery. It was more frequent after surgeries involving bowel resection. There are chances of bias in this finding as the physician treating might be more cautious while starting oral nutrition in diabetics than in non-diabetics, hence the results should be taken with guarded significance. Diabetic gastroparesis is a common condition. It can be diagnosed in 25% of diabetic patients. Other publications have also implicated diabetes in complications involving the gastro-intestinal tract26.

Infective complications:

Diabetes represents an immunosuppressed state and these people are more prone for infections like pulmonary and urinary tract infections.

Urinary tract infections (UTI):

In our study, about 17.8 % of diabetics had UTI which was significantly more than in non-diabetics with 6.8 %. Diabetes tends to increase this complication among females. The same observation was reported in Western studies; female diabetics were found to have a higher prevalence of bacteriuria in a study by Ramana and Chaudhury27.

Table 5

Urinary tract infection

Study	Prevalence in male diabetics	Prevalence in female diabetics
Ramana and Chaudhury[27]	43 %	46 %
Our study	12.3 %	24.5 %

In their study, Bonadio et al.28 did not find any significant difference in the presence of UTI in diabetics compared to non-diabetics but diabetics underwent catheterisation more often and treatment was more difficult than in non-diabetics.

According to Vejlsgaard12, diabetics are 2-3 times more prone to suffer from UTI than non-diabetics.

Pneumonia:

Diabetics are at increased risk of pulmonary complications, maybe because of decreased immunity and higher chances of

gastroparesis. In our study, 22 % of diabetics had pulmonary complications, as opposed to 7.9% of non-diabetics. In the study by Schmeltz et al.29, patients with diabetes also had higher rates of pulmonary complications (p-value 0.002).

Mortality:

Due to the above mentioned increased risk factors and significant pre-existing organopathies, diabetics are at an increased risk of mortality in the postoperative period. In our study, it was 8.5 % among diabetics against 3.3 % among non-diabetics with a significant p-value of 0.017. According to the study by Schmeltz et al.29, patients with a preoperative diagnosis of diabetes had higher rates of postoperative mortality (7.3 vs. 3.3%; p=0.03).

CONCLUSION

Diabetics are more prone to have surgical problems than non-diabetics. At the end of the study, the following conclusions may be derived: Complications were significantly more frequent among diabetics. Most common were prolonged ileus and wound infection, followed by electrolyte abnormalities and pulmonary complications. Wound-related complications were more common among males and patients undergoing emergency surgeries or surgeries wherein the bowel was opened. Diabetics are more prone to have electrolyte abnormality. Diabetes complicating the peri-operative period also increases the mortality significantly.

This study showed that there is a need for greater vigilance in this subset of patients. Further, the importance of tight glycemic control and its impact on minimizing the diabetes-associated complications needs to be explored by similar studies.

References

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