A Comparison of the most common complications after different general surgical procedures for diabetic and non-diabetic patients in Jordanian military sector hospitals

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ABSTRACT

Objective: To assess the influence of high blood sugar on complications after different general surgical procedures in Jordanian diabetic patients.

Methods: This retrospective investigation included adult patients of both genders who were assigned for different elective and emergency general surgical procedures for different conditions. They were patients of Prince Hashim hospital, Zarqa, Jordan, during the period Oct 2015-Sep 2016 and King Hussein hospital, King Hussein medical center, Amman, Jordan, during the period Sep 2016-Sep 2017.Blood sugar levels were obtained for all participants on admission and for 7 days after surgery. In addition the following complications were investigated: hypoglycemia, wound infection, urinary tract infection, post-operative ileus, electrolyte disorders, diabetic ketoacidosis and pulmonary complications. Student's t-test was used for comparison between groups, while the chi-square test was used for comparisons between proportions. A p-value < 0.05 was considered statistically significant.

Results: Diabetic patients experienced more hazards after surgery than non-diabetic patients. The most frequent hazard was lengthened ileus (42.9%) in GI and wound infection (24.1%) in G II. The second most frequent hazard was wound infection (34.3%) in GI and lengthened ileus (22.2%) in GII. The third most frequent hazard was electrolyte disorders both in GI (31.4%) and in GII (14.8%).

Conclusions: The frequency of postoperative hazards is increased in diabetics. Peri-surgical blood sugar control in surgical diabetic patients is crucial.

Keywords: General surgery complications, Elective, Emergency, Diabetic; Jordanian, Non-diabetic.

RMS August 2021; 28(2): 10.12816/0058963

Introduction

Diabetic patients undergoing general and vascular surgery with blood sugar levels after surgery > 150 mg/dL have an increased incidence of infection.[1] Diabetes is quantitatively associated with complications after surgery. Patients undergoing surgery have a modified carbohydrate metabolism, and are exposed to high production of glucose and increased resistance to insulin, causing a stress-related hyperglycemia.[2]

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Frequency of diabetes mellitus increases with age and is strongly correlated with patients admitted for surgical purposes.[3] In patients with diabetes mellitus, electrolyte or metabolic disorders and immunological problems may pre-exist or occur during surgical management. Diabetic patients scheduled for different types of surgical intervention have a high risk of peri-surgical complications, such as increased infection, delayed wound healing, ischemic events and difficulty in controlling blood sugar levels.[4]Optimum diagnosis, good clinical assessment and peri-surgical control are the pathways for adequate operative procedures in medical care.[5]Insulin dependent diabetic patients have a higher risk for any morbidity than those that are non-diabetic or oral hypoglycemic dependent diabetic in the general surgery group. .

The aim of our investigation was to compare the complications after different general surgical procedures for diabetic and non-diabetic patients.

METHODS

This retrospective and observational investigation included 35 diabetic(type II) patients (Group I, GI) and 108 non-diabetic patients(Group II, GII).These 143 patients, aged 35-63 years, of both genders, were assigned for different elective and emergency general surgical procedures for different causes at Prince Hashim hospital, Zarqa, Jordan and King Hussein hospital, King Hussein medical center, Amman, Jordan, during the periods Oct 2015 - Sep 2016 and Sep 2016-Sep 2017, respectively. Written informed consent was obtained from all patients. Approval for this study was also obtained from the local ethical and research board review committee of the Jordanian Royal Medical Services. On admission, the blood sugar levels of patients were determined. All participants were followed up for blood sugar levels and complications after surgery. The frequency of complications and their association with blood sugar level after surgery were recorded for each Jordanian patient group. Diabetes was diagnosed according to the American Diabetic Association and World Health Organization classification: a random blood sugar > 200ml/dl, and a fasting (8 hours) blood sugar > 125mg/dl.[6]

Complications after different elective and emergency general surgical procedures were recorded for 7 days. The following complications were investigated: hypoglycemia (blood sugar levels < 55mg/dl);wound infection, as determined by drainage of serosanguinous fluid from the incision or erythema around the incision; urinary tract infection (UTI), determined by the presence of bacteriuria in culture or pus cells in routine urine analysis;[7]post-operative ileus,indicated by not passing stools, no appreciable flatus or absence of bowel sounds by day 3 post-surgery;[8] electrolyte disorders, such as hypo or hypernatremia, and hypo or hyperkalemia; Stress induced hyperglycemia ,based on raised sugar levels > 250 mg/dl, an acidic pH < 7.3 and presence of urine ketones;[8]and pneumonia, as indicated by3or more of the following, new or changing infiltrate on chest radiograph, fever, purulent sputum or increased lung secretions, white blood cell count > 11,000 or hypoxia and aspiration pneumonia with X-ray findings of bilateral diffuse pneumonitis.[8]

STATISTICS

Student's t test and Mann-Whitney U test were used for normality. For homogeneity between proportions, we used the chi-square test or Fisher's test. A p-value < 0.05 was considered statistically significant.

RESULTS

There was an increase in complications after different general surgical procedures with increasing age in diabetic patients. Wound infection accounted for 5.7%[5]of the complications in patients of 35-40 years of age, and 14.3%[8] in patients of 55-63 years of age. Ileus was commonly found in patients 35-40 years and 55 - 63 years of age, in (11.4%) and 20% of patients, respectively.[7]UTIs were more common in females (5/17, 29.4%) than in males (3/18, 16.7%), while lung complications were found in more males (5/18 27.8%) than females (3/17, 17.6%).

The overall most frequent complication was post-operative ileus (27.3%),followed by wound infection (26.6%) and electrolyte disorders (18.9%; Table I). Diabetic patients experienced more complications after surgery than non-diabetic patients, with the most frequent being post-operative ileus (42.9%) in GI and wound infection (24.1%) in G II. The second most frequent complications were wound infection (34.3%) in GI and post-operative ileus (22.2%) in GII. The third most frequent complications were electrolyte disorders, both in GI (31.4%) and in GII (14.8%; Table II). The total number of complications was 62 in 35 diabetic patients, indicating that some patients had more than 1 issue; on average, every diabetic patient had 1.8 complications. By contrast, the total number of complications in non-diabetic patients was 92 in 108 individuals, meaning they had single issues, with an average of 0.9 complications per patient.

Wound and infection complications were more common in diabetic patients, even after elective surgery (Table III). Even so, most of the complications were found in diabetics after emergency surgery. Infective complications were significantly increased in diabetic patients. Stress induced hyperglycemia was higher in diabetic patients after emergency surgery; however, it was higher in non-diabetic patients after elective surgery.

According to the chi-square test, differences between diabetic and non-diabetic patients for post-operative ileus, UTI, lung infection and electrolyte disorders were highly significant ($p < 0.005$) while wound infection was only significant ($p < 0.05$).In terms of Fisher's test; differences in levels of hypoglycemia and Stress induced hyperglycemia were highly significant.

Table I: Overall complication incidence after surgery (%, n)

Complication	Incidence (%,n)
Post-operative ileus	27.3(39)
Wound infection	26.6(38)
Electrolyte disorders	18.9(27)
Lung complications	16.8(24)
Urinary tract infection	12.6(18)
Hypoglycemia	3.5(5)
Stress induced hyperglycemia	2.1(3)

Table II: Comparison of complications between diabetic and non-diabetic patients(n, %)

Complication	Diabetics(GI)	Non-diabetics(GII)
Post-operative ileus	15(42.9)	24(22.2)
Wound infection	12(34.3)	26(24.1)
Electrolyte disorders	11(31.4)	16(14.8)
Lung complications	9(25.7)	15(13.9)
Urinary tract infection	7(20.0)	11(10.2)
Hypoglycemia	5(14.3)	0
Stress induced hyperglycemia	3(8.6)	0

Table III: Comparison of complications between diabetic and non-diabetic patients in different elective and emergency general surgical procedures (n, %).

Complication	Elective		Emergency	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Post-operative ileus	6(17.1)	13(12.0)	9(25.7)	11(10.2)
Wound infection	5(14.3)	10(9.3)	7(20.0)	16(14.8)
Electrolyte disorders	6(17.1)	6(5.6)	5(14.3)	10(9.3)
Lung complications	3(8.6)	6(5.6)	6(17.1)	9(8.3)
Urinary tract infection	4(11.4)	9(8.3)	3(8.6)	2(1.9)
Hypoglycemia	2(5.7)	0	3(8.6)	0
Stress induced hyperglycemia	1(2.9)	0	2(5.7)	0

DISCUSSION

Diabetic patients are subject to increased risk from many operative techniques, major and minor. Inadequate blood sugar control is increasingly common in underdeveloped countries.[4] The current

study investigated complications in diabetic patients after different elective and emergency general surgical procedures, compared with those without diabetes.[7] The major complications considered in this study were wound, metabolic, neuropathic and infective.[7]

There was an increase in complication frequency after surgery with an increase in age in diabetic patients.[3] This was especially the case for wound infection and urinary infection, and was likely caused by prolonged end organ damage, such as nephropathy and autonomic neuropathy.[7] Increased age was a significant risk factor for infective complications and wound infection.[9]However, in our investigation, ileus was more common in older patients.[8]

Many wound infections were more common after emergency than elective surgery, because of its imperative nature.[10] The risk of infections was greater in diabetic patients after emergency surgery. In our investigation, wound infection was also more common in diabetic patients, mainly after emergency surgery with inadequate blood sugar control. [7] A serum sugar level >140mg/dl was the only significant indicator of operative wound infection.[11] Patients with blood sugar levels of 220 mg/dL had an incidence of infection 2.7 times greater than for patients with lower blood sugar levels (31.3% and 11.5%, respectively).[7] Poor sugar control, particularly for diabetic patients after emergency surgery, increased insulin resistance and hyperglycemia, and Stress induced hyperglycemia was also more common in diabetic patients after emergency laparotomy . Three among the diabetic patients had ketoacidosis, with more after emergency surgery than after elective surgery.[7]

A high frequency of morbidity in diabetic individuals with poor blood sugar control has been reported worldwide. [16] Establishing normal blood sugar levels in this group of patients has been recommended. After surgery, stress is reduced, sepsis is decreased, insulin resistance is reduced, and insulin needs decrease with the changed physiological stress response**.**[12]If sugar level is not followed up, hypoglycemia will be more common. In our investigation, 5 patients experienced hypoglycemia, and they had uncontrolled diabetes with severe sepsis. Hypoglycemia occurred more often after emergency surgery than after elective surgery in diabetic patients. [7] Before surgery, sugar levels were optimized. Diabetic patients have more electrolyte and acid-base disorders. Urinary infections were also found more often in diabetic than non-diabetic patients. In a previous study, the frequency of UTIs was 5.91% and 2.52%, respectively.[7] Diabetes was one of the risk factors for UTIs. Post-operative ileus can be caused by pathologically impaired neural conduction. [8] It was recorded more often in diabetic patients than in non-diabetic patients after surgery. Diabetic gastroparesis is found in 25% of those with diabetes.[7]

Diabetes is an immunosuppressed condition and diabetic patients have increased numbers of infections, such as lung infections and UTIs.[7] In our investigation, diabetic patients had significantly more UTIs than non-diabetic patients. Diabetic females have a higher incidence of bacteriuria.[13]Prevalence of UTIs in diabetic males and females was 43% and 46%, respectively.[7]Diabetic patients have been reported to have 2-3 times more UTIs than non-diabetic patients.[7]In addition, diabetic patients have a higher risk of lung complications due to their reduced immunological status, and also more gastro paresis.[14]This was consistent with our investigation with regard to lung complications. The influence of insulin may be more advantageous as reaction to the acute insult of surgery dissipates. During the acute onset of stressful stimuli such as surgery, treatment with insulin can actually be harmful [15].Improved outcomes have been seen in patients with strict blood sugar control during surgery. In fact, minimal alterations in blood sugar level are correlated with bad outcomes.[16]Similar investigations to this study have been performed in other groups, such as orthopedic, cardiac, vascular and plastic surgery patients, which with a few differences showed consistent results.[17]

CONCLUSIONS

Diabetic patients had significantly more operative complications than those that were non-diabetic. The most frequent issues were post-operative ileus and wound infection, followed by lung complications. Stringent blood sugar control may reduce diabetes-correlated complications.

REFERENCES

1. **Takesue Y, Tsuchida T.** Strict glycemic control to prevent surgical site infections in gastroenterological surgery. Ann Gastroenterol Surg. 2017;1(1):52-59. Published 2017 Apr 25. doi:10.1002/ags3.12006
2. **Continuing Education in Anaesthesia Critical Care & Pain, Volume 4, Issue 5, 1 October 2004, Pages 144–147,** https://doi.org/10.1093/bjaceaccp/mkh040
3. **Selvin E, Parrinello CM.** Age-related differences in glycaemic control in diabetes. Diabetologia. 2013;56(12):2549-51.
4. **Mangrulkar S,Khair PS.**Comparison of healing of surgical wounds between diabetics and non-diabetics.J Indian Med Assoc. 2009 Nov;107(11):765-70.
5. **Fujisawa M,Kojima K,Beppu T, Futagawa S, Kuwahara K, Hiramatsu K.**Early diagnosis of postoperative infection: assessment of whole blood chemiluminescence.Surg Today. 2000;30(4):309-18.
6. **World Health Organization.** Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: report of a World Health Organization/International Diabetes Federation consultation. Geneva: WHO Press; 2006 [cited 2019 Month #]. Available from: https://www.who.int/diabetes/publications/Definition%20and%20diagnosis%20of%20diabetes_new.pdf.
7. **Shetty AR.S, Rai S, Bhat R, Rao S, Thejeswi P.** Comparison of early postoperative complications of laparotomies in diabetics and non-diabetics - astudy on south Indian population. Internet J Surg.2013;30(4).
8. **King JT, Jr., Goulet JL, Perkal MF, Rosenthal RA.** Glycemic control and infections in patients with diabetes undergoing non cardiac surgery. Ann Surg. 2011 Jan;253(1):158–65.
9. **Bower WF, Jin L, Underwood MJ, Lee JF, Lee KF, Lam YH, et al.** Overt diabetes mellitus adversely affects surgical outcomes of non cardiovascular patients. Surgery. 2010 May;147(5):670–5.
10. **Schricker T, Lattermann R, Schreiber M, Geisser W, Georgieff M, Radermacher P.** The hyperglycaemic response to surgery: pathophysiology, clinical implications and modification by the anaesthetic technique.Clin Intensive Care. 1998;9(3):118–28.
11. **Joshi GP, Chung F, Vann MA, Ahmad S, Gan TJ, Goulson DT, et al.** Society for Ambulatory Anesthesia consensus statement on perioperative blood glucose management in diabetic patients undergoing ambulatory surgery. Anesth Analg. 2010 Dec;111(6):1378–87.
12. **Site of Insulin Resistance after Surgery:** The Contribution of Hypocaloric Nutrition and Bed Rest:Jonas Nygren, Anders Thorell, Suad Efendic, K.Sree Nair, Olle LjungqvistClinical ScienceAug 1997,93(2)137-146;DOI: 10.1042/cs0930137
13. **Serio SS, Grauf D, Clements JC, Merchant AM.** Analysis of outcomes of diabetic and nondiabetic general and vascular surgery patients oral presentation: clinical trials & outcomes global measures of quality. Proceedings of the Academic Surgical Congress on Results Previously Presented at Association of Academic Surgeons; February 2013; New Orleans, LA, USA.

14. **Nunnally ME. Con:** tight perioperative glycemic control: poorly supported and risky. J Cardiothorac Vasc Anesth. 2005 Oct;19(5):689–90.
15. **Intensive Insulin Therapy in Mixed Medical/Surgical Intensive Care Units:** Greet Van den Berghe, Alexander Wilmer, Ilse Milants, Pieter
J. Wouters, BernardBouckaert, Frans Bruyninckx, Roger Bouillon, Miet Schetz; Diabetes Nov 2006, 55 (11) 3151-3159; DOI: 10.2337/db06-0855
16. **Jeon CY, Furuya EY, Berman MF, Larson EL.** The role of pre-operative and post-operative glucose control in surgical-site infections and mortality. PLoS One. 2012;7(9):e45616.
17. **Patterson DC, Shin JI, Andelman SM, Olujimi V, Parsons BO.** Increased risk of 30-day postoperative complications for diabetic patients following open reduction-internal fixation of proximal humerus fractures: an analysis of 1391 patients from the American College of Surgeons National Surgical Quality Improvement Program database. JSES. 2017 March;1(1):19-24.