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RESEARCH ARTICLE

STUDY ON PERIOPERATIVE GLYCEMIC CONTROL AND POSTOPERATIVE INFECTIONS – A RETROSPECTIVE STUDY

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ABSTRACT

Objective:
- To study about the 'perioperative' glycaemic control and postoperative infections.
- To study about the postoperative glycaemic status and postoperative infections.
- To study the range of the blood sugar to be maintained

Methods: All patients with diabetes mellitus who underwent elective and emergency surgeries are studied with perioperative blood sugar values and postoperative wound infections, urinary tract infections, lower respiratory tract infections and sepsis

Results: The incidence of surgical site infections in these patients were proportional to the glycaemic control achieved, the highest being in the fourth quartile(261-350md/dl) patients i.e. 100% and the least being in the first quartile patients(120-180mg/dl) i.e.16.6%. In the glycaemic range above 260mg/dl almost all patients had surgical site infections invariably stressing the importance of strict glycaemic control in these patients to avoid long hospital stay and the health care expenditure that results.

Conclusion: It is conclusive that the incidence of postoperative infections in patients with diabetes undergoing surgeries is higher with greater mean plasma glucose levels. patients with control mean sugar values were free of surgical postoperative complications.

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INTRODUCTION

Postoperative infections may cause several problems, which include failure of the surgical procedure, other surgical complications, sepsis, organ failure, and even death. Diabetes mellitus is an increasing challenge to the surgeons, since these patients are at greater risk of developing postoperative infections when compared to the non-diabetic patients. This prospective study on perioperative glycaemic control and postoperative infections will give us better understanding about the importance of glycaemic control in diabetes mellitus and helps lessen the burden of postoperative morbidity in these patients.

MATERIALS AND METHODS

This dissertation is based on a retrospective analysis of fifty diabetic patients undergoing surgical procedures in Thanjavur Medical College Hospital, from 1.1. 2014 to 30.06. 2014

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Non-diabetics, patients with major co morbid illness, patients presenting with postoperative infection within 36 hours of surgery were excluded from this study. Total numbers of 50 cases were included in this study which includes 22 females and 28 male patients. All patients were above 30 years of age with mean age of study being 54 years.

Both patients undergoing elective and emergency surgical procedures were included in this study. In this study 35 patients undergoing elective procedures and 15 patients undergoing emergency procedures were included. All patients were followed up for a period of 30 days following surgery. All patients were treated with insulin to achieve glycaemic control.

Depending upon the mean plasma glucose concentration obtained as mentioned above patients were divided into four quartiles as follows:

- Quartile 1 – 120 to 180 mg/dl
- Quartile 2 – 181 to 220 mg/dl
- Quartile 3 – 221 to 260 mg/dl
- Quartile 4 – 261 to 350 mg/dl

All patients were followed up for signs and symptoms of postoperative infections which included

- Surgical site infections
- Urinary tract infections
- Sepsis and pneumonia

Patients who underwent the following surgical procedures were included in this study and were observed for postoperative infections as mentioned earlier.

- Cholecystectomy
- Appendectomy
- Amputations
- Intestinal resection anastomosis
- Duodenal and gastric perforation closure
- Hernioplasty
- Mastectomy
- Thyroidectomy
- Split skin grafts
- Trendelenberg procedure for varicose veins

OBSERVATIONS

The following observations were made in the prospective analysis of fifty diabetic patients in the perioperative period. All patients were treated with insulin to achieve glycaemic control. The incidence of postoperative infections was evaluated in each of these patients as mentioned earlier and was grouped against their mean plasma glucose concentration in the perioperative period. All the patients participated in this study were above 30 years of age. The minimum age is 35 years and maximum age is 75 years. The mean age of this study is 54.36 years with standard deviation 11.080.

Item	Min	Max.	Mean	S.D
Age	35	75	54.36	11.080

Age Group

The number of males participated in this study were 28 and females 22. The sex of the patients does not have any influence on this study conducted.

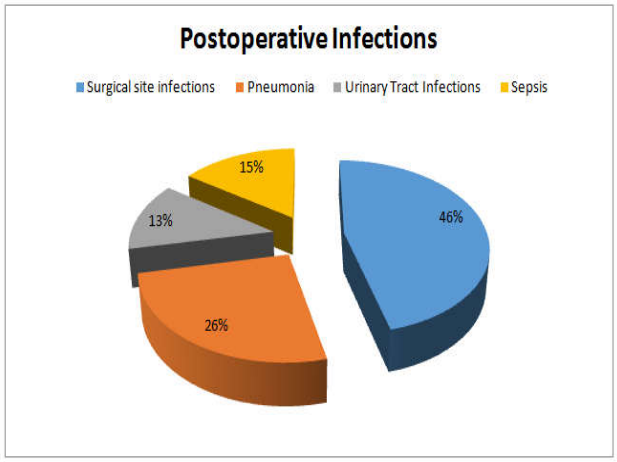
Particulars	No.of respondents (n=50)	Percentage (100%)
Male	28	56.0
Female	22	44.0

The number of patients in each quartile in this study was shown in the following table:

Particulars	No.of respondents (n=50)	Percentage (100%)
120 to 180	30	60.0
181 to 220	11	22.0
221 to 280	6	12.0
281 to 350	3	6.0

The postoperative infections observed in these patients were

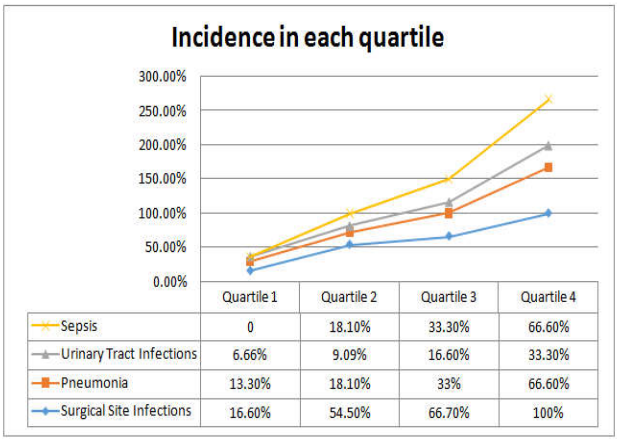
- Surgical Site Infections
- Pneumonia
- Urinary Tract Infections
- Sepsis



Among the postoperative infections observed in the diabetic patients surgical site infections were the most frequent one in each quartile followed by pneumonia, sepsis and finally urinary tract infection irrespective of the glycaemic range.

The overall incidence being as follows:

- Surgical site infections – 46%
- Pneumonia – 26%
- Urinary Tract Infections – 13%
- Sepsis – 15%



	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Sepsis	0	18.10%	33.30%	66.60%
Urinary Tract Infections	6.66%	9.09%	16.60%	33.30%
Pneumonia	13.30%	18.10%	33%	66.60%
Surgical Site Infections	16.60%	54.50%	66.70%	100%

It is noted that the incidence of postoperative infections is directly proportional to the mean plasma glucose concentration. The occurrence being less in the first quartile with glycaemic range 120 to 180 mg/dl. Patients in the I quartile had 16.6% incidence of surgical site infections, 13.3% incidence of pneumonia, 6.66% incidence of urinary tract infections. Sepsis was observed in none of the patients with glycaemic range 120-180 mg/dl.

Quartile 2 patients whose glycaemic range was 181 to 220 mg/dl had the following incidence:

- Surgical site infections – 54.5%
- Pneumonia – 18.1%
- Urinary Tract Infections – 9.09%
- Sepsis – 18.1%

Quartile 3 patients whose glycaemic range was between 221 and 260mg/dl had the following incidence:

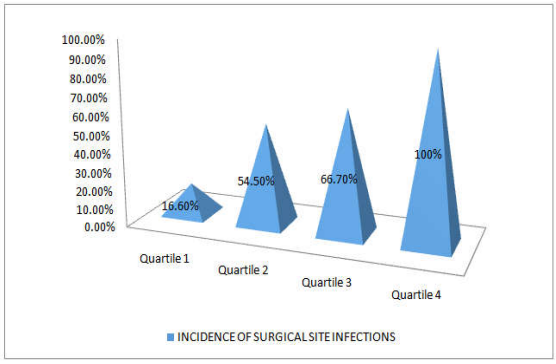
- Surgical site infections – 66.7%

- Pneumonia – 33.3%
- Urinary Tract Infections – 16.6%
- Sepsis- 33.3%

The observations made in the fourth quartile patients with glycaemic range 261 to 350 mg/dl were as follows:

- Surgical site infections – 100%
- Pneumonia – 66.6%
- Urinary Tract Infections – 33.3%
- Sepsis – 66.6%
-

Incidence of surgical site infections

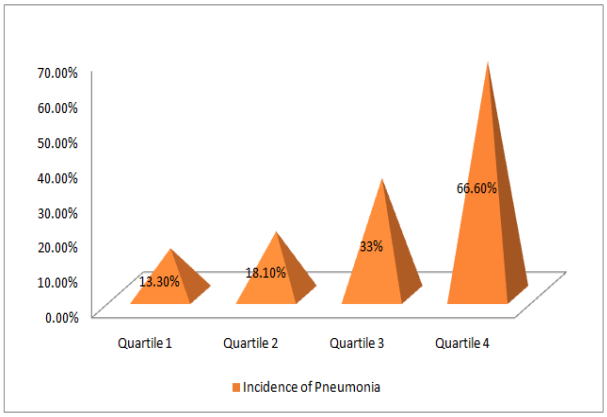


The incidence of surgical site infections in these patients were proportional to the glycaemic control achieved, the highest being in the fourth quartile patients i.e. 100% and the least being in the first quartile patients i.e.16.6%. In the glycaemic range above 260mg/dl almost all patients had surgical site infections invariably stressing the importance of strict glycaemic control in these patients to avoid long hospital stay and the health care expenditure that results.

Blood sugar	Wound infection			Statistical inference
	Negative	Positive	Total	
120 to 180	25(83.3%)	5(16.7%)	30(100%)	X^2=14.291df=3 .003<0.05 Significant
181 to 220	5(45.5%)	6(54.5%)	11(100%)	
221 to 280	2(33.3%)	4(66.7%)	6(100%)	
281 to 350	0	3(100%)	3(100%)	
Total	32(64%)	18(36%)	50(100%)	

The association of surgical site infections with blood glucose level in this study is statistically significant proving the need for good glycaemic control to prevent postoperative wound infections in these patients.

Incidence of Pneumonia

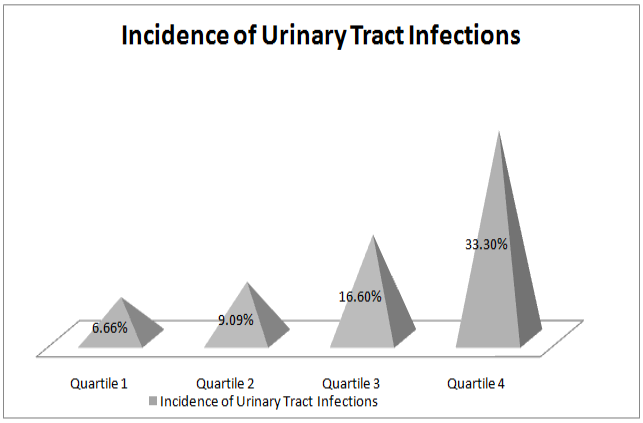


Again the incidence of pneumonia documented clinically and by newly occurring radiographic changes and positive sputum culture was highest in the fourth quartile patients with 66.6% incidence. The incidence is lesser in the third quartile patients with glycaemic range 221 to 260 mg/dl with 33%. Again with strict glycaemic control the incidence of pneumonia is lower in the well-controlled group with mean plasma glucose less than 200 mg/dl; being 18.1% in second quartile and 13.3% in first quartile patients.

Blood sugar	Pneumonia			Statistical inference
	Negative	Positive	Total	
120 to 180	26(86.7%)	4(13.3%)	30(100%)	X^2=5.606 df=3 .132>0.05 Not significant
181 to 220	9(81.8%)	2(18.2%)	11(100%)	
221 to 280	4(66.7%)	2(33.3%)	6(100%)	
281 to 350	1(33.3%)	2(66.7%)	3(100%)	
Total	40(8%)	10(20%)	50(100%)	

According to the statistics, the association of incidence of pneumonia with increasing blood glucose level is statistically not significant in this study. However it is evident that the possibility of pneumonia occurrence is higher in the patients with high blood glucose level when compared with the well-controlled group.

Incidence of Urinary Tract Infections



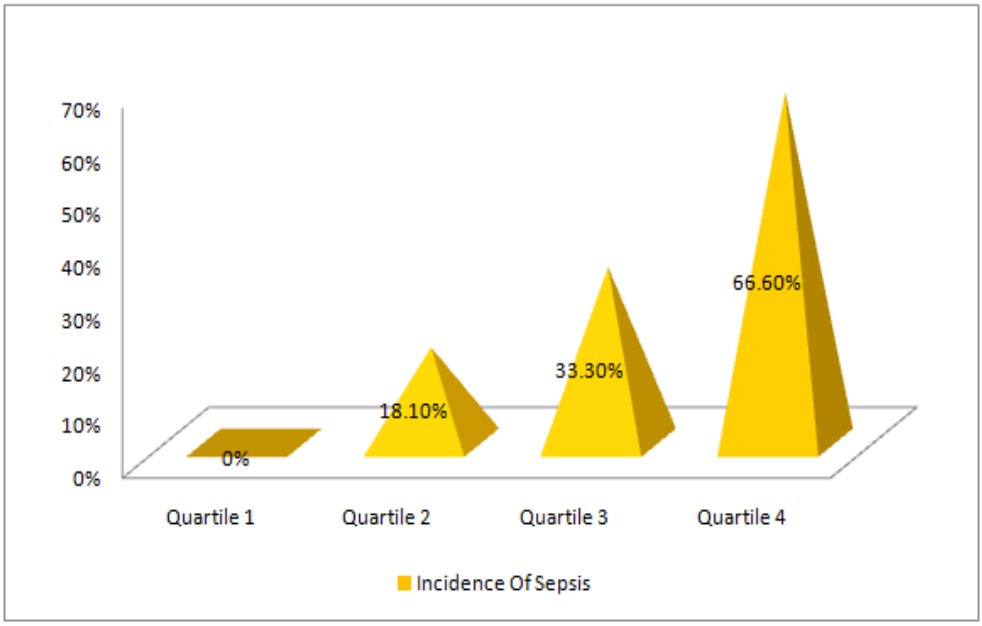
The incidence of urinary tract infections observed in each quartile (I-6.66%, II-9.09%, III-16.6%, IV-33.3%) were similar to the observations made in other postoperative infections. There is a proportionate increase in urinary tract infections and their complications with increasing mean plasma glucose concentrations.

Blood sugar	UTI			Statistical inference
	Negative	Positive	Total	
120 to 180	28(93.3%)	2(6.7%)	30(100%)	X^2=2.492 df=3 .477>0.05 Not significant
181 to 220	10(90.9%)	1(9.1%)	11(100%)	
221 to 280	5(83.3%)	1(16.7%)	6(100%)	
281 to 350	2(66.7%)	1(33.3%)	3(100%)	
Total	45(90%)	5(10%)	50(50%)	

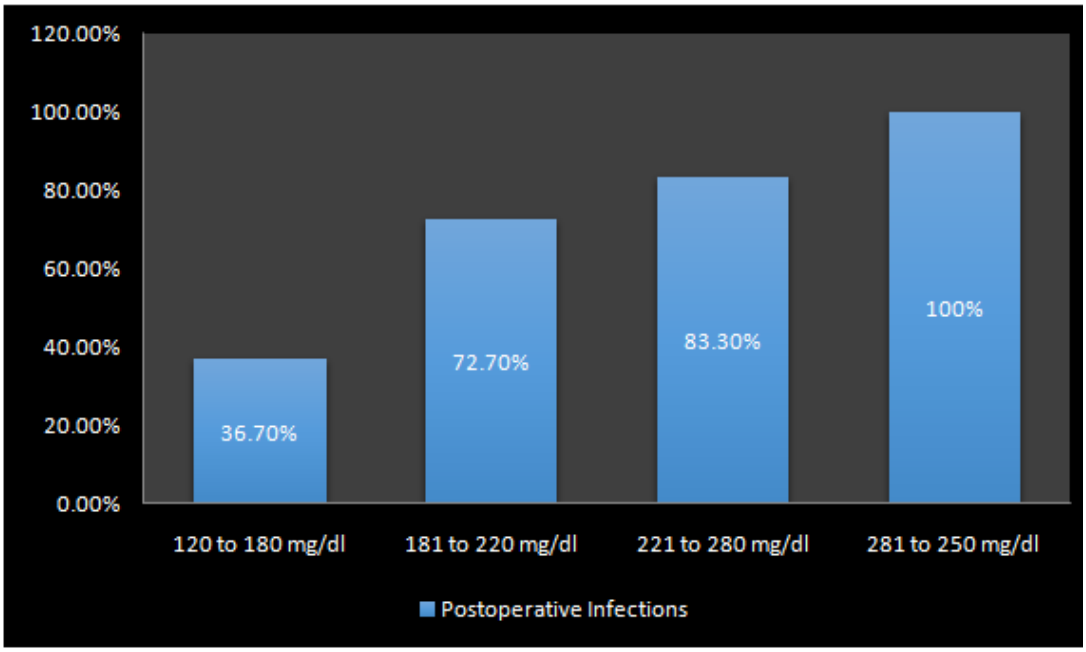
In this study, even though the rate of genito-urinary infections and its complications is higher in the poorly controlled group; it does not have a statistically significant correlation.

Despite good glycaemic control decreased the incidence of these complications in the postoperative period.

Incidence of Sepsis



Blood sugar	SEPSIS			Statistical inference
	Negative	Positive	Total	
120 to 180	30(100%)	0	30(100%)	X^2=15.565 df=3 .001<0.05 significant
181 to 220	9(81.8%)	2(18.2%)	11(100%)	
221 to 280	4(66.7%)	2(33.3%)	6(100%)	
281 to 350	1(33.3%)	2(66.7%)	3(100%)	
Total	44 (88%)	6(12%)	50(100%)	



Blood sugar	Infected			Statistical inference
	Negative	Positive	Total	
120 to 180	19(63.3%)	11(36.7%)	30(100%)	X^2=9.816 df=3 .020<0.05 Significant
181 to 220	3(27.3%)	8(72.7%)	11(100%)	
221 to 280	1(16.7%)	5(83.3%)	6(100%)	
281 to 350	0	3(100%)	3(100%)	
Total	23(46%)	27(54%)	50(50%)	

MASTER CHART

S. No.	Name	Age	Sex	Ip no	Blood ugar group	Wound infection	Pneumonia	Sepsis	Uti	Infected	Type of surgery
1	Usha	53	F	12945	2	+	-	-	-	+	Eme
2	Kumar	47	M	12623	1	-	-	-	-	-	Ele
3	Stephen	63	M	12652	1	-	-	-	-	-	Ele
4	Chinnasamy	72	M	12676	3	+	+	-	+	+	Eme
5	Rengammal	57	F	12690	1	+	-	-	-	+	Ele
6	Ahemed	64	M	12703	1	-	-	-	-	-	Ele
7	Parameshwari	60	F	12718	2	-	-	-	-	-	Ele
8	Malarkodi	58	F	12737	1	-	+	-	-	+	Ele
9	Ganesan	43	M	12744	1	-	-	-	-	-	Ele
10	Jeya	65	F	12753	3	+	-	-	-	+	Eme
11	Anjammal	49	F	12769	1	-	+	-	-	+	Eme
12	Velu	35	M	12771	1	+	-	-	-	+	Ele
13	Mala	59	F	12783	2	-	+	-	-	+	Eme
14	Seethea	56	F	12786	3	-	-	-	-	-	Ele
15	Perumal	48	M	12792	1	-	-	-	-	-	Ele
16	Kaliyamoorthy	67	M	12799	2	+	-	-	+	+	Eme
17	John	44	M	12839	1	-	-	-	-	-	Ele
18	Selvi	73	F	12845	1	-	-	-	-	-	Ele
19	Abdhul	61	M	12853	4	+	+	+	-	+	Eme
20	Chinnaiyan	45	M	12870	1	-	-	-	-	-	Ele
21	Kathan	70	M	12895	1	-	-	-	-	-	Ele
22	Amutha	45	F	12898	1	+	-	-	-	+	Eme
23	Sundaram	37	M	12917	2	-	-	-	-	-	Ele
24	Vadivelu	48	M	12920	1	-	-	-	+	+	Eme
25	Valarmathy	56	F	12948	2	+	-	-	-	+	Ele
26	Chellammal	74	F	12955	2	-	+	+	-	+	Eme
27	Nagooran	49	M	12963	1	-	-	-	-	-	Ele
28	Shanmugam	66	M	12978	3	+	-	+	-	+	Eme
29	Mookayee	62	F	12979	1	-	-	-	-	-	Ele
30	Guru	42	M	12986	1	-	-	-	-	-	Ele
31	Pushpam	58	F	12988	1	-	-	-	+	+	Ele
32	Chandran	42	M	12992	1	-	-	-	-	-	Ele
33	Joseph	62	M	12997	2	+	-	+	-	+	Eme
34	Mahendran	45	M	13311	1	+	-	-	-	+	Ele
35	Padmini	36	F	13327	2	+	-	-	-	+	Ele
36	Kaliyan	75	M	13346	3	+	+	-	-	+	Eme
37	Vijaya	41	F	13370	1	-	+	-	-	+	Ele
38	Kathayee	56	F	13396	4	+	-	-	-	+	Ele
39	Manikam	54	M	13402	1	-	-	-	-	-	Ele
40	Sathish	48	M	13430	1	-	-	-	-	-	Ele
41	Periyasamy	73	M	13446	1	-	+	-	-	+	Ele
42	Maniyammal	41	F	13459	3	-	-	+	-	+	Ele
43	Vaniyammal	64	F	13468	1	-	-	-	-	-	Ele
44	Muthukaruppan	58	M	13474	1	+	-	-	-	+	Eme
45	Santha	66	F	13497	2	+	-	-	-	+	Ele
46	Selvam	48	M	13519	1	-	-	-	-	-	Ele
47	Ravi	44	M	13526	2	-	-	-	-	-	Ele
48	Indirani	54	F	13547	4	+	+	+	+	+	Eme
49	Mani	38	M	13563	1	-	-	-	-	-	Ele
50	Banumathi	47	F	13599	1	-	-	-	-	-	Ele

Sepsis was characterised by high peaks of fever, elevated leukocyte count and sometimes hypotension and shock. Patients with mean plasma glucose concentration with 120 to 180 mg/dl did not have this potential complication in this study. Patients with mean plasma glucose concentration above 180 mg/dl are susceptible and at higher risk with higher concentrations. The incidences in 2nd, 3rd and 4th quartile being 18.1%, 33.3% and 66.6% respectively. The rate of occurrence of sepsis was proportionate to the mean plasma glucose level, with a statistically significant relation in this study with a 'p' value of .001

RESULTS

The overall incidence of postoperative infections in patients with diabetes undergoing surgeries is higher with greater mean plasma glucose levels. Even though some infections rate does not show a statistically significant correlation in this study, it is evident from all of the above observations that tight perioperative glycaemic control within the acceptable range prevented unwanted postoperative infectious complications. All of the above observations made, stressed the importance of strict glycaemic control in the perioperative period for an optimal recovery in the diabetes patients undergoing surgical procedures.

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