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RESEARCH ARTICLE

IMPACT OF PREOPERATIVE GLYCATED HAEMOGLOBINON POST OPERATIVE INFECTION INCIDENCE

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Abstract

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Glycatedhaemoglobin (HBA1C percent) has been used for around three decades to regulate blood glucose regulation in diabetic patients**.**Small increases in perioperative blood glucose concentration are associated with significant increases in rates of hospital mortality and morbidity.

Methodology: The aim of this study is to assess the effect of preoperative glycatedhaemoglobin on postoperative infection incidence following cardiac surgery. This monitored prospective retrospective case-contro study was performed in two centers on 50 diabetic patients undergoing elective baseline cardiac surgery over a 6-month span with the following inclusion and exclusion criteria.

Results: there was statistically significant difference between both groups regarding type of operation and AXC time ($p<0.05$). The majority of both groups undergo CABG operation. Statistically significant difference between both groups regarding post-operative EF ($p<0.05$) was noted. There was no statistically significant difference between both groups regarding ICU stay, hospital stay and reoperation($p>0.05$).

Conclusion: For better results post cardiac surgery in diabetic patient monitoring glucose variability and perioperative strict glycemic control is mandatory. More studies should continue including patients with higher risk including emergency and redo surgery.

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Introduction:-

Glycatedhaemoglobin (HBA1C percent) has been in use for around three decades in diabetic patients to regulate blood glucose regulation. This offers an average amount of blood glucose over the previous 10-12 weeks. It is a very easy blood test that can be administered regardless of prandial state in any clinical environment. (Cork Road 2011) Thirty different laboratory methods have been available to calculate Glycatedhaemoglobin with substantial outcome variability in the same study. In 2009, the International Committee of Experts approved the use of HbA1c to diagnose diabetes with a 6.5% threshold in 2009 (George Alberti et al 2011). The International Federation of Clinical Chemists (IFCC) has proposed that a new device, i.e. mmol HbA1c / mol of total haemoglobin, be implemented instead of mmol HbA1c / mol of total haemoglobin. Oh. Percentage. In the meantime, an analysis was carried out to determine the relationship between average blood glucose and glycatedhaemoglobin, and a linear regression equation was established to calculate the average HbA1c blood glucose. Increased HbA1c has been

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associated with increased morbidity and mortality in cardiac surgery patients (George Alberti et al, 2011). After cardiac surgery, HbA1c can predict adverse outcomes. Following cardiac surgery, optimal preoperative HbA1c can improve the outcome. Small increases in perioperative blood glucose concentration (Natarajan A. et al 2019) are associated with major increases in patient mortality and morbidity rates. Consequently,, A universal standard should be preoperative documentation of the diagnosis of diabetes and its type. At hospital admission, patients undergoing adult cardiac surgery should have a quick glucose measurement and if > 120 mg / dl (6.6 mmol / l) then the glucose level should be tested rapidlyDetermination of haemoglobinA1C (HbA1c) is needed. Increased 24-hour postoperative GV after CABG is an indicator of bad performance (European Journal of Cardio-Thoracic Surgery 53 (2018)). After correcting for postoperative mean glucose and glucose variability (GV), preoperative HbA1c is not associated with major adverse effects. (About Kathleen C et al 2019) Preoperative short-acting subcutaneous insulin should be known to be used when patients are waiting for surgery to control blood glucose levels between 120-180 mg / dl (6.7-10 mmol / l), with a check every 4 hours. Intraoperative intravenous continuous insulin infusion is also recommended for maintaining a blood glucose level of 120-150 mg / dl. (Cardio-Thoracic Surgery Journal of Europe 53) (2018)HbA1c A large proportion of patients undergoing elective CABG are elevated, and these patients are at higher risk for SSI. The effect of increased HbA1c on other postoperative outcomes is less evident. Screening of HbA1c in patients without a history of diabetes is not confirmed by these findings. HbA1c preoperative screening is only useful for the detection of diabetics at risk of SSI. (According to Francesco Nicolinia et al 2018)

A research by Jeanette and her college found that there was an increased risk of death at HbA1c levels above 9.0 percent in patients with T2DM who underwent CABG, and also for the combination of death or MACE at HbA1c levels above 8.1 percent. In T2DM patients who were treated with insulin, there was no correlation between HbA1c levels and death. (2016 by Jeanette Kuhlaf et al) Patients with elevated levels of HbA1c are more likely to have a lower socio-economic community and are at higher risk during cardiac operations for infection and increased hospital LOS. (2017 by Brooke Finger et al)

Patients and Methods:-

This is controlled prospective observational case contro study was carried in two centers on 50 diabetic patients undergoing cardiac surgery on elective bases in the period of 6 months with the following inclusion and exclusion criteria;

Inclusion criteria:

1. Diabetic patients whether on oral or insulin treatment
2. Age 20-70 yesrs old
3. Elective open heart surgery

Exclusion criteria:

1. Emergency cases
2. Preoperative ICU admission
3. Preoperative heart failure
4. Preoperative infection
5. Age more than 70 years old
6. Previous cardiac surgery
7. Patients with major surgical complications.
8. Diet controlled diabetics

CentersNational heart institute (NHI), Mehala Cardiac Center

Patients were divided into two groups
Group A: HbA1c more than 7 % (referring to previously uncontrolled blood sugar)
Group B: HbA1c less than 7 % (referring to previously controlled blood sugar)

All patients'= full-filing criteria were subjected to the following steps preoperative

History taking:

1. Personal history including name, age, sex, occupation, marital status, and habits of medical importance
2. History of the present condition regarding onset, course and duration.

3. Past history of cardiac surgery, leg ulcers.
4. Diabetic drug history

physical examination:
Including general examination and local cardiac examination.

Laboratory assessment:
Routine laboratory investigation including complete blood picture, liver function, kidney function and blood sugar.
HbA1c% level.

Radiological examination:
Plain chest radiography postero-anterior and lateral views,
Coronary angiography or multislice coronary CT above 40 years old
Carotid duplex above 65 years old.

Electrocardiography:
Echocardiography: pre and postoperative assessment of EF.

Operative:
Length of procedure (minute)
Aortic cross clamp duration (AXC time) (minute)
Type of surgery

Post-operative:
1. Return to theater for bleeding
2. ICU stay (days)
3. Hospital stay (days
4. Post operative ejection fraction(EF)
5. Respiratory tract infection (RTI) : lower respiratory tract infection (bronchitis, pneumonia)
6. Urinary tract infection (UTI).
7. Surgical site infection including superficial (discharge for more than two days, positive culture or indicated for secondary sutures), deep (mediastinitis, dehiscence indicated for rewiring) and leg infections: whether discharge for more than two days, positive culture or dehiscence.
8. Acute renal failure: new incidence double increase in serum creatinine level or indicated for dialysis
9. Mortality

Statistical Methods:
Microsoft Excel software is used to codify, enter and analyze data collected throughout history, basic clinical evaluation, laboratory investigations and outcome measures. Sample size evaluated and checked confirming relevant sample size findings and then data were imported into the Social Sciences Statistical Package (SPSS version 20.0) (Social Sciences Statistical Package) Analysis Tools. The following tests were used to assess differences in significance according to the form of qualitative data defined as number and percentage, quantitative continuous group represented by mean ± SD; difference and correlation of qualitative variable by Chi square test (X2). Differences between divisions By t test or Mann Whitney quantitative autonomous classes. To test the association variables for categorical knowledge, Chi-Square test 2 was used. In order to compare quantitative and qualitative data, Kendall Correlation was used.

Results:-

Patients were divided into two groups:
Group A: HBA1C more than 7 %.
Group B: HBA1C less than 7 %.

Table 1:- Pre-operative variants among studied groups:

Variable	Group A (N=20)	Group B (N=30)	t- test	P value
Age (years):				

Mean ± SD **Range**	54.3 ± 7.7 38-64	56.7± 7.3 42-68	-1.11	0.272
Gender: • **Males** • **Females**	**no. (%)** 18 (90) 2 (10)	**no. (%)** 24 (80) 6 (20)	Fisher	0.45
Pre-operative EF (%): • **Mean ± SD** • **Range**	58± 7.3 43-73	54.5 ± 13.3 35-75	1.06	0.294

Data is shown as number (percentage) or mean ± standard deviation.

Chi-square and patient-t tests were used.

Bold values are statistically significant at $p<0.05$.

This table shows that Mean ±SD of age of group A and group B were (54.3 ± 7.7 &56.7± 7.3) respectively. The majority of both groups were males. Mean ±SD of pre-operative EF of group A and group B were (58± 7.3 &54.5 ± 13.3) respectively.

Table 2:- Operative variants among studied groups:

Variable	**Group A (N=20)**	**Group B (N=30)**	**t- test**	**P value**
Operation:	**no. (%)**	**no. (%)**		
➢ **CABG,MVR**	1 (5)	7(23.3)		
➢ **CABG**	15 (75)	19 (63.3)		
➢ **MVR**	0(0)	4 (13.3)	11.43 (χ 2)	**0.02***
➢ **AVR**	3 (15)	0 (0)		
➢ **Aortic root**	1 (5)	0(0)		
AXC time (minutes): • **Mean ± SD** • **Range**	66 ±41.76 25-180	91.33 ± 44.51 40-230	-2.02 (MW)	**0.04***
OR time (minutes): • **Mean ± SD** • **Range**	339± 76 240-480	352 ± 107 180-660	-0.246	0.64

The data is displayed as a percentage (number) or mean ± standard deviation.

Tests were used for Chi-square, MW (Man Wittney) and patient-t tests.

At p<0.05, bold values are statistically important.

This table shows that there was statistically significant difference between both groups regarding type of operation and AXC time (p<0.05). The majority of both groups undergo CABG operation.

Table 3:- Post-operative variants among studied groups:

Variable	Group A (N=20)	Group B (N=30)	t- test	P value
ICU stay (days):				
• **Mean ± SD**	3.45± 6.24	4.5 ± 3.55	-.748 **(MW)**	0.45
• **Range**	1-29	1-16		
Hospital stay (days):				
• **Mean ± SD**	14.85 ±12.55	11.6 ± 7.49	1.25 **(MW)**	0.26
• **Range**	6-58	1-35		
Post-operative EF (%):				
• **Mean ± SD**	58.1± 7.27	51.33 ± 11.53	2.31	**0.02***
• **Range**	38-67	25-67		
Reoperation:	**no. (%)**	**no. (%)**		
• **No**	19 (95)	23(76.7)	Fisher	0.123
• **Yes**	1 (5)	7 (23.3)		

The data is displayed as a percentage (number) or mean ± standard deviation.

The MW (Man Wittney) test and patient-t tests were used by Fisher Exact.

At p<0.055, bold values are statistically important..

A statistically significant difference in post-operative EF (p<0.05) was observed between the two groups. In terms of ICU stay, hospital stay and reoperation(p>0.05), there was no statistically significant difference between the two classes.

Table 4:- Post-operative RTI and UTI among studied groups:

Variable	Group A (N=20)	Group B (N=30)	χ 2	P value
RTI:	**No. (%)**	**No. (%)**		
• **No**	14 (70)	21 (70)	------	NS
• **Yes**	6 (30)	9 (30)		
UTI:				
• **No**	18(90)	28 (93.3)	Fisher	NS
• **Yes**	2 (5)	2 (6.7)		

Data is displayed as the (percentage) number

Chi-square, had been used.
At p<0.05, bold values are statistically important.

Regarding post operativecomplicationsthere was no statistically significant difference among both groups regarding postoperative RTI and UTI (p>0.05).

Table 5:- Post-operative Wound infection among studied groups:

Variable	Group A (N=20)	Group B (N=30)	χ 2	P value
Superficial wound infection:	**No. (%)**	**No. (%)**		
• **No**	18 (90)	25 (83.3)	fisher	0.69
• **Yes**	2 (10)	5 (16.7)		
Deep wound infection:				
• **No**	19(95)	27 (90)	Fisher	0.64
• **Yes**	1 (5)	3 (10)		
Leg infection:				
• **No**	18(90)	27(90)	Fisher	1
• **Yes**	2 (10)	3(10)		

Data is displayed as the (percentage) number

Chi-square, had been used.

At p<0.055, bold values are statistically important..

Concerning wound infection results in previous table stated that there was no statistically significant difference among both groups regarding postoperative superficial, deep and leg wound infection (p>0.05). The majority of both groups had no wound infection

Table 6:- ARF and mortality among studied groups:

Variable	Group A (N=20)	Group B (N=30)	χ 2	P value
ARF:	**No. (%)**	**No. (%)**		
• **No**	15 (75)	25 (83.3)	fisher	0.49
• **Yes**	5 (25)	5 (16.7)		
Mortality:				
• **No**	19(95)	26 (86.7)	Fisher	0.64
• **Yes**	1 (5)	4 (13.3		

This table shows that there was no statistically significant difference among both groups regarding ARF and mortality (p>0.05).

Discussion:-

Francesco and his colleagues stated that increased preoperative HbA1c% is associated with increased rate of post-operative surgical site infection, however we found in our study no significant difference between the figure number of HbA1c % in correlation to postoperative surgical wound infection however superficial or deep.(Francesco Nicolinia et al 2018)

Jeanette and his colleagues mentioned in her study that T2DM with elevated preoperative glycatedhaemoglobin has direct relation with postoperative mortality in CABG patients, which was contrary to our results where no statistical significance was found in mortality rate during both groups.(Jeanette Kuhlaf et al 2016)

Brooke and his colleagues confirmed in previous study that elevated preoperative glycatedhaemoglobin is associated with increased length of hospital stay. In this recent study; we reached statistically non-significant result concerning length of hospital stay even with preoperative elevated glycatedhaemoglobin. (Francesco Nicolinia et al 2018)

Natarajan proved cross linkage between elevated glycatedhaemoglobin and postoperative morbidity and mortality which completely differs from our study where we found no direct relation between elevated glycatedhaemoglobin and morbidity if the form of ARF, UTI, RTI nor wound infection.(Natarajan A. et al 2019)

Strahan went to important issue that is glycatedhaemoglobin cannot be used as single prognostic value for postoperative infection; this statement may clarify the differences in our results comparative to previous studies.(Strahan P. 2009)

Throughout our study we found no clear linkage between preoperative glycatedhaemoglobin and rate of post-operative infection at the level of RTI, UTI, nor surgical site infection. Concerning RTI and UTI comparing the groups of elevated glycatedhaemoglobin and controlled glycatedhaemoglobin; we noted p-value was non-significant. No significant difference was reported in length of ICU and hospital stay. Consequently; we had similar results in relation for superficial and deep wound infection with p-values of 0.64 and 0.69 respectively.

We searched some explanation to these results that was on contrary to many recent studies, and we reached the following:
1. None of previous studies had clear exclusion criteria of emergency patients and preoperative ICU admission these criteria we excluded patients owing to concentrate the study on clear elective patients.
2. The way of perioperative glycemic control was not mentioned in previous studies, we were strict to tight perioperative glycemic control throughout the period of hospital stay and one month post-operative under supervision of endocrinologist according to EACTS guidelines 2018.
3. Small number of patients may owe to less significant positive results.
4. We used a protocol of antibiotics in patients with elevated glycatedhaemoglobin through shifting from cefazolin into imipinem and vancomycin.

Conclusion and Recommendation:-
For better results post cardiac surgery in diabetic patient monitoring glucose variability and perioperative strict glycemic control is mandatory.

More studies should continue including patients with higher risk including emergency and redo surgery.

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