Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

Frequency of Hypertension and Diabetes Mellitus in Patients Undergoing Coronary Artery Bypasses Grafting Surgery

*****ZUBAIR AHMED, *VIKRAM KUMAR, *KAMAL, *ASMAT ACHAKZAI, *AFTAB KHATRI, *SUHYAB KHUSHK

**Department of Cardiac Surgery, National institute of cardiovascular diseases, Karachi, Sindh, Pakistan, *Department of Cardiac Surgery, National institute of cardiovascular diseases, Karachi, Sindh, Pakistan, *Department of Anaesthsia , National institute of cardiovascular diseases, Karachi, Sindh, Pakistan, *Department of Cardiac Surgery, National institute of cardiovascular diseases, Karachi, Sindh, Pakistan, *Department of Anaesthesia, National institute of cardiovascular diseases, Karachi, Sindh, Pakistan, *Department of Cardiac Surgery, National institute of cardiovascular diseases, Karachi, Sindh, Pakistan*

Abstract

Coronary artery diseases (CAD) are the number one cause of death globally, however the complications occur after CABG surgery due to hypertension & diabetes mellitus remains unclear by means of documentation. This descriptive cross sectional study aimed to determine the frequency of HTN & DM among the patients undergoing coronary artery bypass grafting surgery at tertiary care hospital Karachi Pakistan. This study includes 196 patients selected by non-probability consecutive sampling technique. Gender, Age, weight, height, history of diabetes mellitus, hypertension, smoking and detailed medical history of the patients are the inclusion criteria of the study. 59.7% males and 40.3 % females with mean age of 54.92 ± 10.24 years of 196 patients were selected for evaluation of hypertension and diabetes mellitus. In current study hypertension was present in 54.6% patients, diabetes mellitus in 41.8% patients, age > 50 years in 60.0%, BMI > 25 in 50.0%, and smoking in 36.2% patients. It is concluded from the study that patients underwent for CABG due to several CVD are suffering from hypertension and diabetes mellitus along with male gender, increasing age and smoking. As a result, these patients are at a higher risk of short-term and long-term complications.

Keywords Coronary artery diseases (CAD), Coronary artery bypass grafting surgery (CABG), Diabetes Mellitus (DM), Hypertension (HTN), cardiovascular diseases (CVD), Body mass index (BMI)

Introduction

According to world health organization fact sheet of cardiovascular diseases 2017, coronary artery diseases are the number one cause of death globally: more people die annually from coronary artery diseases than from any other cause [1]. A recent study in Pakistani populations showed, diabetes patients are four times more likely to suffer from major cardiovascular and cerebrovascular complication such as heart disease or a stroke than people without diabetes (Moazzam, Amer, & Rehan, 2015). Another recent study shows that some of the CVD risk factors including obesity and hypertension are highly prevalent among low income urban Pakistani adults (Safdar, Bertone-Johnson, Cordeiro, Jafar, & Cohen, 2016). Isolated systolic hypertension is associated with a 40% increase in the likelihood of cardiovascular morbidity perioperative in coronary artery bypass grafting (CABG) surgery patients (Aronson, Boisvert, & Lapp, 2002).

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

Several studies revealed higher morbidity and perioperative mortality rates among patients with diabetes mellitus undergoing CABG, which includes the occurrence of perioperative myocardial infarction, infections, respiratory failure, renal and cerebral complications, and prolong hospital stay (Kappetein et al., 2013; Luciani et al., 2003; Van Den Berghe et al., 2001). Similarly, history of hypertension is associated with a 40% increase in the likelihood of cardiovascular morbidity perioperative in CABG patients (Aronson et al., 2002). Therefore, recognizing high risk patients with continuous and accurate screening is a safe and inexpensive preventive tool. Available data suggest increased postoperative cardiovascular morbidity in presence of diabetes mellitus and hypertension at baseline, but very limited data is available in context of Pakistani population and under the varying rate of disease prevalence we expect to see differences in data from our population. Therefore, it is imperative to quantify the frequency of hypertension and diabetes among the patients undergoing CABG surgery, so that, better management and preventive strategies can be developed for our local population.

The risk factors in patients undergoing CABG in general population have been studied widely. Up to now, numerous studies have been conducted on the risk factors of cardiovascular diseases, such as age, diabetes mellitus, hypertension, peripheral vascular disease; renal failure, left ventricular dysfunction, non-elective surgery hyperlipidemia, obesity, and cigarette smoking have consistently been reported as risk factors of perioperative stroke in patients undergoing CABG surgery. It seems that the patients with two or more risk factors may have more severe coronary artery stenosis and be affected by cardiovascular events. Also, the patients with more uncontrolled risk factors face complications. Considering the increasing elderly population, these risk factors can be considered more as a public health concern. All these risk factors can be assessed before surgery, so the information can assist informed decision-making by patients, their family, and their physicians. The combination of these variables has generated several risk stratification tools that can be implemented before surgery, to determine the individual probability of stroke in patients undergoing CABG (Farkouh et al., 2013; Lai et al., 2012; Mehta et al., 2008).

Method:

Study Design:

This Descriptive cross-sectional study was conducted in department of cardiac surgery, National Institute of Cardiovascular Diseases (NICVD) Karachi, Pakistan. The duration of study was six months from 30-11-2018 to 30-05-2019.

Operational Definition Patients Undergoing Elective CABG Surgery: was defined as the patients undergoing planned Coronary Artery Bypass Grafting (CABG) surgery with angiographic evidence of luminal diameter narrowing of ≥ 50% in at least one of the coronary arteries on angiography.

Sample Size:

Frequency of DM in patients undergoing CABG was reported to be 47.7% [2]. With 95% confidence interval, 7% of margin of error and 47.7% of expected prevalence (p), a total of n = 196 patients was required within the study duration. Sample size was calculated by using WHO sample

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

size calculator version 2.0.

Sampling Technique:

Non probability, consecutive sampling

Sample Selection

Patients fulfilling the following criteria was included in this study; Age between 18 to 65 years; both male and female; Patients underwent elective CABG surgery. Patients was excluded from this study based on following criteria; Patients with previous history of any cardiac related surgery; Patients referred for emergency CABG; Patients refused to give consent.

Data Collection Procedure:

The study was started after approval from CPSP. Approval of ethical review committee of NICVD was also taken prior to the data collection. Patients undergoing CABG surgery at the Surgery Department of National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan during the study duration was included in this study. Data was collected on pre-designed structured questionnaire (provided in annexure A) for all the patients, prior to inclusion the purpose, procedure, risk and benefits of the study will be explained and verbal informed consent was taken by the principal investigator from all patients. Demographic profile of the patients was recorded like gender, age (years), weight (kg), and height (cm). Height of the patient was measured using wall mounted scale and weight was measured by using electronic weighing scale. BMI was calculated by using formula [BMI = weight (kg) / height (m) ^{2}]. History of the patients was taken regarding hypertension, diabetes mellitus, and smoking status as per the operational definitions by principal investigator. In case of referral form other departments or centers, history of the patients was confirmed on examination and investigation. Cardiac surgery was performed by surgeon having minimum 5 years of experience. Confounding variables and biasness was controlled by strictly following inclusion and exclusion criteria and stratification. Patient information was kept secured and available to authorized person only.

Data Analysis Procedure:

Data was entered and analyzed by using SPSS version-21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, version 21.0. Armonk, NY: IBM Corp). Shapiro-Wilk test was applied to check the hypothesis of normality for quantitative (continuous) variables such as age (years), weight (kg), height (cm), BMI kg/m^2 and descriptive statistics such as mean ± SD, median (IQR), skewness, maximum and minimum was calculated appropriately. Frequency and percentages was calculated for categorical variables such as gender, age group, hypertension, diabetes mellitus, smoking, and BMI categories. Effect modifiers like age groups, gender, BMI categories and smoking were controlled through stratification. Post stratification appropriate chi-square test was applied. Two-sided p-value of ≤ 0.05 was taken as criteria of statistical significance. For the graphical presentation of data, bar charts and pi-charts will be used.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

Results:

In table 1 Descriptive statistics of continuous variable of age (in years) was done, where minimum, maximum, median, mean, standard deviation, skewness, and standard error of skewness of age (in years) was 25, 65, 59.0, 54.92 ± 10.24, -1.04, and 0.17 respectively. Patient's age was distributed on the basis of gender into male and female. In male and female minimum, maximum, median, mean, standard deviation, skewness, and standard error of skewness of age (in years) was 25, 65, 59.0, 55.25 ± 10.06, -1.09, and 0.22, and 28, 65, 59.0, 54.43 ± 10.55, -0.99, and 0.27 respectively. Shapiro-Wilk test was applied that accept the null hypothesis i.e., data was normally distributed.

Table 1 Descriptive statistics of continuous variable of Age (in years)

Variables	Age	Male	female
N	196	117	79
Min.	25	25	28
Max.	65	65	65
Median	59.00	59.00	59.00
Mean	54.92	55.25	54.43
Std. Deviation	10.24	10.06	10.55
Skewness	-1.04	-1.09	-0.99
Std. Error of Skewness	0.17	0.22	0.27
Shapiro-Wilk test			
Statistic	0.86	0.86	0.86
P-value	0.001	0.001	0.001
Significant	Yes	Yes	Yes

In table 2 Descriptive statistics of continuous variable of height (cm), weight (Kg), and BMI (Kg/m^2) was done, where minimum, maximum, median, mean, standard deviation, skewness, and standard error of skewness of height in cm was 130, 180, 160, 158.38 ± 9.80, -0.61, and 0.17, weight in Kg was 41, 116, 56, 58.18 ± 11.07, 1.77, and 0.17, and BMI in Kg/m^2 was 16.69, 43.64, 22.48, 23.28 ± 4.26, 1.21, and 0.17 respectively. Shapiro-Wilk test was applied that accept the null hypothesis i.e., data was normally distributed.

Table 2 Descriptive statistics of continuous variable (Height, Weight, and BMI)

Variables	Height (cm)	Weight (Kg)	BMI (Kg/m^2)
N	196	196	196
Min.	130	41	16.69
Max.	180	116	43.64
Median	160.0	56.0	22.48
Mean	158.38	58.18	23.28
Std. Deviation	9.80	11.07	4.26
Skewness	-0.61	1.77	1.21
Std. Error of Skewness	0.17	0.17	0.17
Shapiro-Wilk test			
Statistic	0.96	0.86	0.93

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

P-value	0.001	0.001	0.001
Significant	Yes	Yes	Yes

In table 3 Distribution of gender was done; in this study 117 (59.7%) patients were male and 79 (40.3 %) were female. Male patients were more affected with disease as compare to female patients. Distribution of age was done; in this study enrolled patients were grouped as; in 18-30 years 9 (4.6%) patients, in 31-40 years 18 (9.2%) patients, in 41-50 years 46 (23.5%) patients, and in 51-65 years 123 (62.8%) patients. Distribution of BMI was done; in this study enrolled patients were grouped as; in underweight 19 (9.7%) patients, in healthy 83 (42.3%) patients, in overweight 71 (36.2%) patients, and in obese 23 (11.7%) patients. Distribution of smoking was done; in this study 71 (36.2%) patients were smoker and 125 (23.8%) patients were non-smoker. Distribution of diabetes mellitus was done; in this study 82 (41.8%) patients were diabetic and 114 (58.2%) patients were non-diabetic. Distribution of hypertension was done; in this study 107 (54.6%) patients were hypertensive and 89 (45.4%) patients were non-hypertensive.

Table 3 Distribution of Gender, Age groups, BMI, Smoking, Diabetes Mellitus, HTN

Distribution of Gender (n=196)	Frequency	Percentage
Male	117	59.7
Female	79	40.3
Total	196	100.0
Distribution by Age groups (n=196)	Frequency	Percentage
18-30	9	4.6
31-40	18	9.2
41-50	46	23.5
51-65	123	62.8
Total	196	100.0
Distribution by BMI (n=196)	Frequency	Percentage
Underweight	19	9.7
Healthy	83	42.3
Overweight	71	36.2
Obese	23	11.7
Total	196	100.0
Distribution by Smoking (n=196)		
Yes	71	36.2
No	125	63.8
Total	196	100.0
Distribution by Diabetes Mellitus (n=196)	Frequency	Percentage
Yes	82	41.8
No	114	58.2
Total	196	100.0
Distribution by HTN (n=196)	Frequency	Percentage
Yes	107	54.6
No	89	45.4
Total	196	100.0

In table 4 Stratification of Diabetes Mellitus was done with respect to gender, age, BMI, smoking, and hypertension, where age, BMI, and smoking shows significance result, whereas gender, and hypertension shows non- significance result with p-value ≤ 0.05

Table 4 Stratification of diabetes mellitus w.r.t Age, Gender, BMI, smoking, HTN

Stratification Of Diabetes Mellitus With Respect To Age (n=196)

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

Age groups (Years)	Diabetes Mellitus		Total
	Yes	No	
18-30	1	8	9
31-40	4	14	18
41-50	28	18	46
51-65	49	74	123
Total	82	114	196

Chi- square value = 13.38,P-value = 0.004 (Significant)

Stratification Of Diabetes Mellitus With Respect To Gender (n=196)

Gender	Diabetes Mellitus		Total
	Yes	No	
Male	44	73	117
Female	38	41	79
Total	82	114	196

Chi- square value = 2.13, P-value = 0.14 (Non-significant)

Stratification Of Diabetes Mellitus With Respect To BMI (n=196)

BMI	Diabetes Mellitus		Total
	Yes	No	
Underweight	2	17	19
Healthy	26	57	83
Overweight	51	20	71
Obese	3	20	23
Total	82	114	196

Chi- square value = 45.509, P-value = 0.001 (Significant)

Stratification Of Diabetes Mellitus With Respect To Smoking (n=196)

Smoking	Diabetes Mellitus		Total
	Yes	No	
Yes	43	28	71
No	39	86	125
Total	82	114	196

Chi- square value = 16.044, P-value = 0.001 (Significant)

Stratification Of Diabetes Mellitus With Respect To Hypertension (n=196)

Hypertension	Diabetes Mellitus		Total
	Yes	No	
Yes	50	57	107
No	32	57	89
Total	82	114	196

Chi- square value = 2.318, P-value = 0.128 (Non-significant)

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

In table 5 Stratification of Hypertension was done with respect to gender, age, BMI, smoking, and diabetes mellitus, where age, BMI, and smoking shows significance result, whereas gender, and Diabetes mellitus shows non- significance result with p-value ≤ 0.05.

Table 5 Stratification of Hypertension w.r.t Gender, Age, BMI, smoking, Diabetes Mellitus

Stratification Of Hypertension With Respect To Gender (n=196)			
	Hypertension		
Gender			Total
	Yes	No	

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

Male	68	49	117
Female	39	40	79
Total	107	89	196

Chi- square value = 1.457, P-value = 0.227 (Non-significant)

Stratification Of Hypertension With Respect To Age (n=196)

Age groups (Years)	**Hypertension**		**Total**
	Yes	**No**	
18-30	2	7	9
31-40	4	14	18
41-50	26	20	46
51-65	75	48	123
Total	107	89	196

Chi- square value = 13.504, P-value = 0.004 (Significant)

Stratification Of Hypertension With Respect To BMI (n=196)

BMI	**Hypertension**		**Total**
	Yes	**No**	
Underweight	3	16	19
Healthy	34	49	83
Overweight	57	20	77
Obese	13	16	29
Total	107	89	196

Chi- square value = 29.547, P-value = 0.001 (Significant)

Stratification Of Hypertension With Respect To Smoking (n=196)

Smoking	**Hypertension**		**Total**
	Yes	**No**	
Yes	55	16	71
No	52	73	125
Total	107	89	196

Chi- square value = 23.496, P-value = 0.001 (Significant)

Stratification Of Hypertension With Respect To Diabetes Mellitus (n=196)

Diabetes Mellitus	**Hypertension**		**Total**
	Yes	**No**	
Yes	50	32	82
No	57	57	114
Total	107	89	196

Chi- square value = 2.318, P-value = 0.128 (Non-significant)

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 914-924
Received 25 April 2021; Accepted 08 May 2021.

Discussion

The global burden of cardiovascular diseases (CVD) is rapidly increasing in developing countries (Kasliwal, Kulshreshtha, Agrawal, Bansal, & Trehan, 2006). Increased prevalence of CAD in developing countries has led to an increase in number of coronary artery bypass grafting (CABG) (Lauruschkat et al., 2005; Ledur, Almeida, Pellanda, & Schaan, 2011). Although CABG is a very commonly performed surgical procedure with highly successful outcomes, but due to presence of several risk factors risk of stroke increases in CABG patients (Baskett, Buth, Collicott, Ross, & Hirsch, 2002; Karimi et al., 2009; Ostovan, Darvish, & Askarian, 2014). Increasing age, hypertension, diabetes mellitus, dyslipidemia, and smoking are the common risk factors associated with CABG and CAD. However, several studies have shown a higher postoperative complication rate in these patients after heart surgeries, with reoperation and reintubation requirement, superficial and deep infections, perioperative stroke, kidney failure and longer hospital stay (Dadkhah-Tirani et al., 2018; Luciani et al., 2003; Pieris, Al-Sabti, Al-Abri, & Rizvi, 2014).

The current study was conducted at National Institute of Cardiovascular Diseases Karachi on patients undergoing elective CABG surgery. The focus of study was determination of current frequency of hypertension (HTN) and diabetes mellitus (DM) among the patients undergoing CABG from local population of Sindh, so that, better management and preventive strategies can be developed for our local population.

In current study 196 patients were selected, in which males were 117 (59.7%) and females were 79 (40.3 %) with mean age and standard deviation of 54.92 ± 10.24 and 55.25 ± 10.06 years respectively. Similar high prevalence of males with higher mean age affected with cardiovascular diseases and underwent for CABG were reported by different researchers such as Kasliwal RR, et al. (Kasliwal et al., 2006), Ledur P, et al. (Ledur et al., 2011), Ostovan MA, et al. (Ostovan et al., 2014), Karimi A, et al. (Karimi et al., 2009), and Pieris RR, et al. (Pieris et al., 2014), reports the 88.4%, 67.1%, 64.6%, 74.4%, and 73.29% respectively. All studies are reporting that with increasing age risk of cardiovascular diseases and its associated risk factors also increased, whereas males are at higher risk of developing CVD as compared to females.

In current study, more than 60.0% of patients affected with CVD are at age of > 50 years, Similar results were reported by other researchers such as Kasliwal RR, et al. (Kasliwal et al., 2006), Ledur P, et al. (Ledur et al., 2011), Lauruschkat AH, et al. (Lauruschkat et al., 2005), and Ostovan MA, et al. (Ostovan et al., 2014), that young population is at lower risk of developing CVD as compared to elder population.

In current study 50% of patient suffering from CVD are either overweight or obese. Similar results were reported by Kasliwal RR, et al. (Kasliwal et al., 2006), Lauruschkat AH, et al. (Lauruschkat et al., 2005), and Karimi A, et al. (Karimi et al., 2009). It is believed that BMI ≥ 25 is a risk factor not only developing CVD but also increases the risk of complications.

Smoking is another important risk factor in CVD, in current study 71 (36.2%) patients were smoker among which males were in majority. Similar results were reported by Kasliwal RR, et al. (Kasliwal et al., 2006), Ostovan MA, et al. (Ostovan et al., 2014), Pieris RR, et al. (Pieris et al.,

2014), Kunt AS, et al. (Kunt, Darcin, & Andac, 2005), and Dadkhah-Tirani H, et al. (Dadkhah-Tirani et al., 2018).

Diabetes mellitus is one of the important risk factor that is responsible for increasing complication in CVD patients, in current study 82 (41.8%) patients were diabetic, among which females were in majority. Similar high prevalence of diabetes mellitus in female patients were reported by Kasliwal RR, et al. (Kasliwal et al., 2006), Ostovan MA, et al. (Ostovan et al., 2014), Pieris RR, et al. (Pieris et al., 2014), and Dadkhah-Tirani H, et al. (Dadkhah-Tirani et al., 2018), whereas few studies reported the lower prevalence of diabetes mellitus in CVD patients such as Ledur P, et al. (Ledur et al., 2011), Lauruschkat AH, et al. (Lauruschkat et al., 2005), and Baskett RJ, et al. (Baskett et al., 2002). Difference in prevalence was observed because developing countries of South Asia has higher prevalence as compared to developed countries.

Hypertension is quantitatively the most important risk factor for premature CVD, increasing the complications and worsens the disease. In current study 107 (54.6%) patients were hypertensive, among which males were in majority. Similar high prevalence of hypertension was reported by Ostovan MA, et al. (Ostovan et al., 2014), Karimi A, et al. (Karimi et al., 2009), and Dadkhah-Tirani H, et al. (Dadkhah-Tirani et al., 2018), whereas Kasliwal RR, et al. (Kasliwal et al., 2006), Baskett RJ, et al. (Baskett et al., 2002), and Pieris RR, et al. (Pieris et al., 2014), reported the higher prevalence of hypertension than current study. Thus, similar to diabetes mellitus, hypertension is also found to be common in South-Asians as compared to Western population. The difference can be attributed to the epidemiological shift the South-Asian nations are undergoing at present.

Conclusion

It was concluded from the study that patients underwent for CABG due to several CVD are suffering from high prevalence of cardiovascular risk factors especially hypertension and diabetes mellitus along with male gender, increasing age and smoking. As a result, these patients are at a higher risk of short-term and long-term complications.

Conflict Of Interest

There is no conflict of interest declared by Authors.

References:

Aronson, S., Boisvert, D., & Lapp, W. (2002). Isolated systolic hypertension is associated with adverse outcomes from coronary artery bypass grafting surgery. *Anesthesia & Analgesia, 94*(5), 1079-1084.

Baskett, R. J., Buth, K. J., Collicott, C., Ross, D. B., & Hirsch, G. M. (2002). Preoperative cardiovascular risk factor control in elective coronary artery bypass graft patients: a failure of present management. *Can J Cardiol, 18*(4), 397-402.

Dadkhah-Tirani, H., Hasandokht, T., Agostoni, P., Salari, A., Shad, B., & Soltanipour, S. (2018). Comparison of cardiovascular risk factors among coronary artery bypass graft patients in 2010 and 2016: A single-center study in Guilan province, Iran. *ARYA Atheroscler, 14*(5), 205-211. doi: 10.22122/arya.v14i5.1740

Farkouh, M. E., Boden, W. E., Bittner, V., Muratov, V., Hartigan, P., Ogdie, M., . . . Fuster, V.

(2013). Risk factor control for coronary artery disease secondary prevention in large randomized trials. *J Am Coll Cardiol, 61*(15), 1607-1615. doi: 10.1016/j.jacc.2013.01.044

Kappetein, A. P., Head, S. J., Morice, M.-C., Banning, A. P., Serruys, P. W., Mohr, F.-W., . . . Investigators, S. (2013). Treatment of complex coronary artery disease in patients with diabetes: 5-year results comparing outcomes of bypass surgery and percutaneous coronary intervention in the SYNTAX trial. *European Journal of Cardio-Thoracic Surgery, 43*(5), 1006-1013.

Karimi, A., Marzban, M., Movahedi, N., Salehiomran, A., Sadeghian, S., & Goodarzynejad, H. (2009). Traditional cardiac risk factors profile in Iranian patients undergoing coronary artery bypass surgery. *Acta Cardiol, 64*(3), 371-377. doi: 10.2143/ac.64.3.2038024

Kasliwal, R., Kulshreshtha, A., Agrawal, S., Bansal, M., & Trehan, N. (2006). Prevalence of cardiovascular risk factors in Indian patients undergoing coronary artery bypass surgery. *JOURNAL-ASSOCIATION OF PHYSICIANS OF INDIA, 54*(Y), 371.

Kunt, A. S., Darcin, O. T., & Andac, M. H. (2005). Coronary artery bypass surgery in high-risk patients. *Curr Control Trials Cardiovasc Med, 6*(1), 13. doi: 10.1186/1468-6708-6-13

Lai, H. M., Aronow, W. S., Mercando, A. D., Kalen, P., Desai, H. V., Gandhi, K., . . . Lai, T. M. (2012). Risk factor reduction in progression of angiographic coronary artery disease. *Arch Med Sci, 8*(3), 444-448. doi: 10.5114/aoms.2012.29399

Lauruschkat, A. H., Arnrich, B., Albert, A. A., Walter, J. r. A., Amann, B., Rosendahl, U. P., . . . Ennker, J. r. (2005). Prevalence and risks of undiagnosed diabetes mellitus in patients undergoing coronary artery bypass grafting. *Circulation, 112*(16), 2397-2402.

Ledur, P., Almeida, L., Pellanda, L. C., & Schaan, B. (2011). Clinical features and outcomes in patients with diabetes mellitus undergoing coronary artery bypass graft in a reference center in southern Brazil. *Revista da Associacao Medica Brasileira (1992), 57*(2), 200-204.

Luciani, N., Nasso, G., Gaudino, M., Abbate, A., Glieca, F., Alessandrini, F., . . . Possati, G. (2003). Coronary artery bypass grafting in type II diabetic patients: a comparison between insulin-dependent and non-insulin-dependent patients at short-and mid-term follow-up. *The Annals of thoracic surgery, 76*(4), 1149-1154.

Mehta, R. H., Bhatt, D. L., Steg, P. G., Goto, S., Hirsch, A. T., Liau, C. S., . . . Ohman, E. M. (2008). Modifiable risk factors control and its relationship with 1 year outcomes after coronary artery bypass surgery: insights from the REACH registry. *Eur Heart J, 29*(24), 3052-3060. doi: 10.1093/eurheartj/ehn478

Moazzam, A., Amer, J., & Rehan, N. (2015). ESTIMATING THE RISK OF CARDIO VASCULAR DISEASES AMONG PAKISTANI DIABETICS USING U.K. PDS RISK ENGINE. *J Ayub Med Coll Abbottabad, 27*(2), 277-279.

Ostovan, M. A., Darvish, N., & Askarian, M. (2014). The Prevalence of Risk Factors of Coronary Artery Disease in the Patients who Underwent Coronary Artery Bypass Graft, Shiraz, Iran: Suggesting a Model. *Int Cardiovasc Res J, 8*(4), 139-142.

Pieris, R. R., Al-Sabti, H. A., Al-Abri, Q. S., & Rizvi, S. G. (2014). Prevalence Pattern of Risk Factors for Coronary Artery Disease among Patients Presenting for Coronary Artery Bypass Grafting in Oman. *Oman Med J, 29*(3), 203-207. doi: 10.5001/omj.2014.50

Safdar, N. F., Bertone-Johnson, E., Cordeiro, L., Jafar, T. H., & Cohen, N. L. (2016). Do dietary patterns explain high prevalence of cardiovascular risk factors among Pakistani urban adults? A cross-sectional study. *BMC Nutrition, 2*(1), 1-9.

Van Den Berghe, G., Wouters, P., Weekers, F., Verwaest, C., Bruyninckx, F., Schetz, M., . . . Bouillon, R. (2001). Intensive insulin therapy in critically ill patients. *New England journal of medicine, 345*(19), 1359-1367.