MODIFIABLE RISK FACTORS CONTROL POST CORONARY ARTERY BYPASS GRAFT (CABG) AND ITS CORONARY EVENTS WITHIN 5 YEARS AT HOSPITAL USM:

A RETROSPECTIVE COHORT REVIEW

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LIST OF ABBREVIATIONS AND ACRONYMS

CABG	Coronary Artery Bypass Grafting
USM	Universiti Sains Malaysia
LDL	Low-Density Lipoprotein
TG	Triglycerides
HbA1c.	Hemoglobin A1c
IHD	Ischaemic Heart Disease
ACS	Acute Coronary Syndrome
PCI	Percutaenous Coronary Intervention
CTO	Complete Total Obstruction
LMS	Left Main Disease
HPT	Hypertension
DM	Diabetes Mellitus
CKD	Chronic Kidney Disease
ESC	European Society Of Cardiology
EAS	European Atherosclerosis Society
IMA	Internal Mammary Artery
SVG	Saphenous Vein Graft
AHA	American Heart Association

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ABSTRAK (BAHASA MELAYU)

Pengenalan

Pesakit yang menjalani pembedahan pintasan jantung berisiko untuk kembali mendapat serangan jantung terutama selepas 10 tahun menjalani pembedahan tersebut. Ini disebabkan pintasan graf yang tersumbat. Walaupun pintasan graf telah dibuktikan mempunyai tahap patensi yang tinggi pada 5 tahun pertama selepas pembedahan, pesakit masih berisiko mendapat serangan jantung yang lebih awal sekiranya kawalan faktor faktor risiko boleh ubah iaitu penyakit kencing manis, kolestrol, dan tekanan darah tidak terkawal. Banyak kajian membuktikan kawalan faktor risiko ini tidak optimum dan mengaitkan dengan peningkatan kadar serangan jantung yang mungkin memerlukan angioplasti koronari. Oleh itu objektif kajian ini untuk mengenal pasti kadar insiden kematian, serangan jantung dan angioplasti koronari yang berlaku dalam tempoh 5 tahun pertama selepas pembedahan pintasan jantung di Hospital USM, melihat kawalan faktor faktor risiko boleh ubah iaitu kencing manis, darah tinggi, paras kolestrol dalam darah dan status merokok. Kajian ini juga ingin mengenal pasti kaitan di antara kawalan faktor faktor risiko boleh ubah dengan kadar insiden serangan jantung yang berlaku selepas 5 tahun pintasan jantung dilakukan di Hospital USM.

Kaedah

Ini adalah kajian retrospektif kohort yang melibatkan rekod perubatan 135 pesakit yang menjalani pembedahan pintasan jantung dari 01 Januari 2011 sehingga 31 December 2017 di Hospital USM. Maklumat-maklumat yang relevan seperti jantina, umur, keturunan dan penyakit berkaitan dikenalpasti. Data-data berkaitan kawalan faktor faktor risiko boleh ubah iaitu kencing manis, darah tinggi, paras kolestrol dalam darah dan status merokok serta rekod kemasukan ke wad disebabkan serangan jantung atau angioplasti koronari untuk tempoh 5 tahun pertama direkodkan. Kesemua data ini telah dikutip dan direkodkan di dalam proforma. Setelah selesai , data-data telah di masukkan ke dalam *excel sheet* untuk tujuan analisa data.

Keputusan

Seramai 135 pesakit yang menjalani pembedahan pintasan jantung di Hospital USM telah dikenal pasti memenuhi kriteria yang ditetapkan. Berdasarkan analisa data, 19 pesakit ataupun 14% pesakit telah mendapat serangan jantung dalam tempoh 5 tahun selepas mereka menjalani pembedahan pintasan jantung. Kajian kami juga menunjukkan kesemua kes serangan jantung ini dirawat secara perubatan dan tiada angioplasti ulangan dilakukan ke atas pesakit terlibat. Kawalan faktor faktor risiko boleh ubah iaitu kencing manis, darah tinggi dan paras kolestrol dalam darah menunjukkan kawalan faktor faktor risiko ini tidak berada ditahap yang memuaskan. Secara purata 5 tahun pertama, 46.6% pesakit mempunyai tekanan darah sistolik tidak terkawal (M=149.01 SD=12.7) dan 18.5% mempunyai tekanan darah diastolik darah tidak terkawal (M=87.55 SD=6.7). LDL merupakan faktor risiko paling tidak terkawal dengan 96% pesakit mempunyai LDL tidak terkawal melebihi $\geq$1.8 mmol/L (M=3.08

SD=0.9). 49% pesakit pula di dapati mempunyai TG ≥1.5 mmol/L di sepanjang 5 tahun selepas pembedahan (M=2.32 SD=1.3). Untuk HbA1c, 53% pesakit mempunyai HbA1c lebih daripada yang disyorkan iaitu ≥7% (M=9.36 SD 1.4). Selain itu, 95% pesakit terus kekal tidak merokok dalam masa 5 tahun selepas pembedahan. Analisis data juga menunjukkan hubungan signifikan yang ditemui di antara TG, HbA1c dan aktif merokok dengan dengan kadar serangan jantung.

Konklusi

Kajian kami telah menunjukkan untuk tempoh 5 tahun pertama selepas menjalani pembedahan pintasan jantung, kadar serangan jantung adalah rendah. Kajian kami juga menunjukkan kesemua kes serangan jantung ini dirawat secara perubatan dan tiada ulangan angioplasti dilakukan ke atas pesakit terlibat. Kawalan faktor faktor risiko boleh ubah iaitu kencing manis, darah tinggi, paras kolestrol dalam darah dalam tempoh 5 tahun pertama juga menunjukkan kawalan faktor faktor risiko ini tidak berada di tahap yang memuaskan terutama paras kolestrol dalam darah. Hanya status merokok sahaja yang berada di tahap optimun di mana hanya 5% pesakit masih merokok atau kembali merokok. Selain itu kajian kami menunjukkan hubungan signifikan antara kawalan faktor faktor risiko iaitu TG, HbA1c dan status merokok dengan serangan jantung yang berlaku dalam tempoh 5 tahun selepas pembedahan pintasan jantung.

ABSTRACT

Background

Patient post CABG are at high risk of developing another heart attack that require graft study and coronary angioplasty. These are common after 10 years post operation due to graft occlusion. Even though at 5 years post CABG, graft patency are excellent as reported by many studies (See et al., 2020), patients still can get coronary events earlier than expected if modifiable risk factors control are not well optimized according to guidelines. Modifiable risk factors which are diabetes mellitus, hypertension, hyperlipidemia and active smoking play an important role and contribue to early graft failure. Therefore, this study aim to determine incidence rate of coronary events, to describe the status of modifiable risk factors control and also to look for any association between each modifiable risk factors towards coronary events within 5 years post CABG.

Methodology

This is retrospective cohort review study that involve 135 patients post CABG who had the operation done from 01 Januari 2011 until 31 December 2017 in Hospital USM. Information and data regarding sex, age, race and underlying relevant medical illness are recorded. 5 years data of modifiable risk factors which are diabetes mellitus, hypertension, hyperlipidemia and smoking status also identified. Coronary events which are acute coronary syndrome or angioplasty that were occurred within 5 years post CABG also identified. All of these data were recorded in patient performa then were transferred to excel sheet for data analysis.

Results

A total of 135 patients that underwent CABG in Hospital USM and fulfilled criteria for this study were identified. From data analysis, 19 patients (14%) experienced at least one acute coronary syndrome within 5 years post CABG. None of patient underwent angioplasty, and all of them treated medically. The status of modifiables risk factors control which are blood pressure, LDL, TG and Hba1c showed that they are not well controlled and optimized as per guidelines. Cumulatively within 5 years, 46.6% of patients had uncontrolled systolic blood pressure (M=149.01 SD=12.7) and 18.5% had uncontrolled diastolic blood pressure (Mean=87.55, SD=6.7). 96% patients had uncontrolled LDL (Mean=3.08, SD=0.9). Other cholestrol component TG showed 49% had uncontrolled TG (Mean=2.32, SD=1.3) throughout 5 years. For glycemic control, 53% of patients had uncontrolled HbA1c (Mean=9.36, SD=1.4). In addition, the result showed 95% of patients were remained off ciggarettes within 5 years post CABG). Lastly our study showed significant association between TG, HbA1C, smoking status and acute coronary syndromes.

Conclusion

Our study showed that in first 5 year post CABG, incidence rate of coronary events is low which is 2.8 cases per 100 person years. We also found that all the coronary events which were acute coronary syndrome are treated medically without the need to repeat coronary angioplasty. The status of modifiables risk factors control which are blood pressure, LDL, TG and Hba1c show that they are not well controlled and optimized as per guidelines. The modifiable risk factors which are Hba1c, blood pressure and TG were significantly associated with acute coronary syndromes.

CHAPTER 1: INTRODUCTION

1.1 Introduction

In our country Malaysia, official record from Statistic Department shows 18,515 deaths due to Ischaemic Heart Disease (IHD) in year 2020. Similar to statistic over past decade, male were about twice as likely as females to have IHD in which 12,707 (68.6%) for males, and 5,808 (31.4%) for females (Department of Statistics Malaysia, November 2021). Risk factors for development of IHD include either modifiable or non-modifiable ones. Increasing age, male and genetic factors are the non-modifiable risk factors while smoking, hypertension, hyperlipidaemia, diabetes mellitus are the modifiable risk factors. Percutaneous coronary intervention (PCI), is a less invasive procedure than coronary artery bypass graft (CABG) surgery. Both modalities are used to treat IHD. In general, a number of factors affect the approach of coronary revascularization that is chosen. 3 vessel disease, complete total obstruction (CTO), left main stem (LMS) disease and complex anatomy for PCI are favour coronary artery bypass graft (CABG) while single vessel disease favours PCI (Welt et al., 2022). The first successful coronary artery bypass surgery was performed in the United States on May 2, 1960, at the Albert Einstein College of Medicine-Bronx Municipal Hospital Centre by a team led by Robert H. Goetz and the thoracic surgeon, Michael Rohman with the assistance of Jordan Haller and Ronald Dee (Bakaeen et al., 2018). Technically, majority of the patients receive left internal mammary artery (IMA) grafts to the left anterior descending (LAD) coronary artery and saphenous vein grafts (SVGs) or other conduits to the remaining vessels. Durability of CABG grafts were studied. SVGs had a mean graft patency rate of 88.6% at five years while LIMA had a patency rate of 98.4% at 5 years post CABG (See et al., 2020).

Post CABG graft occlusion remains doctor's nightmare especially the vein grafts. Approximately 50% of saphenous vein grafts (SVGs) block by 5 to 10 years post-coronary artery bypass grafting (CABG) and between 20–40% block within the first year (Hall and Brilakis., 2019). Several mechanisms may play a role in the pathogenesis of SVG failure including harvesting techniques, intimal hyperplasia and later on atherosclerosis. When a SVG is plugged into the arterial system, its physiologic milieu changes and it undergoes adaptive remodeling, starting with fibrointimal hyperplasia. This hyperplasia forms the nidus for atherosclerosis formation, which is usually established by 5–10 years and is often associated with thrombus and friability (Beijk and Harskamp., 2013). Ultimately, graft failure will occur earlier than expected if the modifiable risk factors are not well controlled. To prevent more catastrophic events after 5 years post CABG, modifiable risk factors control should be controlled aggresively.

1.2 Literature Review

According to European Society of Cardiology (ESC) and European Atherosclerosis Society (EAS) guideline 2019, post CABG patients are considered as very high risk group. It is important to concentrate on secondary prevention for recurrent cardiovascular events. Modifiable risk factors should be reduced aggrasively. Blood pressure should be controlled below 140 mm Hg for systolic BP (SBP) and below 90 mm Hg for diastolic (DBP). Guideline also advocate target systolic BP (SBP) below 130 mm Hg and diastolic BP (DBP) below 80 mm Hg in patients with diabetes mellitus particularly for those patients at high risk of stroke or those with diabetic kidney disease. Hba1c target should be less than 7% in Diabetes Mellitus patients. Lipid LDL is the primary target with aim LDL less than 1.8 mmol/L. For triglycerides there is no specific target to achieve. In general, target for triglycerides should be below 1.5 mmol/L. For smoking status, patients should stop tobacco in any form. Hence the risk factors control together with medication compliance play an important roles for post CABG patient to prevents another ischaemic events.

Risk factors control and secondary prevention measures are frequently found to be suboptimal in patients undergoing coronary artery bypass grafting (CABG) and may lead to worse clinical outcomes (Leviner et al., 2021). Leviner et al conducted a study in 2021 involving 1125 patients to investigate association of modifiables risk factors in patient undergoing CABG with long-term coronary events. Preoperative modifiable cardiovascular risk factors evaluated included hypertension (71%), hyperlipidemia (67%), diabetes (42%), obesity (28%), and smoking (21%). During the mean follow-up of median 88 months after CABG, 179 patients (16%) experienced a coronary event. Incidence rates were higher in patients with than without the presence of each of the

modifiable risk factors. Active smoking (hazard ratio [HR]: 1.51; 95% confidence interval [CI]: (1.07–2.13); p ¼ 0.020), presence of diabetes (HR: 1.61; 95% CI: 1.18–2.18; p ¼ 0.002), and hyperlipidemia (HR: 2.13; 95% CI: 1.45–3.14; p < 0.001) were independent predictors of future coronary events after CABG; they also displayed a progressive stepwise increment in the risk of long-term coronary events when cumulatively present.

A study conducted by Salari et al to evaluate risk factor control in patients with coronary artery disease post CABG, 196 patients post CABG were recruited. This study evaluate risk factors control post CABG in relation to adherance to medications prescribed especially aspirin. Overall result show uncontrolled blood pressure, blood glucose and low-density lipoprotein (LDL) were reported in 48%, 61% and 53% of patients, respectively. More than 63% of former smokers restarted smoking during 6-12 months after bypass (Salari et al, 2016).

Another study in Arab Saudi in 2020 (Anas et al., 2020) compare cardiovascular risk factors in CABG patients between two periods which were 2012 and 2018. The study also showed an increase in hypertension and diabetes mellitus in the second period compared to the first (70% vs 71.2% and 68.6% vs 72.1%, respectively), and a reduction in the percentage of patients with hypercholesterolemia (18.3% vs 17.1%). However, these findings were non-significant due to small sample size.

In Malaysia, studies on risk factor control and their early outcome specifically within 5 years after CABG are lacking. See Wong Shiang and colleagues (See et al., 2020) conducted a study in Hospital Sultanah Aminah Johor Bharu to identify the 5 and 10 year graft patency rate and association between acute myocardial infarction and graft block. They also evaluate the risk factors associated with graft failure among 80

symptomatic patients post CABG. Due to small sample size, the implication of smoking status, hyperlipidemia and diabetes mellitus on graft failure was not significant.

Furthermore, previous studies mainly focus on the immediate complications post CABG and its potential predictors. A study by Monash University Malaysia in 2018 investigate the diabetes mellitus control and its impact on in-hospital mortality (Musa et al.,2018). Both non-insulin dependent DM (OR:1.737, 95% CI 1.072-2.815, p=0.025) and insulin-dependent DM (OR: 1.960, 95% CI: 1.209–3.179, p=0.006) are significant predictors of in-hospital mortality in patients undergoing CABG surgery.

Lastly from previous studies there are insufficient information regarding the 5 years coronary outcome post CABG and association between modifiable risk factor control and coronary events mainly due to small sample size. The present study aims to achieve more meaningful conclusion with adequate sample size and statistical power.

CHAPTER 2: RESEARCH OBJECTIVES

2.1 Research Question

1) What is the incidence rate of coronary events within 5 years post CABG.

2) How is the modifiable risk factors control within 5 years post CABG.

3) What is the association between modifiable risk factors control and its coronary events within 5 years post CABG.

2.2 General Objective

To evaluate the modifiable risk factors control in patient with coronary artery disease who underwent CABG in Hospital USM and its impact on coronary events within 5 years post CABG .

2.3 Specific Objectives

1) To determine the incidence rate of coronary events within 5 years post CABG.

2) To describe the status of modifiable risk factors within 5 years post CABG.

3) To determine the association between modifiable risk factors control and its coronary events within 5 years post CABG

2.4 Study Rationale

Coronary events post CABG that commonly occur after 5 years post CABG is a contributor to morbidity and mortality, increasing the burden on healthcare resources. By knowing the status of modifiable risk factors control and the incident rate of coronary events within 5 years, early interventions can be done to prevent more catastrophic events after 5 years post CABG. Data regarding modifiable risk factors control post CABG in Hospital USM are lacking. Thus, this study can elucidate the control status of modifiable risk factors control within 5 years post CABG and their impact on coronary events.

CHAPTER 3: STUDY PROTOCOL

3.1 Study Design

This is a retrospective study involving a review of the medical records of Hospital USM patients underwent CABG in Hospital USM from 01 January 2011 until December 2017.

3.2 Study Period

The study period is 6 months duration from September 2022 until February 2023

3.3 Study Area

The study include medical records unit Hospital USM, Cardiology Clinic Hospital USM and Surgical Outpatient Department Hospital USM (SOPD).

3.4 Study Population

Reference population	Patients post CABG in Hospital USM
Source population	Patients post CABG in Hospital USM from 2011 till 2017 and under Hospital USM follow up
Sampling subjects	Medical records will be identified during patient clinic follow up in Cardiology Clinic and SOPD Clinic. Apart from that, sampling subjects also by collecting their details which are name, registration number and date of operation in operation theatre logbooks (records) and their medical records will be reviewed in medical records unit Hospital USM. Patients who their medical records were disposed or inactive, the confirmation of their death/living status will be done via National Registration Department Kelantan.

3.5 Inclusion And Exclusion Criteria

Inclusion Criteria

- Underwent CABG in Hospital USM from 01 Jan 2011 until 31 Dec 2017.
- Follow up in Hospital USM.
- Active and available medical records.

Exclusion Criteria

- CABG patients not continue follow up in Hospital USM within 5 years post CABG.

3.6 Sample Size Estimation

For objective 1, sample size estimated using Minitab Statistical Software.

Objective 1: To determine the incidence rates of coronary events within 5 years post CABG.

In Literature review of Leviner et al study, 176 (16%) patients experienced a coronary event. Based on calculation using Minitab Statistic Software, estimated overall incidence rate in this study (Leviner et al study) is 2.13/100 person-years. For an estimation with 95% level of confidence and 1.5 % margin of error, required sample size is 367 patients.

Sample Size for Estimation

Method

Parameter	Rate
Length	100
Distribution	Poisson
Rate	2.13
Confidence level	95%
Confidence interval	Two-sided

Results

Margin of Error	Sample Size
0.015	367

Objective 2: To describe the status of modifiable risk factors within 5 years post CABG

No sample size calculation is required as it involve description of status only

Objective 3: To determine the prognostic roles of modifiable risk factors towards coronary events within 5 years post CABG.

Variables	Proportion (p1)	Proportion (p0)	Significance level (α)	n	Drop out Rate, 10%	Total sample size, n	Literature review
Diabetes Mellitus	0.205	0.125	0.05	337	38	375	Leviner et al
Hyperlipidemia	0.194	0.09	0.05	176	20	196	Leviner et al
Smoking	0.224	0.142	0.05	348	39	387	Leviner et al

From cardiac operation theatre registry logbooks in Hospital USM, there were 315 cases of CABG done during period of 01 January 2011 until 31 December 2017. Our study duration cannot be extended above 2017 due to 5 years data collection and cannot be extended below 2011 because our Hospital USM LIS result system did not stored old LDL and HbA1c. In our limitation as a single centre study, our final sample size will be 315.

3.7 Study Procedure

From January 2011 to December 2017, patients post CABG will be identified from the Cardiac OT registry logbooks. Data will be collected from patient medical records and online laboratory information system (LIS). SPSS version 27 will be used to enter and analyse data.

3.8 Operational Definition

1) Coronary events: adverse events caused by disease processes affecting the coronary arteries. These includes angina, non fatal acute coronary syndromes, revascularizations and cardiovascular death.

2) Controlled modifiable risk factors : According to ESC guideline updated in 2019, modifiable risk factors for very high risk group and the target desired are as below

Modifiables risk factors control	**Target control**
LDL	< 1.8 mmol/L or reduction of at least 50% if the baseline is <1.8 mmol/L
TG	< 1.5 mmol/L
HDL	>1.2 mmol/L
HbA1c	< 7.0%
Systolic blood pressure	< 140 mmHg
Diastolic blood pressure	< 90 mmHg
Body weight	BMI 20-25 kg/m^2 , waist circumference < 94 cm (men) and < 80 cm (women)
Lifestyle modifications	Smoking cessation or no exposure to tobacco in any form Regular physical activitity at least 150-300 minutes a week of moderate intensity

3.9 Research Tool

Data Collection Sheet

MODIFIABLE RISK FACTORS CONTROL POST CORONARY ARTERY BYPASS GRAFT (CABG) AND ITS CORONARY EVENTS WITHIN 5 YEARS AT HUSM

PERFORMA

Sample No: ☐

Age: _____

Gender: M / F

Race: M / C / I / Others

Date of CABG:

Diseases	Yes: Tick (/)	No: Tick (/)
Type 2 DM		
Hypertension		
IHD		
Hyperlipidemia		
CKD		

Q1: To determine the incidence rates of coronary events within 5 years post CABG

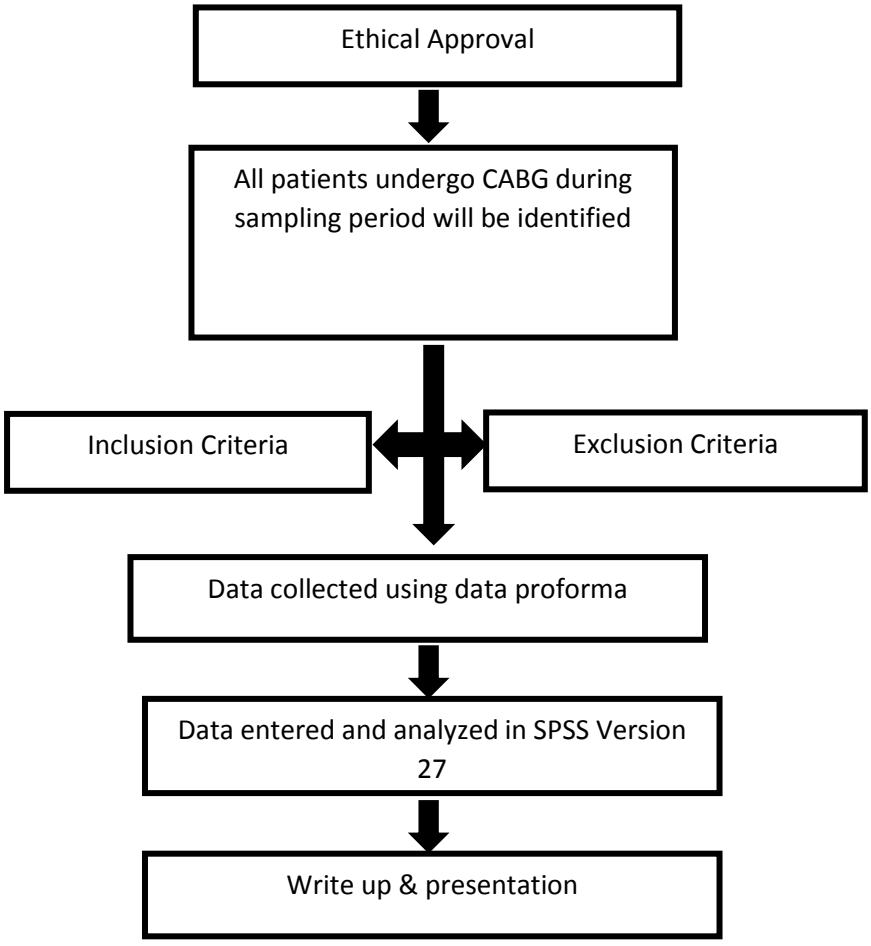
-Tick (/) if any coronary event

Coronary events	Year 1	Year 2	Year 3	Year 4	Year 5
Acute coronary syndrome					
Revascularization					

Q2: To describe the status of modifiable risk factors within 5 years post CABG

Risk factors	Year 1	Year 2	Year 3	Year 4	Year 5
Blood pressure					
LDL level					
TG level					
HbA1c level					
Smoking status					

3.10 Study Flow Chart



3.11 Data Analysis

Statistical Analysis Plan

All the data obtained will be analyzed using the Version 27 of Statistical Package for the Social Sciences (SPSS). Numerical data will be presented as mean while Categorical data will be presented as frequency (n) and percentage (%).Descriptive analysis will be use for objectives 1 and 2. In addition, graphs descriptive statistic in the form of bar graphs are used for objective 2 to show the trends of each modifiable risk factors within 5 years post CABG. Specifically for objective 3, chi square test or logistic regression test will be used to look for association between the categorical variables. $P < 0.05$ was considered as statistically significant.

Expected Result(s)

Table 1: Demographic characteristics of patients post CABG

Variables	**Numbers (%)**
Gender -Male -Female	
Race -Malay -Chinese -India -Others	
Age (Mean)	
Comorbids **Type 2 Diabetes Mellitus** -Yes -No	
Comorbids **Hypertension** -Yes -No	
Comorbids **Hyperlipidemia** -Yes -No	

Comorbids **Ischaemic Heart Disease** -Yes -No	
Comorbids **Chronic Kidney Disease** -Yes -No	

Table 2: To determine the incidence rates of coronary events within 5 years post

CABG

In Hospital USM

Year	**No. of coronary events**	**No. of patient**	**Cumulative Incidence rate per 100 person years**
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			
Total			

Based on calculation, incidence rate = number of total cases/time each patient was observed, totaled for all patients.

Table 3.1: Describe the status of modifiable risk factors within 5 years post CABG

Year 1

Risk factors	**Ranges**	**No. of patient (%)**	**No. of coronary events**
Hypertension -systolic blood pressure (mmHg)	<140		
	≥140-159		
	≥160		
Hypertension -diastolic blood pressure (mmHg)	<90		
	≥90-99		
	≥100		
Hyperlipidemia -LDL level (mmol/L)	<1.40		
	≥1.40-1.79		
	≥1.80-2.39		
	≥2.40-2.99		
	≥3.00		
Hyperlipidemia -TG level (mmol/L)	<1.50		
	≥1.50-1.99		
	≥2.00-2.29		
	≥2.30		
Diabetes Mellitus -HbA1c level **(%)**	<7.0%		
	≥7.0%-7.9%		
	≥8.0%-8.9%		
	≥9.0%		
Smoking Status	Active		
	Non/ex smoker		

Table 3.2: Describe the status of modifiable risk factors within 5 years post CABG

Year 2

Risk factors	**Ranges**	**No. of patient (%)**	**No. of coronary events**
Hypertension -systolic blood pressure (mmHg)	<140		
	≥140-159		
	≥160		
Hypertension -diastolic blood pressure (mmHg)	<90		
	≥90-99		
	≥100		
Hyperlipidemia -LDL level (mmol/L)	<1.40		
	≥1.40-1.79		
	≥1.80-2.39		
	≥2.40-2.99		
	≥3.00		
Hyperlipidemia -TG level (mmol/L)	<1.50		
	≥1.50-1.99		
	≥2.00-2.29		
	≥2.30		
Diabetes Mellitus -HbA1c level **(%)**	<7.0%		
	≥7.0%-7.9%		
	≥8.0%-8.9%		
	≥9.0%		
Smoking Status	Active		
	Non/ex smoker		

Table 3.3: Describe the status of modifiable risk factors within 5 years post CABG

Year 3

Risk factors	**Ranges**	**No. of patient (%)**	**No. of coronary events**
Hypertension -systolic blood pressure (mmHg)	<140		
	≥140-159		
	≥160		
Hypertension -diastolic blood pressure (mmHg)	<90		
	≥90-99		
	≥100		
Hyperlipidemia -LDL level (mmol/L)	<1.40		
	≥1.40-1.79		
	≥1.80-2.39		
	≥2.40-2.99		
	≥3.00		
Hyperlipidemia -TG level (mmol/L)	<1.50		
	≥1.50-1.99		
	≥2.00-2.29		
	≥2.30		
Diabetes Mellitus -HbA1c level **(%)**	<7.0%		
	≥7.0%-7.9%		
	≥8.0%-8.9%		
	≥9.0%		
Smoking Status	Active		
	Non/ex smoker		

Table 3.4: Describe the status of modifiable risk factors within 5 years post CABG

Year 4

Risk factors	**Ranges**	**No. of patient (%)**	**No. of coronary events**
Hypertension -systolic blood pressure (mmHg)	<140		
	≥140-159		
	≥160		
Hypertension -diastolic blood pressure (mmHg)	<90		
	≥90-99		
	≥100		
Hyperlipidemia -LDL level (mmol/L)	<1.40		
	≥1.40-1.79		
	≥1.80-2.39		
	≥2.40-2.99		
	≥3.00		
Hyperlipidemia -TG level (mmol/L)	<1.50		
	≥1.50-1.99		
	≥2.00-2.29		
	≥2.30		
Diabetes Mellitus -HbA1c level **(%)**	<7.0%		
	≥7.0%-7.9%		
	≥8.0%-8.9%		
	≥9.0%		
Smoking Status	Active		
	Non/ex smoker		

Table 3.5: Describe the status of modifiable risk factors within 5 years post CABG

Year 5

Risk factors	**Ranges**	**No. of patient (%)**	**No. of coronary events**
Hypertension -systolic blood pressure (mmHg)	<140		
	≥140-159		
	≥160		
Hypertension -diastolic blood pressure (mmHg)	<90		
	≥90-99		
	≥100		
Hyperlipidemia -LDL level (mmol/L)	<1.40		
	≥1.40-1.79		
	≥1.80-2.39		
	≥2.40-2.99		
	≥3.00		
Hyperlipidemia -TG level (mmol/L)	<1.50		
	≥1.50-1.99		
	≥2.00-2.29		
	≥2.30		
Diabetes Mellitus -HbA1c level **(%)**	<7.0%		
	≥7.0%-7.9%		
	≥8.0%-8.9%		
	≥9.0%		
Smoking Status	Active		
	Non/ex smoker		

Table 4: To determine the prognostic roles of modifiable risk factors towards coronary events within 5 years post CABG using the incidence rate ratio. Incidence rate per 100 person years was calculated for each risk factors.

Risk factors	**Ranges**	**Total person years**	**Cumulative number of coronary events in 5 years**	**Incidence rate per 100 person years**	**Incidence rate ratio**	**P-value**
Hypertension -systolic blood pressure (mmHg)	<140					
	≥140					
Hypertension -diastolic blood pressure (mmHg)	<90					
	≥90					
Hyperlipidemia -LDL level (mmol/L)	<1.80					
	≥1.80					
Hyperlipidemia -TG level (mmol/L)	<1.50					
	≥1.50					
Diabetes Mellitus -HbA1c level **(%)**	<7.0%					
	≥7.0%					
Smoking Status	Active					
	Non/ex smoker					

Gantt Chart

Research activities	**Month 2022**				**Month 2023**			
	9	10	11	12	1	2	3	4
Literature review								
Study design, planning and ethic approval								
Patient screening and selection								
Data collection								
Data analysis/ interpretation								
Report writing								
Presentation and submission of report								
Project completed								
Submission of research papers								