The Association between Risk Factor Profile and Angiographic Severity in Young Patients Presenting with Acute Myocardial Infarction: Single Centre Study

By

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As the candidate's supervisor I have approved this thesis for submission.

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Dedication

To my wife for her unwavering love and support

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Overview of the thesis

Myocardial infarction in the young occurs predominantly in male patients and the majority of these patients present with ST elevation myocardial infarction (STEMI). Non-atherosclerotic etiology accounts for approximately 20% of those diagnosed with myocardial infarction. Etiologies include vasospasm and thrombosis from cocaine abuse and smoking, connective tissue diseases such as Kawasaki disease and hypercoaguable states, which include antiphospholipid syndrome and factor V Leiden mutation. There is currently no consensus in the literature about angiographic severity in young patients presenting with chest pain and abnormal cardiac enzymes. Normal coronary arteries are seen in approximately 9% of all patients with young patients and women accounting for majority of cases. Data on severity and extent of angiographic findings is limited but seems to suggest single vessel disease is more prevalent than triple vessel disease. In some studies there appears to be contradicting evidence. Cole JH et al demonstrated a stenosis morphology that was more complex in younger patients while a North Indian study by Tewari S et al demonstrated less diffuse disease.

A retrospective chart analysis was conducted on patients admitted to a coronary care unit in a government hospital in the Province of KwaZulu-Natal, South Africa. Data was obtained using inpatient notes as well as outpatient records over a 9-year period. Information on risk factor profile and angiographic severity in patients less than 45 years presenting with acute myocardial infarction was documented. Demographic variables including age and gender were documented. Risk factors included Diabetes, Hypertension, smoking history, body mass index and previous history of Coronary Artery Disease or Angina was documented. A detailed family history of Coronary Artery Disease, Cerebrovascular Disease, Diabetes Mellitus and Hypertension was recorded.

From a database of 3886 patients, those who met the age criteria were 621. Of these 510 (82.1%) were males and 111(17.9%) were females. This study cohort was predominantly of Indian descent as evidenced by previous studies performed in the same cohort. Smoking history was the most prevalent risk factor at 79.4% (n-493) of which 90.9% (n-448) were still actively smoking and the remainder 9.1% (n-45) had stopped smoking. Family history of coronary artery disease was common at 68.6% (n-426). Hypertension and diabetes mellitus accounted for 28.2% and 42.4% of cases respectively. 61.8% of the study cohort was either pre obese or obese. Close to half of all cases, 47% had a family history of diabetes mellitus and 44.4% had family history of hypertension. . The majority of patients presented with ST Elevation Myocardial Infarction 489 (85.8%) and 81 (14.2%) presented with Non ST Elevation Myocardial infarction. Hypertension increased the odds of triple vessel disease 2.1 times (p=0.004). Previous MI also increased the odds by 2.5 times (p=0.030), and shock increased it by 5.4 times. The model had a 68% predictive probability with an R squared of 0.073.

Conventional risk factors are responsible for coronary heart disease in young patients in this cohort with smoking being the most prevalent risk factor. STEMI is the commonest presentation. Previous history of myocardial infarction and hypertension increased the odds of triple vessel disease.

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Part 1: The Review of Literature

Coronary heart disease (CAD) remains the leading cause of death for adults throughout the world, although mortality has reduced considerably in the past 30 years (1). It is precipitated in the majority by atherosclerosis and develops more commonly in middle-aged and elderly patients. When it occurs in young patients, it carries a poor long-term prognosis and has a devastating effect on the patient and their families (2).

Myocardial infarction (MI) in the young occurs almost exclusively in male patients and the majority of these patients present with ST Elivation Myocardial Infarction STEMI (3). Nonatherosclerotic aetiology accounts for approximately 20% of those diagnosed with myocardial infarction (4). Aetiologies include vasospasm and thrombosis from cocaine abuse and smoking, connective tissue diseases such as Kawasaki disease, and hypercoagulable states, which include antiphospholipid syndrome and factor V Leiden mutation.

There is currently no consensus in the literature about angiographic severity in young patients presenting with chest pain and abnormal cardiac enzymes. Normal coronary arteries are seen in approximately 9% of all patients, with young patients and women accounting for the majority of cases (5). Data on severity and extent of angiographic findings is limited but seems to suggest single vessel disease is more prevalent than triple vessel disease. In some studies, there appears to be contradicting evidence. Cole JH et al demonstrated a stenosis morphology that was more complex in younger patients(6) while a North Indian study by Tewari S et al demonstrated less diffuse disease(7).

The literature suggests that 10% of patients diagnosed with coronary artery disease are below 45 years old (4). There is documented ethnic variability with individuals of Indian subcontinent descent presenting earlier compared to other ethnic groups (8). This is supported by a local study by Ranjith et al which not only demonstrated patients of Indian origin presenting at a younger age but also presented with more severe disease (9). Coronary angiogram is not routinely offered in younger patients due to normal coronary arteries being found in a significant number of patients. This is supported by a report of 129 patients less than 40 years who had coronary angiograms within 60 days of first acute myocardial infarction. Though this study had a limitation of a small cohort it concluded that coronary angiograms should be performed in patients with recurrent ischemia and multiple risk factors (10).

Control of risk factors is a major strategy in prevention of coronary artery disease in patients >35 years. It has been determined that risk factors are associated with extent and severity of atherosclerosis. However, whether this applies to younger population is still to be determined (11). The risk factor most associated with coronary artery disease in the young is smoking. Compared to nonsmokers the relative risk of developing coronary artery disease in the ages 35 to 44 is documented to be approximately three times higher (11). In a cohort

of 108 patients under the age of 40 years smoking and dyslipidemia were the most prevalent risk factor occurring at 94.5% and 48% respectively (2). This was supported by a South African study of 245 patients under the age of 45 years where smoking was the most important risk factor at 54% followed by dyslipidemia at 26% (9).

There is a paucity of literature describing young patients undergoing coronary angiograms and where available it represents a small percentage of patients with coronary artery disease. The prevalence of normal coronary arteries, atherosclerotic coronary artery disease and non-atherosclerotic etiologies vary in different studies. A study of 60 patients under 35 years following first myocardial infarction triple vessel disease occurred in only 5% of patients with significant coronary artery disease occurring in 73.3%(12). In a study performed in the same center of 200 patients, 23.5% had normal coronaries. The majority of patients had single vessel disease at 32.5% with triple vessel disease occurring at 12.5% (13). In another study by Glover et al., the prevalence of triple vessel disease was 42% with 78% having significant coronary artery disease in a cohort of 120 patients (14). In a comparison performed by Chen et al of patients younger than 45 years and those older than 60 years, younger patients had complex stenosis morphology but less extensive coronary artery disease with triple vessel disease occurring in 10% of young patients(16).

There are studies that speak to the contrary demonstrating less diffuse disease. It seems normal coronary arteries, atherosclerotic coronary artery disease and non-atherosclerotic etiologies vary in different studies. In a comparison performed by Glover et al of patients younger than 45 years and those older than 60 years, younger patients had complex stenosis morphology but less extensive coronary artery disease with triple vessel disease occurring in 10% of young patients(15). In another study of 60 patients under 35 years following their first myocardial infarction, triple vessel disease occurred in only 5% of patients with significant coronary artery disease occurring in 73.3%(12). In a study performed in the same center of 200 patients, 23.5% had normal coronaries. The majority of patients had single vessel disease at 32.5% with triple vessel disease occurring at 12.5% (13).

Smoking is by far the commonest risk in the majority of studies worldwide. In a cohort of 108 patients under the age of 40 years smoking and dyslipidemia were the most prevalent risk factor occurring at 94.5% and 48% respectively (2). Compared to non-smokers the relative risk of developing coronary artery disease in the ages 35 to 44 is documented to be approximately three times higher (11). Cessation of smoking is by far the most effective risk factor modification in the young (37). It is important to note that the benefits of interventions on particular risk factors are related more to the magnitude of the preintervention total CVD risk than to relative risk associated with a single, specific risk factor. Determination of total CVD risk is important for effective and efficient management and control of CVD risk at both population and individual levels. Total CVD risk is a measure of the number of events in a defined population per unit of time (12).

Hypertension on the other hand is a common finding in patients with MI. The literature seems to suggest that this holds true in younger individuals as well (19). It appears to be on

the increase as it now accounts for 2/3 of cases as of 2008 compared to ½ of cases in 1999(20). Hypertension is known to cause severe disease even amongst females, in the absence of other risk factors, and is associated with death (21-23). It is important to note that hypertension is predictive of death post MI (24). Mortality is 2-3 times higher than that of normal blood pressure patients, however this does improve after Percutaneous Transluminal Coronary Angiogram (PTCA) with a stent (25-27). Those with history of previous myocardial infarction had a 50% association with triple vessel disease (18).

Family history of CAD suggest a high probability of a genetic component. There is a 30% higher risk of developing first MI in patients with family history of CAD and associated with recurrent MI (33-34). The prevalence diabetes mellitus in young patients seems to be around 40% (9;17). It is paramount to note that DM is an independent risk factor for prognosis and results in a large number of re-infarctions despite improved care (28). This has an effect on both short and long-term prognosis and increases all-cause mortality(29;31-32). A significant number of diabetics also present late and thereby do not receive fibrinolytic therapy (30).

There is no concrete definition of Major Adverse Cardiovascular Events (MACE) with authors defining it by various overlapping adverse events (36). It ranges from 4.2% to 51% in those above 45 years old but poorly defined in younger patients (38).

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The Association between Risk Factor Profile and Angiographic Severity in Young Patients Presenting with Acute Myocardial Infarction: Single Centre Study

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Abstract

Introduction: Myocardial infarction in the young occurs predominantly in male patients and the majority of these patients present with ST-elevation myocardial infarction (STEMI). Normal coronary arteries are seen in approximately 9% of all patients with young patients and women accounting for the majority of cases. Data on severity and extent of angiographic findings in young patients is limited but seems to suggest single vessel disease is more prevalent than triple vessel disease. In some studies, there appears to be contradicting evidence.

Methodology: A retrospective cohort study was conducted on patients admitted to a coronary care unit in a government hospital in the Province of KwaZulu-Natal, South Africa. A database created by conducting a review of both inpatient and outpatient medical records was used for the purpose of this study. The database contained records of 3886 patients admitted to the coronary care unit between the years 2001 and 2016. Patients that were male and female, aged 45 years and younger, were included in this study. All those who met the universal definition for a myocardial infarct were included in the study. Those who presented with unstable angina were excluded from the study. Information on risk factor profile and angiographic severity in eligible patients was documented.

Results: The study cohort revealed 621 patients that were eligible for the study of which 510 (82.1%) were males, with a mean age of 40.2 (SD $\pm$ 4.4)years . Smoking history was the most prevalent risk factor with 493 (79.4%) of which 448 (90.9%) were still actively smoking and the remainder 45(9.1%) had stopped smoking. Family history of coronary artery disease accounted for 426 (68.6%) cases. Hypertension and diabetes mellitus accounted for 175 (28.2%) and 263 (42.4%) of cases respectively. Almost 2/3 of patients 383 (61.8%) of the study cohort was either pre-obese 227 (36.6%) or obese 156 (25.2%). Close to half of all cases, 292 (47%) had a family history of diabetes mellitus and 276 (44.4%) had a family history of hypertension. The majority of patients presented with ST-Elevation Myocardial Infarction 489 (85.8%). Hypertension increased the odds of triple vessel disease 2.1 times(OR 2.108[1.263-3.518], p=0.004). Previous MI also increased the odds by 2.5 times (OR 2.500 [1.094-5.716], p=0.030)

Conclusion: Risk factors are responsible for coronary heart disease in young patients in this cohort with smoking being the most prevalent risk factor. The high number of patients with family history suggests a genetic component. STEMI was the commonest presentation. Previous history of myocardial infarction and hypertension increased the odds of triple vessel disease.

Introduction

Coronary heart disease remains the leading cause of death for adults throughout the world, although mortality has reduced considerably in the past 30 years (1). It is precipitated in the majority by atherosclerosis and develops more commonly in middle-aged and elderly patients. When it occurs in young patients, it carries a poor long-term prognosis and has a devastating effect on the patient and their families (2).

There is a paucity of literature describing young patients undergoing coronary angiograms and where available it represents a small percentage of patients with coronary artery disease. Myocardial infarction (MI) in the young occurs predominantly in male patients and the majority of these patients present with STEMI (3). Nonatherosclerotic aetiology accounts for approximately 20% of those diagnosed with myocardial infarction (4). Aetiologies include vasospasm and thrombosis from cocaine abuse and smoking, connective tissue diseases such as Kawasaki disease, and hypercoagulable states, which include antiphospholipid syndrome and factor V Leiden mutation.

There is currently no consensus in the literature about angiographic severity in young patients presenting with chest pain and abnormal cardiac enzymes. Normal coronary arteries are seen in approximately 9% of all patients presenting with MI, with young patients and women accounting for the majority of cases (5). Data on severity and extent of angiographic findings is limited but seems to suggest single vessel disease is more prevalent than triple vessel disease. In some studies, there appears to be contradicting evidence. Cole JH et al demonstrated a stenosis morphology that was more complex in younger patients(6) while a North Indian study by Tewari S et al demonstrated less diffuse disease(7).

In light of paucity of data describing risk factors for MI and angiographic severity in young patients, a retrospective observational study was conducted. This study examined the association between risk factor profile and angiographic severity in young patients presenting with acute myocardial infarction and determined the need and/or timing of coronary angiogram in this specific population in a poor-resourced environment.

Methodology

A database was created by conducting a review of both inpatient and outpatient medical records of patients admitted to a coronary care unit in a government hospital in the Province of KwaZulu-Natal (RK Khan Hospital), South Africa over a 15-year period (2001 – 2016). RK Khan hospital patient profile is predominantly of Indian descent as it is located in an area previously reserved for this population under apartheid spatial planning. A retrospective cohort design study was conducted using the database. Information on risk factor profile and angiographic severity in patients less than 45 years presenting with acute myocardial infarction was analysed.

The eligibility criteria for inclusion in this study required a confirmed diagnosis of MI using the universal definition of myocardial infarction. The Universal definition of MI criteria requires 2 out 3 parameters namely chest pain, electrocardiogram (ECG) changes and elevated cardiac enzymes (8). Patients from all races and gender were included in the study. Patients with unstable angina were excluded from the study. In the analysis for MI severity, those who had missing data for angiographic investigation were excluded. A Computer-generated identity number was allocated to each patient in order to maintain anonymity. The data were categorised according to clinical, laboratory and angiographic variables.

Demographic and clinical data

Risk factors recorded included age, gender, smoking history, Diabetes Mellitus (DM), Hypertension, body mass index (BMI) and previous history of Coronary Artery Disease (CAD) or Angina. A detailed family history of Coronary Artery Disease, Cerebrovascular Disease (CVD), DM and Hypertension was obtained. Significant family history was considered in the case of a parent, sibling or first-degree relative with disease at an age younger than 55 years. A diagnosis of DM was confirmed based on personal history or a new diagnosis based on an oral glucose tolerance test (OGTT) or glycated haemoglobin (HbA_{1c}). Electrocardiogram (ECG) findings included type of MI, territory of involvement and presence of any arrhythmias. Cardiac enzymes (Troponin T) were assessed on admission while brain natriuretic peptide (BNP) was done both at admission and at discharge. Those who received fibrinolysis therapy at the presentation were recorded. Angiographic findings for those who were eligible and agreeable to percutaneous transluminal coronary angioplasty (PTCA) were documented and categorised into non-occlusive, single, double or triple vessel disease.

The management received by patients was divided into medical, percutaneous transluminal coronary angioplasty with or without stent and coronary artery bypass graft(CABG). The presence of adverse cardiovascular events namely heart failure, ventricular arrhythmias, supraventricular tachyarrhythmias and the recurrence of angina (ROA) or recurrent MI (ROI) were documented.

Statistical analysis

Data was coded and captured in an Excel spreadsheet and imported into IBM SPSS version 24 for analysis. A p-value <0.05 was considered statistically significant. The prevalence of each categorical risk factor and outcome was reported as frequencies and percentages with 95%

confidence intervals (CI). Continuous variables were summarized using mean, standard deviation (SD) and range for normally distributed variables and median, interquartile range for non-normal variables. Associations between risk factors and outcomes were assessed firstly using univariate analyses. At the 0.1 level of significance, Pearson's chi-square tests was used for categorical predictors, and one-way ANOVA was used for continuous predictors. If multiple predictors were associated with the severity of disease on univariate analysis, multiple logistic regression analysis was used to predict the odds of triple vessel disease whilst adjusting for confounders. A backward stepwise method of modelling was used with entry and exit probabilities set at 0.1 and 0.05 respectively. Odds ratios (OR) and 95% confidence intervals was reported.

Ethics

The University of KwaZulu Natal Biomedical Research Ethics Committee approved this study with the following BREC number BE541/16.

Results

Study Cohort:

From a database of 3886 patients, those who met the eligibility criteria for inclusion in the study were 621 of which 510 (82.1%) were males. The mean age was 40.2 (SD ± 4.4) years.

Risk Factors and Clinical Variables:

A summary of risk factors and other clinical variables are displayed in table I with smoking history being the most prevalent risk factor with 493 (79.4%) of which 448 (90.9%) were still actively smoking and the remainder 45(9.1%) had stopped smoking. Family history of coronary artery disease accounted for 426 (68.6%). Hypertension and diabetes mellitus accounted for 175 (28.2%) and 263 (42.4%) of cases, respectively. Nearly 2/3 of patients 383 (61.8%) of the study cohort was either pre-obese 227 (36.6%) or obese 156 (25.2%). Close to half of all cases, 292 (47%) had a family history of diabetes mellitus and 276 (44.4%) had a family history of hypertension. The number of patients presenting with history of cerebrovascular disease were 113 (18.2%). Those who had a previous history of MI were 50 (8.1%)

Angiographic severity

The findings on Percutaneous Coronary Angiogram (PCA) are summarised in Table II. Only 409 patients were evaluated for severity as not all patient received PCA for a number of factors including, patients refusing the procedure or defaulting on their booking. Those who presented with triple vessel disease were 133 (32.5%).

Single vessel disease was the commonest presentation at 141 (34.5%) . Double vessel disease accounted for 109 (26.7%) of cases. Patients presenting with Non-occlusive disease were in the minority with only 26 (6.4%) of cases. The majority of patients presented with ST-Elevation Myocardial Infarction 489 (85.8%) and 81 (14.2%) presented with Non ST-Elevation Myocardial infarction. Those who presented with inferior territory involvement were 274 (44.1%).

Major Adverse Cardiovascular Events

The major adverse cardiovascular events are summarized in Figure A, with heart failure accounting for 61 (9.8%) of cases. The majority of heart failure cases were classified as mild (Killip class I) accounting for 26 (4.2%). Moderate cases accounted for 31 (5%) of cases which were subdivided into 20 (3.2%) Killip class II and 11 (1.8%) Killip class III. Only 4 (0.6%) of cases presented with severe heart failure (Killip Class IV).

Those who presented with recurrence of MI were 52 (8.4%), with patients experiencing recurrent angina accounting for 35 (5.6%) of the study population. Only 13 (2.1%) patients presented in shock.

Arrhythmias were not a common presentation. SVT accounted for three (0.5%) while those who presented with AF were only six (1.0%) of the patients. Those who presented in VT and VF were 10 (1.6%) and seven (1.1%), respectively.

Association of Risk factors with severity

The association between risk factor profile and angiographic severity is summarised in table III. Triple disease was the outcome of interest. Table III shows the factors which were associated with triple vessel disease on univariate logistic regression analysis. Nearly half, 50 (43.5%) of those who presented with hypertension and 18 (50%) of those with previous MI had triple vessel disease. Hypertension and previous MI were statistically significant with crude OR 1.956 (1.250-3.060) and crude OR 2.243 ((1.126-4.470), respectively. The rest of the variables tested were not statistically significant.

Hypertension, previous MI and variables that were deemed to be clinically significant were subsequently entered into a multivariate logistic regression model resulting in the final model in Table IV. The clinically significant variables included were the following: DM, Smoking, Previous Angina, AF, Shock, CVA, HF, ROI, STEMI and Admission BNP. After 10 steps, the 3 variables that remained statistically significance were hypertension, previous MI and shock. Hypertension increased the odds of triple vessel disease two-fold (OR 2.108[1.263-3.518], p=0.004). Previous MI also increased the odds of triple vessel disease nearly three-fold (OR 2.500 [1.094-5.716], p=0.030. Shock increased the risk by five-fold (OR 5.386 [0.954-30.411], p=0.057). The model had a 68% predictive probability with an R squared of 0.073.

Discussion

This study set out to ascertain the association between risk factor profile and angiographic severity in patients younger than 45 years of age. Hypertension and previous MI increasing the risk of triple vessel disease 2-fold and almost 3-fold, respectively. Hypertension is a common finding in patients with MI. The literature seems to suggest that this holds true in younger individuals as well (19). It appears to be on the increase as it now accounts for 2/3 of cases as of 2008 compared to ½ of cases in 1999(20). In this cohort, hypertension accounted for 28.2% of the cohort with 43.5% developing triple vessel disease that was statistically significant. This is not surprising as hypertension is known to cause severe disease even amongst females, in the absence of other risk factors, and is associated with death (21-23). It is important to note that hypertension is predictive of death post MI (24). Mortality is 2-3 times higher than that of normal blood pressure patients, however this does improve after PTCA with a stent (25-27).

The number of patients in this study who were under the age of 45 were 621, accounting for 16% of the total number of the data compiled. This is above what is suggested by the literature ranging around 10% (4). It is important to note that the city of Durban has the second highest concentration of Indian descendants in the world and there is documented ethnic variability with individuals of Indian subcontinent descent presenting earlier compared to other ethnic groups (8). This is supported by a local study by Ranjith et al which not only demonstrated patients of Indian origin presenting at a younger age but also presented with more severe disease (9).

Those with history of previous myocardial infarction had a 50% association with triple vessel disease (n-18). This was statistically significant with a p=0.03. Family history of CAD accounted for 68.6% of all cases. This suggest a high probability of a genetic component. There is a 30% higher risk of developing first MI in patients with family history of CAD and associated with recurrent MI (33-34). The association with triple vessel disease was 33.1% but was not statistically significant.

The prevalence of triple vessel disease in our study was 133 (32.5%). A local study by AK Pillay et al of 100 young patients supported the fact that multi-vessel involvement was common in the young, occurring in 42% in this study. This study however did also conclude that atherosclerotic disease associated with clustering of risk factors is highly prevalent in CAD in young individuals(17). This supports previous data that coronary angiogram should not routinely be offered in younger patients with single risk factor due to normal coronary arteries being found in a significant number of patients. A report of 129 patients less than 40 years who had coronary angiograms within 60 days of first acute myocardial infarction. Though this study had a limitation of a small cohort, it concluded that coronary angiograms should be performed in patients with recurrent ischemia and multiple risk factors (10). In a study by Glover et al., the prevalence of triple vessel disease was 42% with 78% having significant coronary artery disease in a cohort of 120 patients (15).

There are studies that speak to the contrary demonstrating less diffuse disease. It seems normal coronary arteries, atherosclerotic coronary artery disease and non-atherosclerotic aetiologies vary in different studies. In a comparison performed by Chen et al of patients younger than 45 years and those older than 60 years, younger patients had complex stenosis morphology but less extensive coronary artery disease with triple vessel disease occurring in 10% of young patients(16). In another study of 60 patients under 35 years following their first myocardial infarction, triple vessel disease occurred in only 6.8% of patients with significant coronary artery disease occurring in 73.3%(13). In a study performed in the same center of 200 patients, 23.5% had normal coronaries. The majority of patients had single vessel disease at 32.5% with triple vessel disease occurring at 12.5% (14). Spontaneous Coronary Artery Dissection may be responsible for poorer outcomes in younger individuals (41).

Control of risk factors is a major strategy in the prevention of coronary artery disease in patients >35 years. It has been determined that risk factors are associated with extent and severity of atherosclerosis however, whether this applies to younger populations is still to be determined (11). A total of 21.4% of cases received medical therapy with 36.7% having received fibrinolytic therapy. We found that smoking was by far the commonest risk factor at 79.4% in our cohort. This is in keeping with the literature in the majority of studies worldwide. Compared to non-smokers the relative risk of developing coronary artery disease in the ages 35 to 44 is documented to be approximately three times higher (11). Cessation of smoking is by far the most effective risk factor modification in the young (40). In a cohort of 108 patients under the age of 40 years smoking and dyslipidemia were the most prevalent risk factor occurring at 94.5% and 48% respectively (2). This was supported by a South African study of 245 patients under the age of 45 years where smoking was the most important risk factor at 54% followed by dyslipidaemia at 26% (9). Thirty-one percent of patients with a smoking history developed triple vessel disease, which was not statistically significant. It is important to note that the benefits of interventions on particular risk factors are related more to the magnitude of the pre-intervention total CVD risk than to relative risk associated with a single, specific risk factor. Determination of total CVD risk is important for effective and efficient management and control of CVD risk at both population and individual levels. Total CVD risk is a measure of the number of events in a defined population per unit of time (12).

The prevalence of DM was 42.4%. The number of diabetics presenting with triple vessel disease in our cohort was 33.3%, but was statistically not significant. This was similar prevalence to other studies in the same population (9;17). It is paramount to note that DM is an independent risk factor for prognosis and results in a large number of re-infarctions despite improved care (28). This has an effect on both short and long-term prognosis and increases all-cause mortality(29;31-32). A significant number of diabetics also present late and thereby do not receive fibrinolytic therapy (30).

Figure A is a summary of all those who presented with MACE. There is no concrete definition of MACE with authors defining it by various overlapping adverse events (36). It ranges from 4.2% to 51% in those above 45 years old but poorly defined in younger patients (38). Outcomes of MACE may also vary depending if the cause is atherosclerotic or non-atherosclerotic (40). HF was the commonest MACE with 61 cases followed by ROI (n-52) and ROA with 35 patients. Triple vessel disease can

predict MACE so it is essential to identify it and intervene early (39). Arrhythmias in our cohort were a lot less common. The association between MACE and severity of disease showed close to a 50/50 split between triple vessel disease and the control as noted in Figure B. This is possibly due to the low number of cases. We believe that further studies are required to ascertain the extent of this association.

Study Limitations

This study had limitations with some of the data not being available namely the race of the patients. Information on dyslipidaemia was largely inadequate and not all the patients in the study cohort received percutaneous coronary angiograms.

Conclusion

The presence of conventional risk factors was responsible for coronary heart disease in young patients in this cohort. Previous history of myocardial infarction and hypertension increased the odds of triple vessel disease. The high number of patients with family history suggests a genetic component. In a resource-constrained environment, those with hypertension, previous MI or family history of CAD should be considered for early intervention in this population

Tables and Figures:

Table I – Study Characteristics			
Study Cohort:			
Total number (n)		621	
Age (Years)		40.2 (Mean)	4.4 (SD)
Gender	Male	510	82.1%
	Female	111	17.9%
Risk Factors		**Number(n)**	**Percentage (%)**
Smoking History		493	79.4%
Smoking Status	Current Smoker	448	90.9%
	Ex-Smoker	45	9.1%
Family history CAD		426	68.6%
Family history Diabetes		292	47%
Family history Hypertension		276	44.4%
Diabetes Mellitus		263	42.4%
Hypertension		175	28.2%
Family history CVD		113	18.2%
Previous history of MI		50	8.1%
Clinical Variables			
Pulse (Beats per minute)		84.8 (Mean)	18.7 (SD)
Systolic Blood Pressure (mmHg)		130.6 (Mean)	24.9 (SD)
Diastolic Blood Pressure(mmHg)		83.2 (Mean)	17.7 (SD)
		Number (n)	**Percentage (%)**
Admission BNP (Abnormal)		322	62.5%
Discharge BNP (Abnormal)		294	89.6%
Normal BMI [<25kg/m^2]		212	34.2%
Pre Obese BMI [26-29kg/m^2]		227	36.6%
Obese [≥30kg/m]		156	25.2%
Intervention Strategies			
PTCA + Stent		113	18.2%
CABG		162	26.1%
Medical		133	21.4%
Metalyse		228	36.7%

*CAD – Coronary Artery Disease; SD – Standard Deviation; CVD – Cerebrovascular Disease; mmHG – Millimetres of Mercury; BNP – Brain Natriuretic Peptide; BMI – Body Mass Index; PTCA – Percutaneous Transluminal Coronary Angioplasty; CABG – Coronary Artery Bypass Graft

Table II		
Site and type of Infarct		
	Number (n)	Percentage (%)
Single Vessel Disease	141	34.5%
Triple Vessel Disease	133	32.5%
Double Vessel Disease	109	26.7%
Non-Occlusive	26	6.4%
ST-Elevation	489	85.8%
Non ST-Elevation	81	14.2%
Total	409	100%

*only 409 patients were assessed for severity

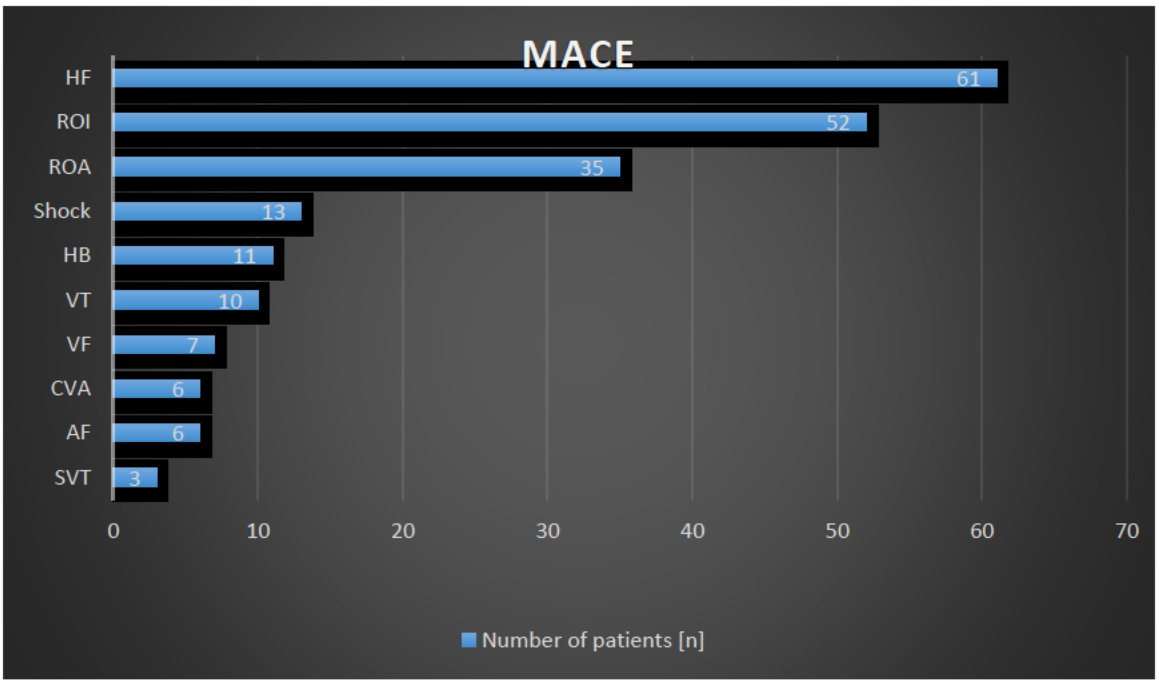
Table III					
Angiographic severity vs risk factors					
Risk Factor	Non-Occlusive, Single or Double		Triple Vessel Disease		
	Number(n)	Percentage (%)	Number(n)	Percentage (%)	Crude OR (95% CI)
Gender Male	228	66.3%	116	33.7	1.437 (0.791-2.609)
DM	131	66.2%	67	33.3%	1.124 (0.743-1.700)
Hypertension	65	56.5%	50	43.5%	1.956 (1.250-3.060)
Smoking	229	68.2%	107	31.8%	0.845 (0.497-1.437)
Previous MI	18	50%	18	50%	2.243 (1.126-4.470)
Previous Angina	19	55.9%	15	44.1%	1.719 (0.844-3.501)
Family History CAD	194	66.9%	96	33.1%	1.097 (0.693-1.735)
Family History CVD	46	65.7%	24	34.3%	1.101 (0.639-1.890)
Family history hypertension	131	67.2%	64	32.8%	1.027 (0.679-1.553)
Family History DM	133	64.9%	72	35.1%	1.269 (0.838-1.922)
Normal BMI	95	67.9%	45	32.1%	0.974 (0.630-1.509)
Pre-Obese	108	70.1%	46	29.9%	0.822 (0.534-1.266)
Obese	67	62%	41	38%	1.390 (0.878-2.201)
Discharge BNP	128	65%	69	35%	2.048 (0.733-5.725)
Admission BNP	144	64.3%	80	35.7%	1.380 (0.848-2.248)

*OR – Odds Ratio; CI – Confidence Interval; DM – Diabetes Mellitus; MI – Myocardial Infarction; CAD – Coronary Artery Disease; CVD – Cerebrovascular Disease; BMI – Body Mass Index; BNP – Brain-natriuretic Peptide

Table IV			
Multivariate Logistic Regression Model			
After 10 steps:			
	Sig.	OR	95% CI for OR
Hypertension	0.004	2.108	(1.263 – 3.518)
Previous MI	0.030	2.500	(1.094 – 5.716)
Shock	0.057	5.386	(0.954 – 30.411)
R Squared	0.073		

*Sig. – statistical significance; OR – Odds Ratio; CI – Confidence Interval; MI – Myocardial Infarct

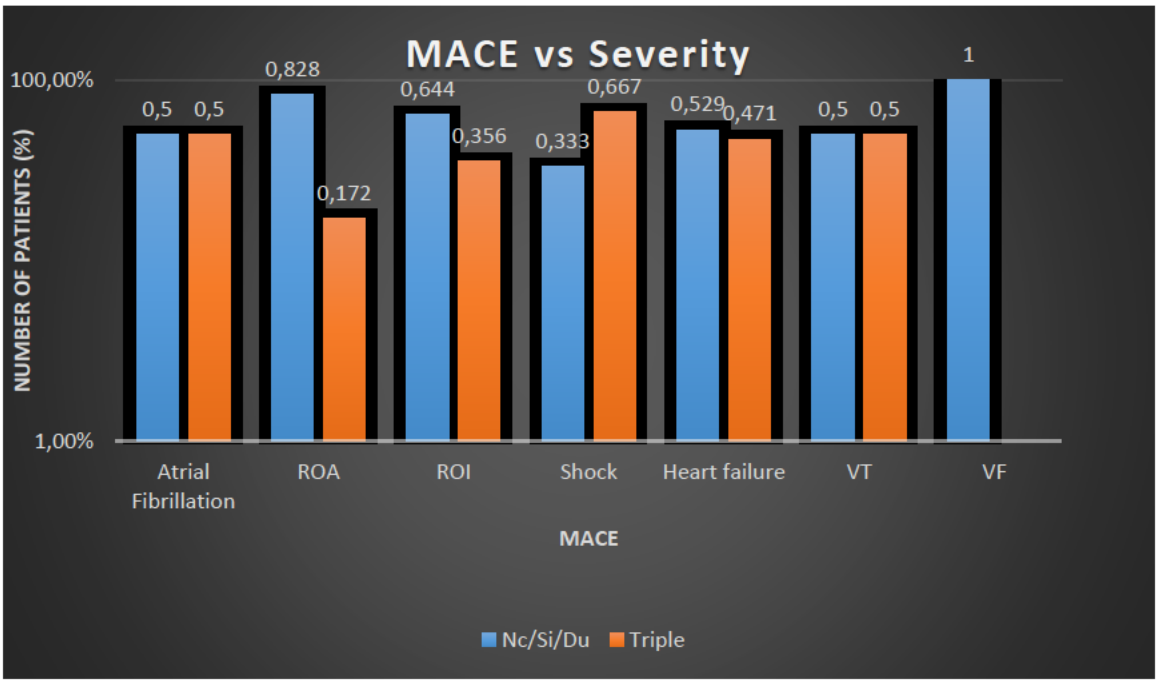
Figure A



*HF – Heart failure; ROI – Recur; Recurrent Myocardial Infarction; HB – Heart Block; VT – Ventricular Tachycardia;

VF – Ventricular fibrillation; CVA – Cerebrovascular Accident; AF – Atrial Fibrillation; SVT – Supraventricular Tachycardia

Figure B



*Nc – Non-Occlusive Disease; Si – Single Vessel Disease; Du – Double Vessel Disease

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Appendices

Appendices should be used for illustrative material which is not included in the main body of the thesis, or for material which interrupts the flow of the text, such as list of abbreviations, pertinent documents and extensive raw data. If several separate items are relegated to appendices, each one should form a separate appendix. If the appendices contain further references, a separate list should be included at the end of each appendix.

Appendix 1, 2 and 3 below are standard for all theses.

Appendix 1: The final Study

University of KwaZulu-Natal

College of Health Sciences

School of Clinical Medicine

Title: Association between Risk factor profile and Angiographic severity in young patients (≤ 45yrs) with acute myocardial infarction admitted into a coronary care unit of a South African Regional Hospital

Degree: MMed Medicine

Principal Investigator: Dr M.A Hlophe

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Date of Submission: 23 August 2022

EXECUTIVE SUMMARY:

This is a retrospective observational study to examine the association between risk factor profile and angiographic severity in young patients admitted with acute myocardial infarction. A retrospective chart analysis will be conducted on patients admitted to a coronary care unit in a government hospital in the Province of KwaZulu-Natal, South Africa.

Data will be obtained from a database constellated using both inpatient notes as well as outpatient records where the risk factor profile and angiographic severity in patients less than 45 years presenting with acute myocardial infarction will be recorded.

This study will hopefully provide reliable information on the need and timing of angiographic intervention in young patients presenting with acute myocardial infarction in a South African setting.

THE PROTOCOL

TABLE OF CONTENTS

INTRODUCTION:

Coronary heart disease still remains the leading cause of death for adults throughout the world, although mortality has reduced considerably in the past 30 years (1). It precipitated in the majority by atherosclerosis and develops more commonly it middle-aged and elderly patients. When it occurs in young patients it carries a poor long term prognosis and has a devastating effect on the patient and their families (2).

Myocardial infarction in the young occurs almost exclusively in male patients and the majority of these patients present with STEMI (3). Non-atherosclerotic etiology accounts for approximately 20% of those diagnosed with myocardial infarction (4). Etiologies include vasospasm and thrombosis from cocaine abuse and smoking, connective tissue diseases such as Kawasaki disease and hypercoaguable states which include antiphospholipid syndrome and factor V Leiden mutation.

There is currently no consensus in the literature about angiographic severity in young patients presenting with chest pain and abnormal cardiac enzymes. Normal coronary arteries are seen in approximately 9% of all patients with young patients and women accounting for majority of cases (5). Data on severity and extent of angiographic findings is limited but seems to suggest single vessel disease is more prevalent than triple vessel disease. In some studies there appears to be contradicting evidence. Cole JH et al demonstrated a stenosis morphology that was more complex in younger patients(6) while a study in a North Indian study by Tewari S et al demonstrated less diffuse disease(7).

1. BACKGROUND AND LITERATURE REVIEW

1.1 The Clinical Problem

Is there a association between risk factors and angiographic severity in young patients presenting with acute myocardial infarction. Can this information assist to stratify these patients further for angiographic intervention in a poor resourced environment.

1.2 The Literature Review

The literature suggests that 10% of patients diagnosed with coronary artery disease are below 45 years old (4). There is documented ethnic variability with individuals of Indian subcontinent descent presenting earlier compared to other ethnic groups (8). This is supported by a local study by Ranjith et al which not only demonstrated patients of Indian origin presenting at a younger age but also presented with more severe disease (9). Coronary angiogram is not routinely offered in younger patients due to normal coronary arteries being found in a significant number of patients .This is supported by a report of 129 patients less than 40 years who had coronary angiograms within 60 days of first acute myocardial infarction. Though this study had a limitation of a small cohort it concluded that coronary angiograms should be performed in patients with recurrent ischemia and multiple risk factors (10).

Control of risk factors is a major strategy in prevention of coronary artery disease in patients >35 years. It has been determined that risk factors are associated with extent and severity of atherosclerosis however whether this applies to younger population is still to be determined (11). The risk factor most associated with coronary artery disease in the young is smoking. Compared to nonsmokers the relative risk of developing coronary artery disease in the ages 35 to 44 is documented to be approximately three times higher (11). In a cohort of 108 patients under the age of 40 years smoking and dyslipidemia were the most prevalent risk factor occurring at 94.5% and 48% respectively (2). This was supported by a South African study of 245 patients under the age of 45 years where smoking was the most important risk factor at 54% followed by dyslipidemia at 26% (9).

There is a paucity of literature describing young patients undergoing coronary angiograms and where available it represents a small percentage of patients with coronary artery disease. The prevalence of normal coronary arteries, atherosclerotic coronary artery disease and nonatherosclerotic etiologies varies in different studies. A study of 60 patients under 35 years following first myocardial infarction triple vessel disease occurred in only 5% of patients with significant coronary artery disease occurring in 73.3%(12). In a study performed in the same center of 200 patients, 23.5% had normal coronaries. Majority of patients had single vessel disease at 32.5% with triple vessel disease occurring at 12.5% (13).

In another study by Glover et al., the prevalence of triple vessel disease was 42% with 78% having significant coronary artery disease in a cohort of 120 patients (14). In a comparison performed by Chen et al of patients younger than 45 years and those older than 60 years, younger patients had complex stenosis morphology but less extensive coronary artery disease with triple vessel disease occurring in 10% of young patients(15).

1.3 The Research Question

Is there an association between risk factor profile and angiographic severity in young patients <45 years presenting with acute myocardial infarctions?

2. AIMS AND OBJECTIVES

Aim:

To examine the association between risk factor profile and angiographic severity in young patients presenting with acute myocardial infarction and hence determine the need and/or timing of coronary angiogram in this specific population in a poor resourced environment.

Objectives:

- Describe the risk factor profile of young patients with acute myocardial infarctions
- Describe angiographic severity in this specific population
- Ascertain if an association exists between risk factor profile and angiographic severity
- Describe the major adverse cardiovascular events

3. METHODS

3.1 Study Design

This is a Quantitative Retrospective Observational study

3.2 Setting

Our study is based at RK Khan Hospital; A regional hospital in KwaZulu-Natal Province of South Africa. Information will be derived from a computerized database comprising patients admitted to the coronary care unit.

3.3 Participant Selection and Sampling Strategy

Inclusion Criteria

- All patients 45 years and younger
- Must have a confirmed diagnosis of Acute Myocardial Infarction based on universal definition
- Patients of all gender and race will be included
- When evaluating for severity, patients who have undergone percutaneous coronary angiogram will be included

3.4 Data Collection and Statistical Analysis

Please refer to the attached appendix for a detailed description of all variables that will be assessed in all participants.

- Patient anonymity will be maintained by using computer numbers for all patients included in the study

Ms Tanya Esterhuizen will be performing all statistical analyses.

Sample size and power:

- It is anticipated that approximately 200 records will meet inclusion criteria during the sampling period.
- The expected rate of events (defined as triple vessel disease cases) is 50% (Ranjith et al)
- This should result in approximately 100 events, which will allow a stable logistic regression model with up to 10 explanatory variables to be constructed.
- A sample size of 200 will yield a 95% confidence interval width of 6.2% around an estimate of 50% (ie 43.8% to 56.2%), which is deemed adequate precision.

Data analysis plan:

Data will be coded and captured in an Excel spreadsheet and imported into IBM SPSS version 24 for analysis. A p-value <0.05 will be considered statistically significant. The prevalence of each categorical risk factor and outcome will be reported as frequencies and percentages with 95% confidence intervals (CI). Continuous variables will be summarized using mean, standard deviation (SD) and range for normally distributed variables and median, interquartile range for non-normal variables. Associations between risk factors and outcomes will assessed firstly using univariate analyses. At the 0.1 level of significance, Pearson's chi-square tests will be used for categorical predictors, and one-way ANOVA will be used for continuous predictors. If multiple predictors are associated with the severity of disease on univariate analysis, multiple logistic regression analysis will be used to predict the odds of triple vessel disease whilst adjusting for confounders. A backward stepwise method of modelling will be used with entry and exit probabilities set at 0.1 and 0.05 respectively. Odds ratios (OR) and 95% confidence intervals will be reported.

4. ETHICAL CONSIDERATIONS

1. No patient names will be used

2. All patients will be allocated numbers for Identification

3. All patient files will be kept in a secure room with lock up draws

4. All electronic information will be encrypted with a password that will only be shared with supervisor and statistician when required

REFERENCES:

1. Lloyd-Jones DM, Larson MG, Beiser A, Levy D. Lifetime risk of developing coronary heart disease. The Lancet. 1999;353(9147):89-92.

2. Fournier J, Sanchez A, Quero J, Fernandez-Cortacero J, González-Barrero A. Myocardial infarction in men aged 40 years or less: A prospective clinical-angiographic study. Clinical cardiology. 1996;19(8):631-6.

3. Bhardwaj R, Kandoria A, Sharma R. Myocardial infarction in young adults-risk factors and pattern of coronary artery involvement. Nigerian medical journal: journal of the Nigeria Medical Association. 2014;55(1):44.

4. Choudhury L, Marsh JD. Myocardial infarction in young patients. The American journal of medicine. 1999;107(3):254-61.

5. Klein LW. Acute coronary syndromes in young patients with angiographically normal coronary arteries. American heart journal. 2006;152(4):607-10.

Appendix 2: The Guidelines for Authorship for the Journal selected for submission of the manuscript

SA HEART IS AN OFFICIAL JOURNAL OF THE SOUTH AFRICAN HEART ASSOCIATION AND APPEARS ON A QUARTERLY BASIS

2016 Volume 13 Number 4

sa heart

Instructions for authors

SA Heart publishes peer reviewed articles dealing with cardiovascular disease, including original research, topical reviews, state-of-the-art papers and viewpoints. Regular features include an ECG quiz, image in cardiology and local guidelines. Case reports are considered for publication only if the case or cases are truly unique, incorporates a relevant review of the literature and makes a contribution to improved future patient management.

Publication policy

Articles must be the original, unpublished work of the stated authors. Written permission from the author or copyright holder must be submitted with previously published material including text, figures or tables. Articles under consideration elsewhere or previously published (except as abstracts not exceeding 400 words) may not be submitted for publication in SA Heart. On acceptance transfer of copyright to the South African Heart Association will be required. No material published in SA Heart may be reproduced without written permission. Permission may be sought from the Editor (Email: afd@sun.ac.za).

Disclosures

Authors must declare all financial disclosures and conflicts of interest in the cover letter and on the title page of the manuscript.

Ethics

All studies must be in compliance with institutional and international regulations for human and animal studies such as the Helsinki declaration (2008) (http://www.wma.net/en/30publications/10policies/b3/17c.pdf) and the South African MRC ethics guidelines (http://www.sahealthinfo.org/ethics/index.htm). Human studies require ethics committee approval and informed consent which must be documented in your manuscript. Animal studies require ethics committee approval and must conform to international guidelines for animal research. Compliance with these requirements must be documented in your manuscript.

Content

1. Title page: It should contain the title of the manuscript, the names of all authors in the correct sequence, their academic status and affiliations. If there are more than 4 authors, the contribution of each must be substantiated in the cover sheet. The main author should include his/her name, address, phone, fax and email address.
2. Authors are solely responsible for the factual accuracy of their work.
3. Articles should be between 3 000 and 5 000 words in length.
4. A 200-word abstract should state the main conclusions and clinical relevance of the article.
5. All articles are to be in English.
6. Abbreviations and acronyms should be defined on first use and kept to a minimum.
7. Tables should carry Roman numeral, I, II etc., and figures Arabic numbers 1, 2 etc.
8. References should be numbered consecutively in the order that they are first mentioned in the text and listed at the end in numerical order of appearance. Identify references in the text by Arabic numerals in superscript after punctuation, e.g. …trial.[13]

The following format should be used for references:

Articles

Kaplan FS, August CS, Dalinka MK. Bone densitometry observation of osteoporosis in response to bone marrow transplantation. Clin Orthop 1993;294:73-8. (If there are more than six authors, list only the first three followed by et al.)

Chapter in a book

Young W. Neurophysiology of spinal cord injury. In: Errico TJ, Bauer RD, Waugh T (eds). Spinal Trauma. Philadelphia: JB Lippincott; 1991:377-94.

Online media

Norback JS, Lwellyn DC and Hardin JR (2001). Shoptalk 101. Integrating workplace communication into undergraduate engineering curricula [online]. Retrieved February 15, 2012: http://www.lionhrtpub.com/orms/orms-8-01/norback.html.

9. Articles are to be submitted by email. The text should be in MS Word. Pages should be numbered consecutively in the following order wherever possible: Title page, abstract, introduction, materials and methods, results, discussion, acknowledgements, tables and illustrations, references.
10. Where possible all figures, tables and photographs must also be submitted electronically. The illustrations, tables and graphs should not be imbedded in the text file, but should be provided as separate individual graphic files, and clearly identified. The figures should be saved as a 300 dpi jpeg file. Tables should be saved in a MS Word or PowerPoint document. If photographs are submitted, two sets of unmounted high quality black and white glossy prints should accompany the paper. Figures and photographs should be of high quality with all symbols, letters or numbers clear enough and large enough to remain legible after reduction to fit in a text column. Each figure and table must have a separate self-explanatory legend.
11. Remove all markings such as patient identification from images and radiographs before photographing.

Submission of manuscripts

Please submit the manuscript to the Editor (afd@sun.ac.za) and copy it to the Guest Editor (if applicable) and the secretary of the South African Heart Association (erika@saheart.org).

Appendix 3: Ethical approvals

Included hospital and provincial approvals as well as the BREC approval (or waiver if appropriate).

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

330 Langalibalele street
Private Bag X9051 PMB, 3200
Tel: 033 395 2805/3189/3123 Fax: 033 394 3782
Email: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:
Health Research & Knowledge Management (HKRM)

Reference: HRKM423/16
KZ_2016RP38_481

09 December 2016

Dear Dr M A Hlophe
(University of KwaZulu-Natal)

Subject: Approval of a Research Proposal

1. The research proposal titled **'Risk factor profile and angiographic severity in young patients (≤ 45yrs) with acute myocardial infarction admitted into a coronary care unit of a South African Regional Hospital'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at RK Khan Hospital.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Ms G Khumalo on 033-395 3189.

Yours Sincerely

[redacted]
Dr E Lutge
Chairperson, Health Research Committee
Date: 12/12/16

Fighting Disease, Fighting Poverty, Giving Hope

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

14 March 2017

Dr MA Hlophe (201502352)
Discipline of Medicine
School of Clinical Medicine
m.hlophe@yahoo.com

Dear Dr Hlophe

Title: Risk factor profile and angiographic severity in young patients (≤45 yrs) with acute myocardial infarction admitted into coronary care unit of a South African Regional Hospital.
Degree: MMed **BREC REF NO: BE541/16**

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 21 September 2016.

The study was provisionally approved pending appropriate responses to queries raised. Your response received on 08 March 2017 to BREC letter dated 20 October 2016 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given **full ethics approval** and may begin as from 14 March 2017.

This approval is valid for one year from **14 March 2017.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its next meeting taking place on **11 April 2017.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

[redacted]egweni
Chair: Biomedical Research Ethics Committee

cc supervisor: ranjith@lantic.co.za cc postgraduate administrator: konar@ukzn.ac.za

Appendix 4: Data collection tools (for example)

APPENDIX

STUDY DATA SHEET

PATIENT NUMBER:				
DEMOGRAPHIC CHARACTERISTICS				
AGE (years):				
Gender:	MALE	☐	FEMALE	☐
CLINICAL VARIABLES				
Waist Circumference (cm):				
Blood Pressure:	Systolic	☐	Diastolic	☐
Heart rate:				
Type of Infarct:	STEMI	☐	NSTEMI	☐
Site of Infarct:	Anterior	☐		
	Anterolateral	☐		
	Anteroseptal	☐		
	High Lateral	☐		
	Posterior	☐		
	Inferior	☐		
Heart Failure	yes	☐	no	☐
	Killip Classification:	Killip I	☐	
		Killip II	☐	
		Killip III	☐	
		Killip IV	☐	

ECHO FINDINGS:					
RISK PROFILE:					
	Hypertension				
	Diabetes				
	Smoking				
	Hypercholesterol aemia				
	Family history of Vascular Disorder				
	1. Premature CAD				
	2. Hypertension				
	3. Diabetes				
	4. CVA				
LABORATORY VARIABLES:					
NT-proNT-PROBNP:	Admission				
	Discharge (+- Day5)				
Troponin T	Admission:				
	24 Hours:				

	Discharge (+- Day5)	
Urea (mmol/L)		
Creatinine (µmol/L)		
Lipid Profile	Total cholesterol	
	Triglycerides	
	HDL	
	LDL	

IN-HOSPITAL & 30-DAY COMPLICATIONS

Recurrent MI	Yes		No	
Recurrence of Angina	Yes		No	
Heart Failure	Yes		No	
Atrial Fibrillation	Yes		No	
Ventricular Dysrhythmia	Yes		No	
Cardiogenic Shock	Yes		No	
Death	Yes		No	

CORONARY ANGIOGRAM

Single Vessel Disease	
Double Vessel Disease	
Triple Vessel Disease	

CARDIAC REVASCULARIZATION

PCI + Stent	
CABG	
Medical Management	

Appendix 5: Raw data (for example)