THE TREND OF INCREASING REDO CORONARY ARTERY BYPASS GRAFTING (CABG) IN ELDERLY MALE PATIENTS: AN ANALYTICAL LITERATURE REVIEW

ABSTRACT

Cardiovascular diseases pose a great risk to the health of individuals worldwide. These diseases are seen to be increasing in both their incidence and prevalence, mainly in middle-aged people. Although younger individuals are also not completely spared by these diseases, different types of cardiovascular diseases are seen to prevail in different age groups. Cardiovascular diseases are also an important contributor to the world's mortality and morbidity. Despite the advancements in medical science and technology, there are still some cardiovascular diseases that cannot be cured or treated definitely and completely to ensure the good health status of the patient. In some cases, even if the patient is declared symptom-free, there still remains a risk factor for them to develop the same or an even more exacerbated form of the disease at one or another point in their lifetime. From these observations, it is evident that it is not only the age group or gender that makes a person susceptible to developing cardiovascular diseases, but also the presence and prevalence of several other underlying factors that contribute to these causes in some way or the other.

Amongst the many leading treatment options for coronary artery disease, a major cardiovascular health risk, Coronary artery bypass grafting (CABG),is considered to be the definitive treatment option. CABG is also popularly referred to as bypass surgery, and it is a procedure that is done to improve blood flow toward the heart. A CABG surgery is advised when the blood flow to the heart is compromised or reduced. Therefore, bypass surgery is considered to be the definitive

treatment plan for all such patients. Bypass surgery is an invasive and complicated surgery, and many risks are associated with it. Sometimes, if the surgery does not go well, or reportedly there is another blockage within the artery after some time of the initial surgery or an occlusion within the 'graft'. In such cases, it becomes necessary to perform a 're-do' surgery to help get rid of the problem at hand.

This review deals with the incidence of re-do bypass graft surgery which has occurred over the years in male patients. This review will deal with the causes, rates of occurrence, and the possible factors that forced the need for a re-do surgery in all these patients. It will also work to explore the complications that make a re-do surgery take place as the only option for saving the life of the patient.

Keywords: cardiovascular disease, Coronary artery bypass grafting, myocardial infarction, re-do surgery

INTRODUCTION

The coronary arteries are important arteries that occur in relation to the heart and the circulatory system of a human being's body. The main function of these coronary arteries is to supply blood to the heart. There are both right and left coronary arteries present in relation to the heart, they could be seen diligently performing their function of transporting blood effectively and efficiently towards the heart.(1)

However, sometimes, there could be a limitation of blood flow through either of these arteries, which ultimately results in limiting the blood flow to the heart. When this happens, the myocardium is bound to malfunction in a series of events that follow, and all of this is collectively termed 'coronary artery disease'.(2) Although there are many causative factors that lead to the development of this arterial disease, however, atherosclerosis is considered to be the

leading factor in the pathogenesis of coronary artery disease. Congenital disorders are also another cause behind the occurrence of this disease in adulthood. Depending on the right or left artery involved, different regions and sites of the heart could be involved, thus giving rise to different symptoms as well.(3) In people who are at risk of developing conditions, usually a routine EKG, CT angiogram, and echocardiogram are advised to be done at regular intervals. This helps monitor the risk and check whether the risk has elevated or remained constant over time.(4)

In cases where the risk has elevated or gotten worse over time, the risk of developing a heart attack increases in the patient. If the patient is also suffering from some other co-morbid disease or has any other underlying pathology, then the risk of developing myocardial infarction is multiplied by many folds.(5)

However, when it comes to treating this condition, there are many treatment options available. Out of all these options, the priority is to select the one option that is essential for saving the life and improving the prognosis of a patient, provided that they are already at a higher risk of developing further complications as a result of this myocardial infection.(6)

In a modern and advanced world like ours, for managing coronary artery disease that necessitates medical intervention, there exist two primary approaches: PCI (percutaneous coronary intervention) or bypass grafting. Within the intricate anatomy of the heart, the coronary arteries originate as two main branches - left and right, either of them emerging from the sinuses of Valsalva.(7) These arteries embark on different pathways along the heart's surfaces, as has already been established above. It is seen that the left coronary artery often splits into the left anterior descending and circumflex arteries. Meanwhile, the right artery continues its path along the heart's right border, culminating as a posterior descending artery in roughly half of the

population.(8)This unique configuration holds significance, particularly in cases of subsequent surgeries, where distinct myocardial regions susceptible to ischemic damage must be identified. Since this review deals with only CABG surgery, our topic of discussion would remain within this span.

It is a well-known fact that CABG Surgery emerges as a significant and intricate procedure, which is mainly focused on re-establishing the normal blood flow within the blocked or obstructed coronary arteries of the heart. CABG Surgery has been around for a long time now, and it is needless to say that as successful and helpful as it has been in treating patients with coronary artery disease, it also has its complications and after-effects that often make it a longer than expected process.(9)

The CABG surgery revolves around making the use of arterial or venous conduits to re-establish connections with the obstructed or blocked pathways. These re-established pathways ensure that the vital flow of blood to the myocardium suffering from ischemia is started once again.(10) Once this has been achieved, the heart's functioning is seen to improve, and simultaneously, all the symptoms that initially were present in the patient start resolving one by one. Nearly 500,000 CABGsurgeries are carried out annually, thus qualifying as being the most commonly performed elective surgeries.(11)

Even after the introduction of newer and more modern techniques like Percutaneous Coronary Intervention (PCI), there are still many people and even cardiologists who prefer going over the traditional CABG method, while the reality still exists that the rate of CABG surgeries is decreasing because of the newer modalities slowly gaining popularity and also becoming the treatments of choice because of their lower invasiveness.(12)

From a very broad perspective, it is seen that there are two basic types of Coronary Artery Bypass Graft procedures that are widely used in the world today - one is an on-pump procedure while the other is an off-pump procedure.(13)

The main difference between either of these methods is the usage of a cardiopulmonary circuit and a temporarily arrested heart in the on-pump method. This technique greatly influences the manner in which the rest of the surgery is carried out. As far as the option for the bypass grafts is concerned, the two most commonly used conduit arteries are either the left internal mammary artery (LIMA), which is harvested from the thoracic cavity, or the saphenous vein grafts (SVG), which is harvested from the lower limb.(14)

However, over the past few years, there have also been variations in the selection of these artery grafts, and the right internal mammary artery (RIMA), radial artery, and gastroepiploic artery are seen to be potential candidates for performing this procedure.

Typically, the left internal mammary artery finds its purpose in grafting to the left anterior descending (LAD) artery, while the assortment of other conduits serves the purpose of reestablishing blood flow to the remaining blocked arteries.(15)

THE INCREASING INCIDENCE OF RE-DO CORONARY ARTERY BYPASS GRAFTS IN ELDERLY MALES

It has already been seen that the CABG procedure is not exactly an easy-to-perform procedure. It has its sets of complications, risk factors, and increased rates of patient compliance that make it a questionable procedure to be performed in all. It is also because of reasons like these that this procedure is reserved only for those patients for whom medicinal treatment can no longer provide comfort or resolution of symptoms. Moreover, it is also being seen that the trend of

CABG surgery is slowly declining over time as newer and more advanced modalities are being introduced to the world.

However, one aspect of the CABG surgery is the re-operation risk that is associated with it. In patients who have been given the CABG procedure as a final resort to their coronary artery disease, follow-up is very necessary to see whether the patient is recovering well after their surgery or not.(16)

This re-operation or re-do CABG procedure is indeed a challenging task for both the patients and their cardiac surgeons. The main reason associated with it is the mental willingness and preparedness of the patient, who might not exactly be willing to go through the same procedure once again. It is evident that when patients are aware of the risks and complications associated with a particular procedure, they are less likely to affirm getting the same done and that too, more than once in a row.(17)

Redo CABG, which is both a delicate, complex, and intricate operation comes into play when individuals who have previously undergone CABG find themselves in the midst of either the recurrence of their coronary artery disease with the same intensity or worse, or when there is any occlusion present within the graft that was introduced in the patient's body. Whatever the circumstances are, it then becomes the need of the time to urgently revascularize the patient with immediate effect.(18)

However, just because the re-do operation is an urgent need does not make it an easy-to-perform procedure. It is seen to have even more complications and risks associated with it than its initial surgery. It is usually seen that the technical aspects of the re-do surgery are notably more complex, thereby demanding an expert surgeon's utmost skill and precision. One significant obstacle is the limited availability of available conduits, which are considered to be the vital

pathways used to reroute blood flow around blocked arteries. These conduits are often in short supply during redo CABG, making the surgeon's job even more demanding.(19)

Adding more to the complexity, patients requiring redo CABG are frequently in poorer health than those undergoing their first coronary bypass. This is quite an expected outcome as well since the re-do mostly has to take place when the patients are already immunocompromised and complicated state of health. It is evident since their bodies have endured the toll of multiple surgeries and the relentless progression of coronary artery disease. As a result, the surgical team must navigate through a delicate and intricate landscape to achieve success.(20)

Despite these formidable challenges, the field of cardiac surgery has developed a range of operative strategies and techniques to mitigate the potential adverse outcomes associated with redo CABG. Through innovation and dedication, medical professionals strive to provide these patients with a renewed chance at a healthier life, conquering the intricate obstacles that lie in their path to recovery.(21)

Regarding the incidence and relevance of cases that require a re-do revascularization surgery to be done, a study was carried out by the Society of Thoracic Surgeons (STS). In this study, a total of about 720,000 individuals were selected. All these patients were in their Middle ages, with the mean age being 65 years and above. All these patients had undergone CABG between 2001 and 2007. The study tracked their journey over the years, revealing some compelling insights. Over this period, the study disclosed cumulative incidences of repeat revascularization, marking moments at 1, 5, 10, and 18 years post-surgery. (22)

These statistics revealed that at the one-year mark, 2% of the patients required repeat revascularization, a figure that gradually increased to 7% at five years, 13% at a decade, and eventually plateaued at 16% after 18 years. Interestingly, the majority of these revascularization

procedures took the form of percutaneous coronary interventions (PCI), underscoring the importance of less invasive approaches in addressing recurrent coronary issues. Notably, the prevalence of redo CABG was remarkably lower beyond this point forth, and amounted for about 0.1% within a year, 0.6% in five years, 1.3% in a decade, and 1.7% after 18 years.(23)

Delving deeper into the data, certain factors emerged as influential determinants of the likelihood of revascularization. Patients, who presented those with more severe disease conditions, individuals undergoing preoperative dialysis, and those who had partial revascularization initially, were found to have a higher chance of undergoing revascularization. Similarly, advanced age, smoking, and other heart-related comorbidities were associated with a lower likelihood of requiring repeat revascularization.(24)

Furthermore, the extent of arterial grafting performed during the primary CABG operation demonstrated a noteworthy impact on the need for subsequent coronary reintervention. Increasing the number of arterial grafts during the initial procedure appeared to decrease the likelihood of requiring further revascularization, pointing to the critical role of surgical technique in long-term outcomes.

In essence, this STS study not only offers a comprehensive glimpse into the journey of older patients who undergo CABG but also underscores the importance of patient characteristics, surgical choices, and less invasive procedures in shaping the trajectory of their cardiac health over time.

Therefore, in light of these observations, it was easier to say that those in need of CABG carry with them a unique set of characteristics and challenges, setting them apart from those undergoing primary CABG procedures. This makes it easier for them to be selected on the basis

of their underlying health conditions and factors, thus making the choice for their selection for surgery much easier and less complicated.(25)

Among these patients, the first and foremost ones are the patients who find themselves requiring redo CABG tend to be in the later stages of life, their years marked by the accumulation of comorbidities. These particular individuals bear a heavier burden of coronary atherosclerosis, a condition where the arteries supplying blood to the heart become progressively narrowed by the buildup of fatty deposits.(26)

Alongside this, their ventricular function, the ability of their heart to pump blood effectively, is often compromised, further complicating their medical picture. This stark contrast to those undergoing primary CABG highlights the critical nature of the surgery they face. These complications are often the presenting side of the symptoms that coax the need for a revascularization surgery to be done effectively and with immediate effect in the most severe of all cases.

Notably, on a national scale, the risk profile of patients seeking cardiac intervention has shown a worrisome trend over time. Increasingly, individuals present with critical conditions like myocardial infarction (heart attack) and heart failure, necessitating urgent or even emergency surgery. These emergencies leave little room for pre-planning and often require immediate action to save lives. Furthermore, these patients exhibit a higher prevalence of a wide array of comorbidities, including stroke, liver disease, and kidney disease, hyperglycemia, and blood pressure. These additional health challenges further complicate the already intricate landscape of redoing CABG.(27)

In essence, the population of patients in need of redo CABG represents a group burdened by the weight of age, the complexity of their medical conditions, and the urgency of their cardiac needs.

Their journey underscores the evolving nature of cardiac surgery and the pressing need for effective interventions to address the changing landscape of cardiovascular health.

PATIENT INDICATIONS FOR ELEVATED RE-DO CABG INCIDENCES AMONG THE MALE POPULATION

Since males are the most heavily populated gender among the various cardiovascular diseases, it was only reasonable to select them as the target population for this study. It has also been noted that male patients, who have either had a family history of cardiovascular diseases or have just recently gotten at risk of developing myocardial infarction due to any other related health risk.

In light of these factors, it becomes both easy and complicated for doctors to develop indications regarding which patient to select for further evaluation and study over the other. Consequently, there are also several key considerations when it comes to redoing CABG:

Patient Selection:

Patients who have issues with their Left Anterior Descending (LAD) arteryare seen to benefit the most from redo CABG. This is especially true when a particular type of artery called the Left Internal Thoracic Artery (LITA) is available and the lower part of the LAD artery can be surgically improved. However, it is also essential to note that redoing CABG might not improve survival for patients who already have a good LITA-to-LAD artery connection but have problems in other areas of their hearts. (28)

Ruling this out is important at several levels, but the most important one is to check whether the remainder of the heart is being supplied by any or part of this Left Anterior Descending (LAD) Artery.

This could be done by performing nuclear imaging on the patient, which then helps in deciding the outcome for the patient accordingly.

Preoperative Testing:

Along with the standard tests that primary CABG patients undergo as a part of their preoperative protocol, it is crucial to perform some extra tests before redoing CABG. These tests have significant value in the context of a re-do CABG surgery, mainly because it helps assess several factors that could be of help in evaluating the health and risk status of a patient. (29)

For instance, it is important to test the quality and availability of the blood vessels or the conduits that will be used during the surgery.

Moreover, it is also important for doctors to use diagnostic coronary angiography to examine the internal thoracic arteries to ensure that they are in good shape and not damaged from previous surgeries.

Vein Mapping:

For a patient to undergo re-do CABG surgery, it is very important that the patency and functioning of the veins are also assessed before taking any step forward.

For doing this, and also for determining the suitability of veins from the legs - both the greater and lesser saphenous veins for grafting, cardiologists often employ a popular technique called ultrasonographic vein mapping. (30)

This step is of particular importance when previous surgeries have used endoscopic vein harvesting, as it could be very challenging to estimate how much viable vein is left to be used for grafting purposes.

In addition to this, tests like the Allen test or more advanced non-invasive assessments could help decide whether radial arteries from the wrist can be utilized. However, recent advancements in the equipment used for diagnostic coronary angiography can make it unsafe to use the radial

artery. Therefore, it is better to reserve the use of the radial artery only under extreme conditions or when it is necessary to harvest this artery in place of the other ones.

Computed Tomographic Angiography (CTA):

Before opting for any re-do CABG surgery, it is recommended practice to opt for computed tomographic angiography (CTA) using a multidetector routinely. The purpose of using this computed angiography test is to determine and identify any potential high-risk situations, calcification of the ascending aorta (if present), and pseudoaneurysms.(31)

By identifying these issues, that could arise as exacerbated health conditions, doctors can adopt preventive surgical strategies to enhance the safety factors and improve outcomes.

If a patient's kidney function allows, contrast dye is administered to improve the clarity of vascular imaging.

Coronary Angiogram:

Performing a comprehensive and well-executed coronary angiogram is of utmost importance. This procedure helps identify any potential target areas that might not be receiving enough blood flow or could be completely missed, in not done professionally.

Antithrombotic Therapy Assessment:

Special attention is given to assessing the antithrombotic and blood-thinning therapies that patients might be receiving before surgery. Doctors carefully evaluate whether it is safe to stop these medications or if they should be temporarily replaced with other treatments to reduce the risk of blood clots.(32)

REDUCING THE RISK OF RE-DO CABG SURGERY IN MALE PATIENTS

Even after assuring and taking maximum care of the patient in both the pre- and post-operative duration, there is still a chance of complications to take place.

In the pre-operative phase, it might be possible for the patients to develop complications or problems during the surgical phase, which would immediately lead to the development of complications and even the incidence of re-do surgery. However, in the re-do phase of the surgery, these complications might create hindrances in the operative procedure, thus making it difficult for the surgeons to effectively and smoothly carry out the surgery.(33)

Therefore, it is expected that by taking proper care of the patient and optimizing them to the extent that there is no room for any errors or any inevitable or unmanageable complications left to arise in the patient.

A few measures that could be taken to make this experience a better one for the patient include the following steps:

Optimization Of Medical Therapy:

It is seen that the aggressive management of risk factors and optimal medical therapy can help slow the progression of coronary artery disease (CAD) and reduce the need for revascularization procedures like CABG.

This includes controlling high blood pressure, managing diabetes, and aggressively managing cholesterol levels. Such targeted therapies should be started at their optimal dosages which would help reduce the patient's risk of developing further complications.

Lifestyle Modification:

Encouraging the patients to adopt a heart-healthy lifestyle. This includes regular exercise, a heart-healthy diet, smoking cessation, and weight management. These lifestyle changes can help slow the progression of CAD.

This step is of vital importance in patients who have already undergone CABG surgery. Since these patients are already at risk of developing further complications, it is better if all these complications are avoided by taking care of the patient's health from all aspects.

Medications:

It must be ensured that patients are on appropriate medications to manage their CAD. This may include antiplatelet agents, such as aspirin or clopidogrel, beta-blockers, statins, and angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs).

Taking these medications could easily help optimize the health status of a patient. Patients with CAD should have regular follow-up appointments with their healthcare providers to monitor their condition and adjust medications as needed.

Medical Compliance:

Ensure that patients are compliant with their medications and lifestyle modifications. Non-compliance can lead to disease progression and the need for revascularization. This could be done by providing patients with education and counseling on the importance of adhering to their treatment plan and making healthy lifestyle choices.

Patients should be monitored closely for signs of recurrent symptoms or progression of coronary artery disease. Early detection and intervention can prevent the need for re-doing CABG.

CONCLUSION

Coronary Artery Disease (CAD) is a chronic, progressive condition that affects the coronary arteries of the heart. In this condition, the patient is unable to lead a normal life because of the

increased burden on their heart. The heart receives reduced blood flow, which causes ischemia and a risk of developing myocardial infarction. However, with appropriate treatment and management, all these could be avoided within the right time.

A CABGsurgery is recommended for people with CAD. This surgery has its set of complications and often, there might also be a need for a re-do of this surgery or a revascularization when the initial surgery does not go as well as planned.

However, it is best that the re-do is not planned, in the context that the CABG surgery proceeds smoothly and without any complications. For this, it is recommended to encourage a multidisciplinary approach to the management of CAD, involving cardiologists, cardiac surgeons, and other healthcare professionals to determine the most appropriate treatment plan for each patient.

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