WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 12, Issue 7, 234-245. Review Article ISSN 2277– 7105

AA REVIEW ON PERCUTANEOUS TRANSLUMININAL CORONARY ANGIOPLASTY (PTCA) VERSES CORONARY ARTERY BYPASS (CABG) IN CORONARY ARTERY DISEASE (CAD) AND MYOCARDIAL INFRACTION (MI)

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Article Received on
08 March 2023,

Revised on 29 March 2023,
Accepted on 19 April 2023

DOI: 10.20959/wjpr20237-27951

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ABSTRACT

Coronary artery disease is the narrowing or blockage of coronary arteries, usually caused by atherosclerosis or any obstruction in the arteries by plaque formation in the heart valves. CAD is thought to begin with damage or injury to the inner layer of a coronary artery. In India a study conducted[27] in 2016, CVDs were responsible for 28.1% of all fatalities and 14.1% of all DALYs, up from 15.2% and 6.9%, respectively, in 1990. The prevalence of myocardial infarction (MI) is now greatest in India. With 261,694 fatalities from hypertensive heart disease in 2013 (an increase of 138% from 1990), this CVD is among India's major health issues. Compared to other ethnic groups, Indians are 2-4 times more likely to be hospitalized for CAD complications, and admission rates are 5–10 times higher for populations under 40 years Diabetics have a CAD prevalence of 21.4%, whereas non -diabetics have a prevalence of 11%. Risk factors for higher prevalence of CAD in Indians include hypertension, diabetes mellitus, dyslipidaemia, smoking, and obesity. These heart conditions, such as CAD and MI, are brought on by plaque build-up along the inner walls of coronary arteries, atherosclerosis, heart valve rupture, smoking, family history, and lifestyle

changes. This results in symptoms of reduced blood and oxygen flow to the heart, which can include chest pain, shortness of breath, abnormal ECG readings, and occasionally life-threatening issues. These conditions are treated initially by non-invasive treatment like use of Antiplatelet, Calcium channel blockers, and Nitrates if these symptoms are not subsided by drugs then the invasive treatments like CABG and PTCA are done. CABG is an open heart surgery suggested to patients based on the symptoms, its shows grater recovery results where it is an expensive surgery, longer hospital stay, and recovery rate takes time, may show further complications, so these procedure is not be acceptable by all patients. Whereas PTCA is an inexpensive process, shorter stay, quick recovery, less complications compared to CABG. But based on the symptoms, preference and willingness of the patients the type of surgery is preferred by the physician.

KEYWORDS: PTCA (percutaneous transluminal coronary angioplasty), CABG (coronary artery bypass grafting), CAD (coronary artery disease), MI (myocardial infraction), MVD (multivessel disease).

INTRODUCTION CAD is most common heart disease that caused due to build-up of plaques in the coronary artery causes the same effect as coronary artery disease. CAD is thought to begin with damage or injury to the inner layer of a coronary artery. The plaque is carried on by arteries narrowing and blood flow becomes blocked, which in turn will cause heart valves to get blocked. Symptoms of fatigue, breathlessness, and particularly chest pain. ECG variations can be used to diagnose CAD, here the non-invasive treatments are given if the symptoms are not subsided then invasive methods are used, PTCA and CABG are effective in treating the coronary artery disease.

Myocardial Infraction, often known as a heart attack, is a condition when the heart's blood flow is limited. The prevalence of myocardial infarction (MI) is now greatest in India. This condition is frequently brought on by atherosclerosis, trauma, or plaque formation. Angina, which manifests as chest discomfort that radiates to the shoulders, arms, back, neck, jaw, and teeth, fatigue, shortness of breath, anorexia, heartburn, and nausea, is not only brought on by blockage but also by coronary artery spasm, spontaneous coronary artery dissection, and some infections.

PTCA: (percutaneous transluminal coronary angioplasty) it is also called as percutaneous coronary intervention.

CABG: (coronary artery bypass grafting) is a procedure to treat coronary artery disease.

ANATOMY AND PHYSIOLOGY: The[32] primary pathways that transport blood to the heart are recognized as the left and right coronary arteries. The left coronary artery (LCA) is further categorized into the left anterior descending (LAD) and left circumflex artery (LCX). The LCA is accountable for providing blood to the left ventricle of the heart. The right coronary artery (RCA) is also subdivided into the right posterior descending (PDA) and poster lateral (PL) branches. The RCA's function is to supply blood to the ventricles, right atrium, and Sino atrial node (SV). Since the coronary arteries are end –arteries that deliver blood to the myocardium, an obstruction can have severe adverse effects. The accumulation of plaque inside the coronary arteries causes' coronary artery disease, which can narrow and obstruct the blood flow to the myocardium.

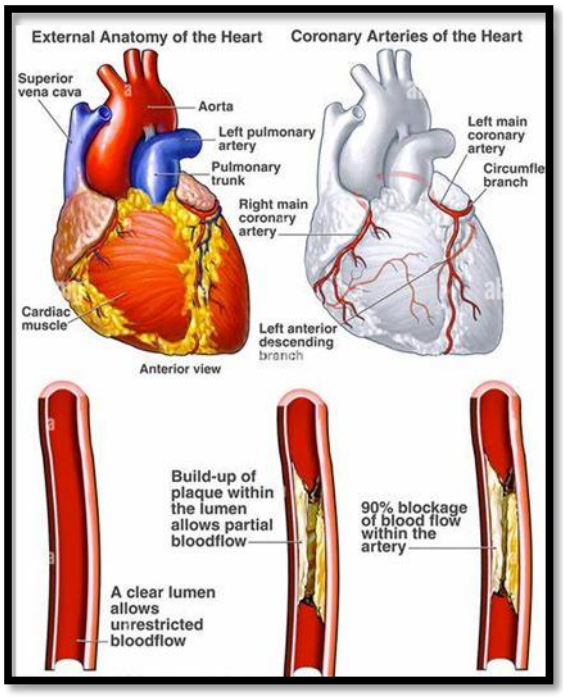

Fig (1)[28] Saneera- Kulathilake at all.

Plaque formation: These blocks develop in CAD and MI for a variety of reasons, including fatty deposition, blood cholesterol levels, smoking, obesity, hypertension, and diabetes. Medical management for these symptoms includes anticoagulants, beta blockers, anti-angina medications, statins, ACE inhibitors, calcium channel blockers, and surgical procedures like PTCA and CABG.

TYPE OF ARTERIES[4]

1) Right coronary artery (RCA)
2) Left artery, the main artery (LM)
3) Left anterior descending artery (LAD)
4) Left coronary artery (LCA)

TYPES OF BLOCKS[4]

a. Simple lesion

b. Complex lesion

c. Intermediate lesion

NUMBER OF BLOCKS[4]

1. Single vessel disease (SVD)
2. Double vessel lesion (DVD)
3. Triple vessel disease (TVD)
4. Left main disease or LM disease

PTCA

PCTA[19] was originally created by Andreas Gruentzig in 1977 and was first executed in Zurich, Switzerland. In the mid-1980s, numerous distinguished institutions worldwide began utilizing this procedure to treat coronary artery disease. PTCA is a fundamental procedure that serves as the foundation for many other intracoronary interventions. It is a prevalent procedure in the United States, accounting for 3.6% of all operating room procedures conducted in 2011.

PROCEDURE

PTCA is a medical procedure aimed at unblocking the narrowed coronary artery and restoring proper blood flow to the heart muscle. First, the patient is diagnosed with blocked arteries using ECG and Angiogram tests, and then they are provided with thorough counselling regarding the PTCA process. The surgery is performed with the patient under anaesthesia, which numbs the groin area. A needle is inserted into the femoral artery, and then replaced with an introducer, followed by a thinner wire. The doctor will then pass a diagnostic catheter over the new wire, through the introducer, and into the artery, after which the guide wire is removed. The thinner wire is then guided across the blockage, where a balloon catheter is inserted and guided to the blocked site. The balloon is then compressed

against the blocked wall to widen the space, and this process is repeated by the doctor wherever the artery is narrowed. Once the compression is complete, a dye is injected and an X-ray is taken to check for any changes. If everything is well, the catheter is removed, and the surgery is completed.

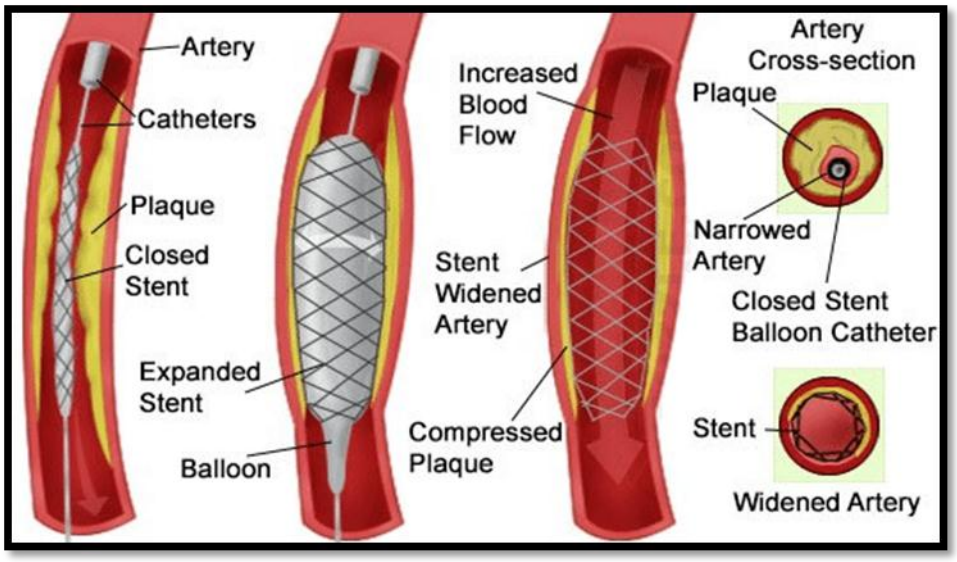

Fig (2)[29] Hemantha Kulathilake at all.

CABG

This[3] is a surgical process performed by a cardiologist during emergency situations to address obstructions in the heart's walls. The approach taken is determined by factors such as the number and type of blockages, as well as the patient's preference, and is intended to facilitate blood flow around the affected artery. Anaesthesia is used, and the heart is opened, which may require cutting through the breastbone. Healthy vessels from the chest or leg are utilized to bypass the blocked artery. While CABG does not provide a complete cure for the obstructions, it alleviates chest discomfort and breathing difficulties.

PTCA PREFERED IN[24]

- Patients who have single vessel disease SVD, double vessel disease DVD based on number of blocks in the heart
- Advised in patients with left artery (LM), left anterior descending artery (LAD), left coronary artery (LCA)
- With simple lesion
- Patients having more comorbid conditions
- Patient preference

CABG PREFERED IN[24]

- Patients who have triple vessel disease (TVD), left main disease (LM) based on the blocks in the heart
- With complex and intermediate lesion
- Patients with Ostia disease
- History of PTCA failure
- Patient preference

DISCUSSIONS

STUDY 1

According to David j. Malenka, at all an RCT was conducted in January 1997to compare the effectiveness of CABG and PTCA inpatients with multivessel coronary artery disease, with 1892 patients with angiographically documented multivessel CAD and clinically severe angina or objective evidence of ischemia that requires revascularization who are suitable candidates for CABG and PTCA. overall vital status for 1792 people were determined (98%). CABG were allocated to 914 patients, while PTCA was allocated 915 the results included mortality, cumulative survival, myocardial infraction (MI) and subsequent revascularization, including 1796 patients receiving treatment in 98% of cases in this trail, hospital mortality was 1.3% vs. 1.1 % (p= 0.67), while hospital stroke was 0.8% vs. 0.2% (P=0.67). (P=0.09) were comparable across CABG and PTCA grafts. those allocated to CABG were more likely than patients assigned to PTCA to experience an in hospital Q wave MI (4.6% vs. 2.1p=0.01) no difference existed between CABG and PTCA groups in 5 years mortality rate (12.1%vs 4.3% p=0.19), 5 years cumulative survival rate 89.3% vs. 86.3% CI for 3%absolute difference -0.29 to 6.0% p=0.19) the rate of survival free of Q –wave MI (80.4% vs. 78.7%,CI for the 1.65 absolute difference -2.2% to 5.4% p=0.84) cumulative rate of Q- wave MI(11.7% vs. 10.9%, p=0.45) at 5 years, 8% of CABG patients experienced recurrent revascularization compared to 2% of non CABG patients (p=0.001) of those assigned to PTCA. patients with diabetes who underwent CABG had a better 5 years survival rate than those who underwent PTCA (80.6% vs 65.5%, CI for the 15.1% absolute difference 1.4% to 28.9% p=0.003).in conclusion, mortality rates were comparable among patients with multivessel coronary artery disease who were allocated to either CABG or a prior PTCA approach. Some who received PTCA, on the other hand, were more probably to need recurrent CABG. CABG enhanced diabetic patients' survival.

STUDY 2

According to mark *DB, Nelson CL* at all a study conducted, in that scanned patients were(17, 309), patients enrolled (9,263), mean patient age (50 – 69), female (25) mean follow up 5 years. The inclusion criteria were satisfied by participants who were referred to the Duke Heart Canter for a first cardiac catheterization to investigate suspected ischemic heart disease.75% left main stenosis; no significant (75% diameter stenosis) stenosis in at least one major epicardial coronary segment; Previous PTCA or CABG, 3plus or 4plus ischemic mitral regurgitation, primary valvular, congenital, or non-oischemic cardiomyopathy condition, in addition to prior PTCA or CABG.

After catheterization, patients were tracked in the Duke Cardiovascular Disease Data Base for six months, a year, and subsequently yearly.

STUDY 3

According to *Benedetto u,* at all a study conducted on total of 9,263 persons participated in the survey, with 97% of them surviving. In single vessel disease, PTCA had a greater ejection percentage and a higher prevalence of MI, whereas CABG has a more severe disease and a lower ejection fraction (SVD) in two vascular disease (TVD), 91% of PTCA, 93% CABG, 94% MEDICINE, and 86% of medication in that 260 individuals received just PTCA. CABG was superior for 95% proximal left anterior descending (LAD) lesion and another diseased vessel and three vessel disease, PTCA has lower mortality than CABG, CABG and PTCA were similar in severe single vessel disease > 95% proximal LAD and two vessel disease, CABG superior in two vessel disease and three vessel disease, and PTCA superior in two vessel disease and three vessel disease, and PTCA superior in two vessel disease and three vessel disease.

STUDY 4

According to CARDA 2010 UK. RCT were 11.0% PCI, 7.9 BG longer fall of 4.6 years SYNTAX TRAIL: PCI was 17.8% higher and CABG was 12.4 % higher based on 12 month serious adverse cardiac events performed in 1800 patients repeat revascularization reduced PCI 113.5% and CABG 5.9%. Based on comorbidity, mortality, myocardial infraction, stroke and revascularization 11.3% for CABG and 19.3% for PCI at 1 year among 19000 people with diabetes, a complex multivascular disease, 26.6% of patients in the PCI group vs. 18.7 % in the CABG group experienced relative worsening at 5 years including death, all – cause,

non fata –MI, non-fatal stroke.Stroke is more common in the CABG cohort, death and MI are higher is PCI cohort, and CABG shows greater benefit than PCI in diabetic patients.

STUDY 5: META ANALYSIS

According to *Benedetto u*,at all randomised controlled study using PCI and drug study random control trails in 4,563 patients with multi vessel disease with PCI and with drug eluting stent (DES) increased relative risk of repeative revascurization of late mortality increased 51% and myocardial infraction increased 102% compared to CABG.CABG has hampered by 29% risk of stroke was minimal when compared with absolute risk reduction in mortality and myocardial infarction in 100 patients comparisons of DEC-PCI placing CABG, 3-4 death' 4-5 myocardial infraction, 8-9 revascularization follow up 3.4 years subgroup analysis suggests CABG improve survival and mini two risk of myocardial infarction. CABG is relevant to two and three vessel disease proximal left descending artery disease and for PCI three vessel disease. G-eluting stents (DES) in 4563 patients with multivascular disease found the relative risk of repeat revascularization for late mortality compared with CABG. Increased by 51% and myocardial infarction by 102%. CABG reduced stroke risk by 29%, which was minimal compared to the absolute risk reduction for mortality and myocardial infarction. In the 100 patients comparing DEC-PCI with CABG placement, 3-4 deaths, 4-5 myocardial infarction and 8-9 revascularization followed 3.4 year subgroup analysis suggest that CABG improves survival and minimizes the risk of myocardial infarction. CABG is associated with bi- and tri-vessel disease of the proximal left descending artery and PCI tri-vessel disease.

STUDY 6

According to the RCT *Sipan College*, their meta-analysis shows a significant reduction in total mortality, MI and revascularization with repeat CABG compared to PCI the conclusion suggest that CABG is the best treatment option compared to PCI for patients with multi vessel disease. In a 1 year RCT study of unprotected LM disease, one year PCI was associated with a higher rate of target vascularization, a lower incidence of stroke, and no difference in MI death compared with CABG. a 5 year PCI is associated with higher mortality and myocardial infraction rate.

STUDY 7

According to a *Hakan akay*, at all random control trails using one or more arterial grafts in 90% and 0ne or more stents in 70% of muti vessel diseases.6 RCTS conducted in 6055

patients, median follow up 4.1 years CABG signifintally reduced overall mortality compared to PCI 0 % relative (RR) 0.73%, confidence interval (CI) 0.62-0, 86, buckle, is 0.001 with CABG. myocardial infraction also decreases relative risk (RR) is 0.58, CI is 0.21-0.41pandlt, 0.001 and at repeated revascularization is 75.6% RR 0.29, 95% CI 0.21- 0.41 pandlt, 0.01 with CABG.CABG is 24.9% RR and 36, 95% CI 0.99-1.86, p is 0.06, there was an excess trend for stroke, but these was not statistically significant for reductions in repeated revascularisations and MACCE, and also readuses long term deaths from all causes by 27% and MI by 42%.

CONCLUSION

This sort of research is critical in determining who should undergo which type of surgery. We concluded[30] that based on various types of studies, the physician's decision is based on the condition of the patients, who have multivessel diseases like CAD, MI, based on the ECG diagnosis, number of heart blocks, type of the block, comorbid conditions, age related factors, prior heart problems, prior surgeries like PTCA, CABG, mortality, morbidity, diabetes, revascularization, recovery period, hospital stay, patient wiliness PTCA has a quicker recovery rate than CABG but requires a longer follow-up period. CABG[4] is an open heart surgery that will benefit triple vessel disease patients based on their concomitant diseases. The recovery rate in CABG is high, however it is linked with more adverse effects. PTCA was less expensive than CABG depending on patient desire. Further research is being conducted based on these conditions. At the beginning, PTCA is preferable; nevertheless, the procedure cannot be chosen solely on benefits and cannot be compared to determine which is best. The sole decision is dependent on the patient's condition and preference, and the physician will follow the approach that is most beneficial to the patient.

ACKNOWLDEGEMENTS

We authors convey our heartfelt gratitude to the management of Vijaya Institute of Pharmaceutical Sciences for women for providing the necessary support and our sincere thanks to our guide for skilfully guiding us, constantly encouraging us, patiently correcting our drafts and thereby helping us in the due course of this review.

Conflicts of interest

The authors confirms that this article’s conflict has no conflict of interest.

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