Student's Journal of Health Research Africa
Vol. 4 No. 9 (2023): September 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i9.659
Original article

A NARRATIVE REVIEW OF POST-CORONARY ARTERY BYPASS GRAFT MYOCARDIAL ISCHEMIA AND INFARCTION.

B B Bharti*
Ford Hospital, Bihar, Patna, India.

Abstract:

Patients with obstructive coronary artery disease are advised to undergo coronary artery bypass graft (CABG) surgery to enhance survival and quality of life. Patients receive arterial and venous implants to enhance coronary blood flow. There are factors that can cause periprocedural myocardial necrosis and factors that can cause late recurrent angina following CABG. In this article, an endeavour is made to examine these particulars.

Keywords: Obstructive coronary artery disease, artery bypass graft, myocardial ischemia and infarction, Submitted: 2023-08-29, Accepted: 2023-08-09

1. Introduction:

Mechanical consequences from an acute myocardial infarction (AMI) are rare but life-threatening. These consequences often follow ST-segment elevation myocardial infarction (STEMI) [1, 2]. In recent decades, thrombolysis and percutaneous coronary intervention (PCI) as early interventions for acute myocardial infarction (AMI) have improved survivorship rates and reduced comorbidities [3-5]. Despite early surgical intervention, these patients have a substantial risk of in-hospital mortality [6]. Mechanical complications after an acute myocardial infarction (AMI) can cause acute mitral regurgitation, including ventricular septal rupture (VSR), left-ventricular free-wall rupture (LVFWR), and papillary muscle rupture (PMR). The early complications of acute myocardial infarction (AMI) have raised questions about surgical intervention timing and CABG's efficacy in treating the underlying cause. The debate about revascularizing necrotic myocardium during high-risk emergency procedures is notable. This patient cohort has inconsistent results on the early and late survival benefits of concurrent coronary artery bypass grafting (cCABG) [7].

1.1. Objective:

This review aims to investigate the relationship between post-coronary artery bypass graft myocardial ischemia and infarction.

2. Presentation of Symptoms:

2.1. Early symptoms:

10% of coronary artery bypass grafts occlude within the first month. This occlusion can be caused by endothelial damage during vein or arterial conduit harvesting, improper graft lengths (either excessive or insufficient) that tent the coronaries, kinks in the grafts, suboptimal venous conduits, distal target arteries, and the inaccessibility of the target vessels' intramyocardial course. Poor revascularization often causes symptoms to return

*Corresponding author.
Email address: bbbharti_dr@rediffmail.com (B B Bharti)

following coronary artery bypass graft (CABG) surgery [8]. Advanced age, male gender, co-morbidities such diabetes, systemic hypertension, dyslipidemia, smoking, and obesity were also risk factors for symptom recurrence. The ASCERT study found that numerous significant variables affected symptom recurrence. The urgency of the surgery, shock, the requirement for repeat CABG surgery, insulin-dependent diabetes, smoking, and dialysis dependency were variables [2].

2.2. Immediate Symptoms:

The pathophysiology of CABG patients 1-3 years after surgery includes platelet aggregation, intimal hyperplasia, and impaired fibrinolytic function [5]. Graft failure rates reached 25% in the first 18 months [6]. The PREVENT IV Trial found VGF in 43% of participants. VGF often has no sound [7]. A study at Emory University found that 25 of 34 patients with distal anastomotic stenosis (74% of the sample) had problems in the first year after surgery [8].

2.3. Late symptoms:

The problem occurs three years after coronary artery bypass grafting (CABG) due to neoatherosclerosis in the native or graft coronary arteries. Over time, vascular graft failure (VGF) increases from 1% to 4% to 5% per year. The Post CABG experiment [9] found that late graft stenosis is affected by several factors, including surgery duration, a history of prior myocardial infarction (MI), a low left ventricular ejection fraction (LVEF), male gender, current smoking habits, abnormal lipid levels, and inadequate distal run off. The BARI experiment [10] found that diabetes did not affect saphenous vein graft (SVG) patency after 4 years. The use of SVG conduits for many anastomoses is associated with higher vein graft failure (VGF) rates over a year. Deteriorating vein grafts have a high thrombus burden and a low left ventricular ejection fraction after five years. Azotemia was more common, increasing the risk of its effects.

3. Usage of echocardiography in CABG-related change detection:

Echocardiography is commonly used after coronary artery bypass grafting (CABG) to detect myocardial damage. Ventilation, inflammation, and pleural or pericardial effusions impair transthoracic echocardiography's capacity to produce high-quality pictures early postoperatively. Transesophageal echocardiography (TEE) is the preferred approach [2, 11]. After an uncomplicated coronary artery bypass graft (CABG), wall motion should improve immediately after cardiopulmonary bypass [12]. Swaminathan et al. examined 1412 CABG patients. The 16-segment wall-motion score (WMS) from post-procedural echocardiogram was used to determine the connection between clinical outcomes throughout a 2-year follow-up period [13]. The after cardiopulmonary bypass working memory score (WMS) was unaltered in 812 people, 58% of the sample. The WMS worsened in 219 patients (16% of the subjects) and improved in 368 (26%). The Kaplan-Meier analysis showed a statistically significant difference in cardiac event-free survival between CABG patients with deteriorated wall motion score (WMS) and those without WMS change ($P = 0.004$). The drop in WMS was associated with major adverse cardiac events (hazard ratio = 1.47, 95% confidence range = 1.06–2.03; $P = 0.02$) in the Cox proportional hazards regression analysis [14].

3.1. Arterial Grafts:

The study found that arterial grafts had a higher long-term patency rate than venous ones. LIMA grafts often carry large vessels like the left anterior descending artery or ramus intermedius. Surgical technique, distal conduit diameter, distal runoff, and anastomosis to a noncritical target artery blockage can cause early arterial graft failure. The long-term benefits of single arterial grafts have influenced whole arterial revascularization, which now uses bilateral internal mammary arteries, radial artery conduits, and gastroepiploic arteries. Radial artery conduits have higher angiographic patency rates than SVGs, according to randomised research [13, 14].

3.2. *Lytic Therapy:*

In the majority of primary PCI trials, patients with prior CABG were excluded, and there were no clear guidelines. Depending on the status of the graft, renal parameters, LV function, etc., the course of treatment must be determined on an individual basis. Lytic therapy has demonstrated low success rates in this subset of patients [1, 15]. When ACS presented very late after CABG surgery, reperfusion rates were low due to diffusely diseased venous grafts with thrombus burden and a small proportion of patients attaining TIMI III flow [16].

3.3. *Acute Coronary Syndrome*

Annually, 3% of patients with prior CABG develop STEMI. STEMI was categorised as type 5 MI according to the universal definition [17, 18]. Welsh et al. [19] reported an incidence of STEMI in 2%-14% of cases with prior CABG surgery. These cases were linked to the worst outcomes [20]. National Cardiovascular Registry Information revealed that only 6% of the 15,628 patients underwent primary percutaneous coronary intervention (PCI) prior to CABG surgery [21]. In the PAMI-2 trial [22], only 5.3% of the 1100 patients with prior CABG surgery had STEMI.

4. Percutaneous coronary interventions in CABG acute coronary syndromes:

When an SVG vessel was the offender, the primary PCI results were inferior to those of native vessels. In 2240 consecutive patients with post-CABG STEMI, Thielmann et al. [23] found that those who underwent PCI to SVG were ill, had poorer LV function, and had three vessel CAD more frequently than those who underwent PCI to native vessel. The angiographic SVG patency rate at 1 year was only 64%. Patients with SVG interventions had lower TIMI grades, greater hospital mortality, and poorer 10-year survival, and the SVG patency rate at 1 year was only 64%. Others have reported similar results. Primary PCI is currently a Class I indication if it can be performed promptly [18]. During PCI in the early postoperative period, care must be taken to avoid perforating suture lines with guide wires. Occasionally, it may be impossible to identify the vessel of the offender.

5. Conclusion:

Patients with ACS who have undergone prior CABG are a high-risk group. The STEMI presentation is uncommon. Response to lytic therapy is weak, and door-to-balloon times of less than 90 minutes are rare. When feasible, it is always preferable to contemplate native coronary PCI. In SVG interventions, poor long-term results are observed. As the CABG population grows, so too must the number of PCIs in this subset, and one must be prepared to meet this challenge.

6. Acknowledgement:

We are thankful to our readers.

7. List of abbreviations

CABG- coronary artery bypass graft
AMI- acute myocardial infarction
STEMI- ST-segment elevation myocardial infarction
VSR- ventricular septal rupture
LVFWR- left-ventricular free-wall rupture
PMR- papillary muscle rupture
cCABG- concurrent coronary artery bypass grafting
VGF- vascular graft failure
MI- myocardial infarction
LVEF- left ventricular ejection fraction
SVG- saphenous vein graft
TEE- Transesophageal echocardiography
WMS- working memory score
PCI- percutaneous coronary intervention

8. Source of Funding:

Nil

9. Conflict of interest:

The authors report no conflicts of interest in this work.

Vol. 4 No. 9 (2023): September 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i9.659
Original article

10. Publisher details

Publisher: Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256775434261
Location: Wisdom Centre, P.O.BOX. 148, Uganda, East Africa.

11. References

1. Grines CL, Booth DC, Nissen SE, Gur- ley JC, Bennett KA, O'Connor WN, et al. Mechanism of acute myocardial infarction in patients with prior coronary artery bypass grafting and therapeutic implications. Am J Cardiol 1990;65:1292-6.
2. Shahian DM, O'Brien SM, Sheng S, Grover FL, Mayer JE, Jacobs JP, et al. Predictors of long-term survival after coronary artery bypass grafting surgery: Results from the Society of Thoracic Surgeons Adult Cardiac Surgery Database (the ASCERT study). Circulation 2012;125:1491-500.
3. Mehta RH, Ferguson TB, Lopes RD, Hafley GE, Mack MJ, Kouchoukos NT, et al. Saphenous vein grafts with multiple versus single distal targets in patients undergoing coronary artery bypass surgery: One-year graft failure and five-year outcomes from the Project of Ex-Vivo Vein Graft Engineering via Transfection (PREVENT) IV trial. Circulation 2011;124:280-8.
4. Widimsky P, Straka Z, Stros P, Jirasek K, Dvorak J, Votava J, et al. One-year coronary bypass graft patency: A randomized comparison between off-pump and on-pump surgery angiographic results of the PRAGUE-4 trial. Circulation 2004;110:3418-23.
5. Motwani JG, Topol EJ. Aortocoronary saphenous vein graft disease: Pathogenesis, predisposition, and prevention. Circulation 1998;97:916-31.
6. Fitzgibbon GM, Kafka HP, Leach AJ, Keon WJ, Hooper GD, Burton JR. Coronary bypass graft fate and patient outcome: Angiographic follow-up of 5,065 grafts related to survival and reoperation in 1,388 patients during 25 years. J Am Coll Cardiol 1996;28:616-26.
7. Hess CN, Lopes RD, Gibson CM, Hager R, Wojdyla DM, Englum BR, et al. Saphenous vein graft failure after coronary artery bypass surgery: Insights from PREVENT IV. Circulation 2014;130:1445-51.
8. Douglas JS Jr., Gruentzig AR, King SB 3rd, Hollman J, Ischinger T, Meier B, et al. Percutaneous transluminal coronary angioplasty in patients with prior coronary bypass surgery. J Am Coll Cardiol 1983;2:745-54.
9. Domanski MJ, Borkowf CB, Campeau L, Knatterud GL, White C, Hoogwerf B, et al. Prognostic factors for atherosclerosis progression in saphenous vein grafts: The postcoronary artery bypass graft (Post-CABG) trial. Post-CABG Trial Investigators. J Am Coll Cardiol 2000;36:1877-83.
10. Schwartz L, Kip KE, Frye RL, Alderman EL, Schaff HV, Detre KM, et al. Coronary bypass graft patency in patients with diabetes in the Bypass Angioplasty Revascularization Investigation (BARI). Circulation 2002;106:2652-8.
11. Loop FD, Lytle BW, Cosgrove DM, Stewart RW, Goormastic M, Williams GW, et al. Influence of the internal-mammary-artery graft on 10-year survival and other cardiac events. N Engl J Med 1986;314:1-6.
12. Desai ND, Cohen EA, Naylor CD, Fremes SE; Radial Artery Patency Study Investigators. A randomized comparison of radial-

artery and saphenous-vein coronary bypass grafts. N Engl J Med 2004;351:2302-9.
13. M. Swaminathan, R.W. Morris, D.D. De Meyts, M.V. Podgoreanu, J.G. Jollis, H.P. Grocott, C.A. Milano, M.F. Newman, J.P. Mathew. Deterioration of regional wall motion immediately after coronary artery bypass graft surgery is associated with long-term major adverse cardiac events. Anesthesiology, 107 (2007), pp. 739-745
14. Collins P, Webb CM, Chong CF, Moat NE; Radial Artery Versus Saphenous Vein Patency (RSVP) Trial Investigators. Radial artery versus saphenous vein patency randomized trial: Five-year angiographic follow-up. Circulation 2008;117:2859-64.
15. Zhang B, Zhou J, Li H, Liu Z, Chen A, Zhao Q. Comparison of graft patency between off-pump and on-pump coronary artery bypass grafting: An updated meta-analysis. Ann Thorac Surg 2014;97:1335-41.
16. Shroyer AL, Hattler B, Wagner TH, Collins JF, Baltz JH, Quin JA, et al. Five-Year Outcomes after On-Pump and Off-Pump Coronary-Artery Bypass. N Engl J Med 2017;377:623-32.
17. Shroyer AL, Grover FL, Hattler B, Collins JF, McDonald GO, Kozora E, et al. On-pump versus off-pump coronary-artery bypass surgery. N Engl J Med 2009;361:1827-37.
18. Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD, et al. Third universal definition of myocardial infarction. J Am Coll Cardiol 2012;60:1581-98.
19. Welsh RC, Granger CB, Westerhout CM, Blankenship JC, Holmes DR Jr., O'Neill WW, et al. Prior coronary artery bypass graft patients with ST-segment elevation myocardial infarction treated with primary percutaneous coronary intervention. JACC Cardiovasc Interv 2010;3:343-51.
20. Mathew V, Gersh B, Barron H, Every N, Tiefenbrunn A, Frederick P, et al. Inhospital outcome of acute myocardial infarction in patients with prior coronary artery bypass surgery. Am Heart J 2002;144:463-9.
21. Bench TJ, Parikh PB, Jeremias A, Brener SJ, Naidu SS, Shlofmitz RA, et al. The impact of previous revascularization on clinical outcomes in patients undergoing primary percutaneous coronary intervention. J Invasive Cardiol 2013;25:166-9.
22. Lee KL, Woodlief LH, Topol EJ, Weaver WD, Betriu A, Col J, et al. Predictors of 30-day mortality in the era of reperfu- sion for acute myocardial infarction. Re- sults from an international trial of 41,021 patients. GUSTO-I Investigators. Circulation 1995;91:1659-68.
23. M. Thielmann, P. Massoudy, A. Schmermund, M. Neuhäuser, G. Marggraf, M. Kamler, U. Herold, I. Aleksic, K. Mann, M. Haude, G. Heusch, R. Erbel, H. Jakob. Diagnostic discrimination between graft-related and non-graft-related perioperative myocardial infarction with cardiac troponin I after coronary artery bypass surgery. Eur. Heart J., 26 (2005), pp. 2440-2447.

Author biography

B B Bharti Cardiologist, Director, Ford Hospital, Patna, Bihar, India