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Original Research Article

SINGLE VERSUS MULTIPLE ARTERIAL GRAFTS: COMPARISON OF IN HOSPITAL MORTALITY

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Abstract: *Even though not all findings have been equally positive, many retrospective studies seem to have shown an incremental survival improvement by increasing the number of arterial grafts. Multiple arterial (MultArt) grafting is only currently used in a small number of coronary arteries bypass grafting (CABG) surgeries, despite the convincing and comprehensive information in the published literature. The goal of the study is to compare the incidence of in-hospital mortality in patients following CABG with single versus multiple arterial grafts and to evaluate the frequency of single and multiple CABG arterial grafts in patients undergoing CABG for coronary arteries diseases (CAD). Following institutional review board permission, this descriptive case series was carried out at Jinnah Hospital's heart surgery department in Lahore. 250 patients receiving CABG under general anaesthesia were a part of this study. The quantity of arteries grafted was recorded during CABG. It was observed whether there were one or several arterial grafts. A single surgical team carried out every procedure, under general anaesthesia. Patients were moved to post-surgical wards after surgery. Following surgery, patients were monitored there for 7 days. In-hospital mortality is defined as when a patient dies while receiving treatment in the hospital. In this study, inpatient mortality affected 7 (or 5.9%) of patients treated with single grafts and just 1 (or 0.8%) of patients treated with multiple grafts (p=0.022). Patients who received single graft CABG had a considerably greater incidence of in-hospital mortality. The superiority of multiple arterial graft CABG in terms of lower hospital mortality rate was demonstrated by the study's findings.*

Keywords: Single, Multiple, Arterial grafts, Coronary artery bypass grafting, Coronary artery disease, In-hospital, Mortality

Introduction

When compared to percutaneous coronary intervention (PCI) utilising either bare-metal stents or drug-eluting stents, the traditional single-arterial coronary artery bypass graft (CABG) has been associated with greater intermediate-term survival and reintervention. When contrasting the two processes, this is the case (Habib et al., 2015).Which coronary revascularization technique is best is a hotly contested issue that has significant implications for both patients and their treating doctors, especially in the case of multivessel coronary artery disease (CAD) (Bundhun et al., 2016; Kappetein et al., 2011; Kapur et al., 2010).CABG has been consistently linked with a significant reduction in the requirement for coronary reinterventions in randomised controlled trials as well as large observational studies focusing on multivessel coronary artery disease. These studies have been focused on multivessel coronary artery disease. In addition, the findings of the bulk of these studies indicate that CABG leads to a slightly improved intermediate survival rate in comparison to either DES-PCI or BMS-PCI. Additionally, the amount of the CABG advantage appears to be dependent on the severity of the coronary disease, and it is greatest for more complex cases that have intermediate or high SYNTAX (Synergy Between PCI With TAXUS and Cardiac Surgery) scores. This is because CABG appears to have a synergistic effect with cardiac surgery (Natsuaki et al., 2014; Petrosian, 2018).

It's vital to keep in mind that the alleged advantages of CABG are virtually entirely dependent on the "conventional" single arterial CABG being used as the main surgical approach. It is crucial that you remember this. The most common type of bypass surgery is called a coronary artery bypass graft (CABG) operation. Along with other vein grafts, the left internal thoracic artery is frequently linked to the left anterior descending graft during this type of procedure. To enable the surgeon to finish the procedure, this is done. Even though this is the most popular type of bypass surgery, it's likely that it's not

the best surgical approach (Kim et al., 2012; Verma et al., 2013; Weintraub et al., 2012).

In point of fact, compelling evidence has rapidly accumulated over the course of the past decade suggesting that a second arterial graft (i.e., multi-arterial CABG), most commonly involving the right internal thoracic artery or the radial artery, significantly improves intermediate and long-term outcomes in comparison to those of single artery CABG. This is the case despite the fact that a single artery CABG is still the most common type of coronary artery bypass graft This is the case despite the fact that a coronary artery bypass grafting (CABG) procedure involving a single artery remains the most prevalent form of CABG (coronary artery bypass grafting) procedure. In contrast to this, the CABG surgery makes use of only a single one of the patient's arteries (Kurlansky et al., 2010; Schwann et al., 2013; Tranbaugh et al., 2010).

CABG procedures with a single graft were carried out 38.7 percent of the time, whereas CABG procedures with multiple grafts were carried out 61.3 percent of the time. According to the findings of one study, 13 patients who underwent CABG with many grafts had a much lower probability of dying while in the hospital than patients who got CABG with a single graft (0.26 percent vs. 1.666 percent; p 0.001) (Habib et al., 2015).

In order to compare the frequency of in-hospital mortality in patients undergoing CABG with single versus multiple arterial grafts, the purpose of this study is to assess the frequency of single and multiple CABG arterial grafts. This will be done in order to determine the frequency of single versus multiple arterial grafts. The purpose of this investigation is to evaluate and contrast the rates of in-hospital mortality experienced by patients who underwent CABG with either a single or multiple arterial grafts. According to the studies that have been conducted, coronary artery bypass grafting (CABG) procedures that involve more than one graft have a significantly lower risk of mortality than CABG procedures that involve only one graft. However, the aforementioned literature also contains material that can be interpreted in a number of different ways. In addition, there is no data that is readily available in the area that can indicate the amount to which death happens following a CABG treatment that involves a single or multiple artery graft. As a result, it is essential to do research on the local population in order to verify the results.

Methodology

The current descriptive case series was carried out at the Jinnah Hospital in Lahore's heart surgery department. from March 6 to March 12, 2017. The hospital's institutional review board gave its approval to this study. With a 95 percent confidence level, a 6 percent margin of error, and the estimated percentage of single artery CABG, or 38.7 percent in patients receiving CABG for CAD, a sample size of 250 patients is determined. The data was gathered using a non-probability / sequential sampling technique. The study included all patients undergoing CABG for CAD (presence of >70% stenosis in one or more coronary arteries detected on angiography) between the ages of 40 and 75, regardless of gender. Patients undergoing CABG with valvular or congenital heart surgery, as well as patients with diabetes (BSR > 186 mg/dl), were excluded from the study. A total of 250 patients from the cardiac ward of the Department of Cardiology, Jinnah Hospital, Lahore, who met the inclusion criteria, were included in the study. Informed consent was obtained, along with demographic data (name, age, gender, BMI, and CABG type). Patients then underwent CABG while unconscious. The quantity of arteries grafted was recorded during CABG. There were either one or many arterial grafts present. A single surgical team carried out every procedure while under general anaesthesia. Patients were moved to post-surgical wards following surgery. Following surgery, patients were monitored there for 7 days. If a patient passes away while in the hospital, in-hospital mortality was recorded. Through IBM SPSS 21, all of the data was entered and evaluated. For quantitative factors like age, weight, height, and BMI, mean and SD were determined. For categorical variables including gender, CABG type (on-pump vs off-pump), number of grafts (single / multiple arterial grafts), and in-hospital mortality, frequency and percentage calculations were made. Using the chi-square test, single and multiple graft groups were compared for in-hospital mortality, with P 0.05 being considered significant. Data were separated based on age, gender, BMI, and CABG type. The Chi-square test was used after stratification, with P0.05 considered significant.

Results

The study included a total of two hundred and fifty participants. Among selected patients 129(51.6%) were male and 121(48.4%) were females (Figure 1). The mean age of patients was 57.78±10.66 years. Mean BMI of patients was 26.68±5.07. Minimum and maximum BMI of patients was 18.50 and 36.06. (Table 1). On pump surgery was done in 154 patients and Single graft was used in 119(47.6%) patients while multiple graft was used for 131(52.4%) patients. Single graft was used in 119(47.6%) patients while multiple graft was used for 131(52.4%) patients (figure 2). Age, gender, BMI and type of CABG surgery did not show any statistically significant association for the type of grafts used for the patients. (Table 2) In hospital mortality was significantly higher for patients who

were operated with single graft as compared to those patients who were treated with multiple grafts. i.e., 5.9% vs. 0.8%, p-value=0.02. Age had no significant effect on mortality in patients who were operated with single graft or multiple grafts. But patients who were treated with single grafts among them in hospital mortality was higher as compared to those patients who were treated with multiple grafts. Like age the same trend was seen for gender of patients. That gender of the patients did not influence the in-hospital mortality in relation to the use of single graft or multiple graft. But among male and female patients who underwent single graft procedure among them in hospital mortality was high. No statistically significant effect was observed for BMI of patients on in hospital mortality for the use of single and multiple graft usage. However, patients for whom single graft was used among them mortality was higher. Patients who underwent on-pump surgery among them mortality was significantly higher among patients for whom single graft was used. However, for off –pump cases of statistically significant association were seen between in hospital mortality and use of single or multiple grafts for patients. (Table 3)

Table-1: Age of patients

Variables	**Min**	**Max**	**Mean SD**
Age	40	75	57.78 ± 10.66
BMI	18.50	36.06	26.68 ± 5.07

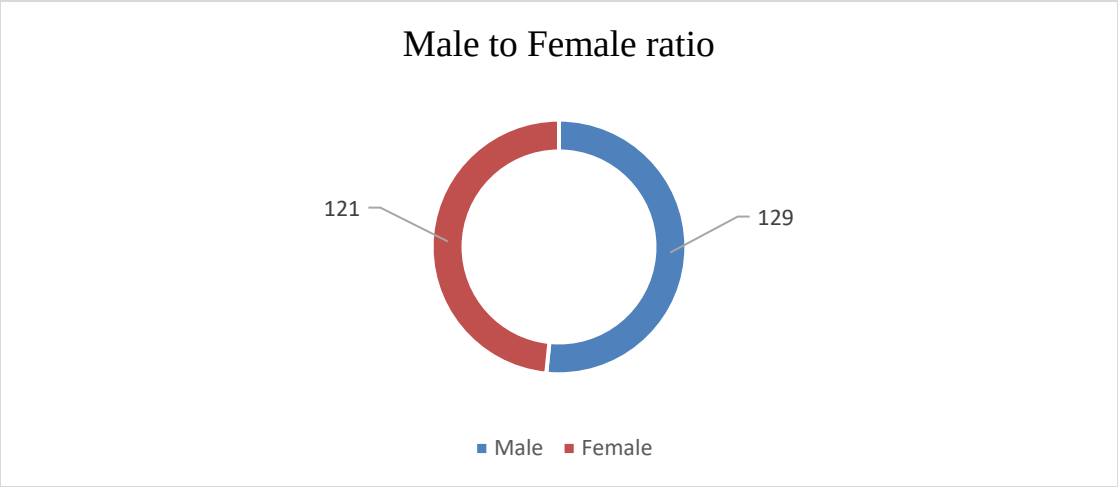

Figure 1 Gender Distribution

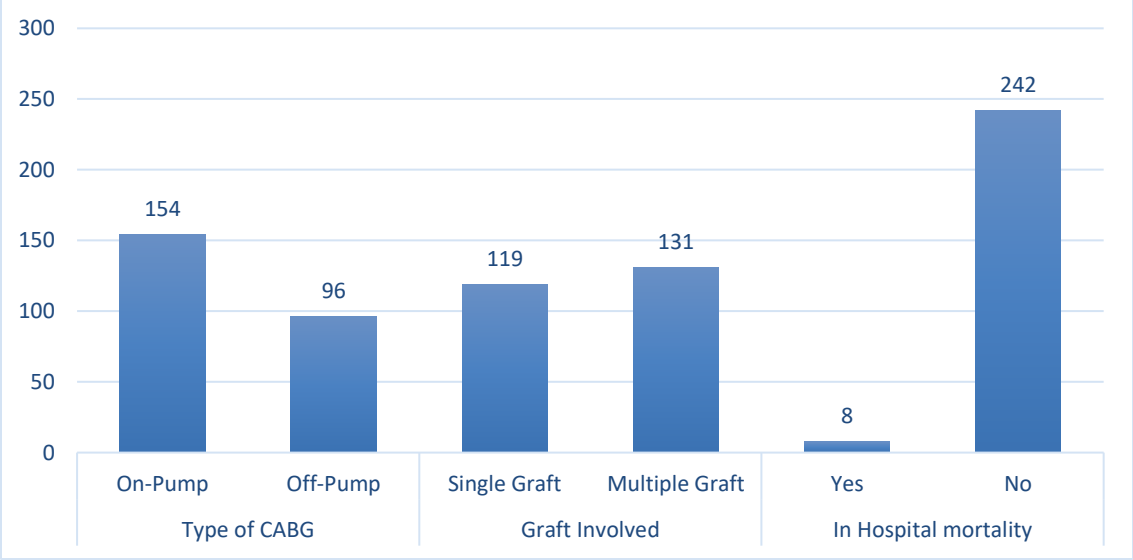

Figure 2 Distribution of participants with respect to CABG type, Graft numbers and in hospital mortality

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Table-2: Graft Involved in relation to age, gender, BMI & Type of CABG

Variables	Constructs	Graft		p-value
		Single Graft 119	Multiple Graft 131	
Age	**40-50**	37(31.1%)	40(30.5%)	**0.990**
	51-60	34(28.6%)	37(28.2%)	
	>60	48(40.3%)	54(41.2%)	
Gender	**Male**	62(52.1%)	67(51.1%)	**0.880**
	Female	57(47.9%)	64(48.9%)	
BMI	**Normal**	49(41.2%)	55(42%)	**0.992**
	Overweight	34(28.6%)	37(28.2%)	
	Obese	36(30.3%)	39(29.8%)	
Type of CABG	**On-Pump**	72(60.5%)	82(62.6%)	**0.734**
	Off-Pump	47(39.5%)	49(37.4%)	

Table-3: Association between in Hospital mortality with different variables

Variables	Mortality	Graft		p-value
		Single Graft 119	Multiple Graft 131	
In Hospital Mortality	**Yes**	7(5.9%)	1(0.8%)	**0.022**
	No	112(94.1%)	130(99.2%)	
Age				
40-50	**Yes**	1(2.7%)	0(0%)	**0.481**
	No	36(97.3%)	40(100%)	
51-60	**Yes**	3(8.8%)	1(2.70%)	**0.344**
	No	31(91.2%)	36(97.3%)	
>60	**Yes**	3(6.3%)	0(0%)	**0.101**
	No	45(93.7%)	54(100%)	
Gender				
Male	**Yes**	4(6.5%)	0(0%)	**0.051**
	No	58(93.5%)	67(100%)	
Female	**Yes**	3(5.3%)	1(1.6%)	**0.342**
	No	54(94.7%)	63(98.4%)	
BMI				
Normal	**Yes**	2(4.1%)	0(0%)	**0.220**
	No	47(95.9%)	55(100%)	
Overweight	**Yes**	4(11.8%)	1(2.7%)	**0.187**
	No	30(88.2%)	36(97.3%)	
Obese	**Yes**	1(2.8%)	0(0%)	**0.480**
	No	35(97.2%)	39(100%)	
Type of CABG				
On-Pump	**Yes**	4(5.6%)	0(0%)	**0.046**
	No	68(94.4%)	82(100%)	
Off-Pump	**Yes**	3(6.4%)	1(2%)	**0.357**
	No	44(93.6%)	48(98%)	

DISCUSSION

Multiple retrospective studies appear to have revealed an incremental longevity advantage that can be acquired by increasing the number of artery grafts, despite the fact that not all of the findings have been equally favourable (Dewar et al., 1995;

Rankin et al., 2007; Zacharias et al., 2004). In 2018, it is anticipated that the results of a multicenter prospective randomised control trial comparing single internal mammary artery transplantation to bilateral internal mammary artery grafting in terms of 10-year survival would be published. The trial will evaluate single versus bilateral internal mammary artery transplantation. The results of these two distinct meta-analyses show that there is a long-term benefit, and the results of this trial are expected to be published in 2018 (Rizzoli et al., 2002). Multiple artery grafting is now performed in only around 13 percent of CABG procedures, despite the availability of solid data in the published literature (Ruttmann et al., 2011; Taggart et al., 2006).

In this study, a single graft was used for 119 patients, which accounts for 47.6 percent, while multiple grafts were used for 131 patients (52.4 percent). The use of numerous grafts was significantly more common than the use of single grafts. This discovery is in line with the findings that were reported in pat studies. They found that the frequency of multiple graft CABG was 61.3%, while the frequency of single graft CABG was 38.7%. This finding is consistent with those findings (Locker et al., 2016). Patients in this study who were treated with a single graft, of which there were 7 (5.9 percent), suffered from hospital mortality, whereas patients who were treated with numerous grafts, of which there was only 1 (0.8 percent), did not. The p-value for this comparison was 0.022.

Patients who had a CABG procedure with a single graft had a considerably increased risk of dying while they were still in the hospital. Patients who underwent CABG with several grafts had a much-reduced risk of dying while in the hospital than patients who underwent CABG with a single graft (0.26% vs. 1.666%; p 0.001), according to the findings of one study. These data reveal a low incidence for in hospital mortality with multiple grafts CABG, which is supported by the findings of this study, which show the same thing. According to the findings of Chaim Locker's research, patients who underwent repeated arterial grafting procedures had a significantly decreased operative mortality rate (0.8 percent as compared to 2.1 percent, P=0.005) (Locker et al., 2016). Guru et al. have showed higher risk adjusted survival and greater independence from cardiac morbidity in patients with multiple arterial grafts (12 percent of patients with multiple arterial grafts) compared to those with single arterial grafts. Guru et al proposed that multiple arterial grafts had a survival and morbidity advantage over single arterial grafts (Guru et al., 2006).

Both authors Chaim Locker and Guru noticed a higher survival rate, lower mortality, and reduced cardiac morbidity in patients treated with multiple grafts, which is similar with the findings of our study. Multiple arterial grafts make heart surgery more complicated. The procedure is more time-consuming, technically challenging, and difficult to teach. Emerging evidence suggests that the use of at least two artery grafts enhances the long-term outcome of surgical revascularization. In a time when PCI is the predominant procedure for myocardial revascularization and is employed even in patients with left main coronary artery stenosis, it is crucial to convey this message to patients, cardiologists, and surgeons.

The Chaim Locker findings also indicate that repeated arterial grafts is a potent surgical strategy that should be considered for all CABG patients in order to significantly enhance their long-term outcome (Guru et al., 2006; Locker et al., 2016).The body of evidence reported thus far implies that multiple arterial grafting in CABG surgery is at least as successful as traditional grafting and, as such, is not hazardous. Despite some evidence that bilateral internal mammary artery grafting may raise the risk of deep sternal wound infection, surgery should be deemed safe in a vast proportion of patients. Until now, randomised studies on multiple arterial grafting have not been able to conclusively demonstrate that multiple arterial grafting is preferable to conventional grafting. However, there are a number of significant drawbacks that have not yet been addressed by published research.

To begin with, not a single one of the cited research has explored how the conduits' quality, which includes venous conduits, impacts their long-term patency. Second, no comparative study of grafting techniques has studied the effect of secondary prophylaxis and medicinal therapy on the long-term outcomes of the surgery (Buszman et al., 2008; Elghobary and Légaré, 2010). Given the lack of proof that repeated arterial grafts represent a risk and the possibility that they may be beneficial to the patient, one could argue that there are few reasons not to utilize it in an increasing number of patients. However, this line of reasoning highlights the discrepancy between cardiothoracic surgeons who advocate repeated arterial grafts in CABG procedures and those who reject it. When all of these considerations are taken into account, the ultimate result is a low use rate of multiple arterial grafts and a failure to solve this crucial clinical issue.

Conclusion

Results of this study have shown the superiority for multiple arterial grafts CABG in terms of lower in hospital mortality rate. With the help of this study, we are able to obtain local evidence, which allows us to better develop preventative and management protocols in the future, with the goal of reducing mortality and improving patient survival.

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Conflict of interest

The authors declared absence of conflict of interest.

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