

Internal mammary artery flow in different racial groups of Pakistan

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Abstract

Objective: To find out any differences in free flow of internal mammary artery among different ethnic groups.

Methods: This observational, cross-sectional study was conducted at the Civil Hospital, Karachi, from January 2013 to December 2015, and comprised patients who underwent coronary artery bypass grafting. The participants were divided into 5 groups, i.e. Sindhi, Muslim migrants from India, Punjabi, Pathan and Balochi patients. Free flow of internal mammary artery was measured immediately after harvesting within a syringe, and its flow was measured in 30 seconds. SPSS 18 was used for data analysis.

Results: Of the 158 patients, 44(27.8%) were Sindhi, 33(20.9%) Punjabi, 8(5%) Baloch, 21(13.3%) Pathan and 52(32.9%) were migrants. The overall mean age was 52±8 years and the mean flow was 11.6±9.6ml per 30 seconds. The flow was 9.3±6 ml, 10±8ml, 13±11ml, 17±14ml and 15±13 ml in 30 seconds among migrants, Sindhi, Punjabi, Pathan and Baloch patients, respectively, with significant higher flow in Pathan patients compared to Sindhi and migrant patients ($p<0.05$). A flow of less than 5ml/30 sec was mostly found in migrants or Sindhi subjects 30/40(75%), and flow more than 30ml/ 30 seconds was found mostly in Baloch or Pathan patients 4/8(50%). Low flow internal mammary artery, which was used on left anterior descending artery, showed significantly higher need of inotropic support as compared to high flow internal mammary artery ($p=0.004$), more low cardiac output syndrome ($p=0.022$) and more use of intra-aortic balloon pump ($p=0.028$).

Conclusion: Internal mammary artery flow was higher in Pathan and Baloch patients and low in migrants and Sindhis.

Keywords: CABG, Internal mammary artery, Post-operative complications, IMA flow. (JPMA 67: 1558; 2017)

Introduction

Internal mammary artery (IMA) is one of the commonest arterial grafts used for coronary artery bypass grafting (CABG). Its superiority has been shown over saphenous vein graft in terms of long-term patency, better survival and very low chances of degeneration.¹ Moreover, the internal mammary artery has rare chances of atherosclerosis.² Many reports have shown that using IMA as a graft for CABG is associated with decreased operative mortality.³ Long-term survival and freedom from myocardial infarction (MI), recurrence of angina, percutaneous re-intervention and repeat operation may further be reduced by the use of bilateral IMA.^{4,5} Other advantages of IMA are its ability to dilate in response to increase myocardial blood flow demand.^{6,7}

The current study was designed to review the flow pattern of IMA in different racial groups and its relation with gender, age, and in different diseases. If this clinical data suggests that certain groups have low IMA flow, then a decision can be made not to use the IMA in order to prevent the possible complications, and a pre-operative

plan possibly be made in these group of patients. Therefore, complications may be predicted and mortality/morbidity can be reduced and prevented.

Patients and Methods

This cross-sectional, observational study was conducted at the Civil Hospital, Karachi, from January 2013 to December 2015, and comprised of patients who underwent primary, isolated and elective CABG. IMA was harvested by a single surgeon. Patients with emergency surgery, urgent referral for operation, patients who underwent redo-coronary artery bypass surgery, off-pump surgery and CABG with valve surgery were excluded. Purposive sampling methodology was employed.

To calculate IMA flow one minute after systemic heparinasation, the distal part of IMA was clamped with Roberts clamp and then the artery was divided with scissors. Immediately after division, a reading of free flow of blood from IMA was collected in a 30ml syringe, and then measured over a period of 30 seconds. The divided tip of the artery was then occluded with a fine metal bulldog clamp to enhance its distension with each beat. The topical vasodilator, either papaverin, or glyceryl trinitrate was then sprayed from syringe and needle along the whole length of the upper surface of the artery with some pressure, and the swab was wrapped around the

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artery, which was placed till we used the IMA.

Data was collected using a questionnaire, which comprised questions about demographic features, clinical history and co-morbid conditions of enrolled subjects, IMA flow and post-operative complications among them. Each subject was enrolled after obtaining informed consent. SPSS 18 was used for statistical analysis. Data was presented as mean with standard deviation and the discrete variables were presented as frequencies. Comparison of the two groups was performed by the independent sample t-test for continuous variable with 95% confidence interval (CI). $P < 0.05$ was considered statistically significant. The study was approved by institutional review board (IRB) of Dow University of Health Sciences (DUHS).

Results

Of the 158 patients, 44(27.8%) were Sindhi, 33(20.9%) Punjabi, 8(5%) Baloch, 21(13.3%) Pathan and 52(32.9%) were Muslim migrants from India (MMIs).

Furthermore, 129(81.6%) participants were males and 29(18.4%) females. The overall mean age was 52 ± 8 years. Diabetes mellitus was present in 66(41.8%) patients, hypertension in 116(73.4%), history of smoking in 77(48.7%), and obesity (body mass index [BMI] > 30 kg/m²) in 47(29.7%) patients. The Canadian Cardiovascular Society angina (CCSA) class II was present in 35(22.2%) patients, class III in 102 (64.6%) and class IV in 21(13.3%) patients. New York Heart Association (NYHA) class I was present in 6(3.8%) patients, class II in 117(74.1%), class III in 29(18.4%) and class IV in 6(3.8%) patients. Renal impairment (creatinine more than 2 mg/dl) was present in 9(5.7%) patients. Carotid bruit was present in 2(1.3%) patients, chronic obstructive pulmonary disease (COPD) in 5(3.2%) patients, stroke in 5(3.2%), liver disease in 8(5.1%) and history of tuberculosis was present in 3(1.9%) patients. Pre-operative MI was present in 114(72%) patients. Moreover, left ventricular function was normal (more than 60%) in 30(19%) patients, moderate (30 to 60%) in 107(67.7%) patients and poor (less than 30%) in 21(13.3%) patients. Additionally, left main

Table-1: IMA flow in different ethnic groups of Pakistan.

Ethnic origin	Mean IMA flow with SD	P value
Sindhi (27.8%)	10±8 ml	p =.03 (low as compared to Pathan)
Punjabi (20.9%)	13±11ml	
Baloch (5%)	15±13ml	p =.03&.01(High as compared to Sindhi and MMI)
Pathan (13.3%)	17±14ml	
MMI (32.9%)	9.3±6ml	

IMA: Internal mammary artery

MMI: Muslim migrated from India

SD: Standard deviation.

Table-2: High flow IMA > 30 mls in 30 sec. (n=8) and Low flow IMA < 5 mls in 30 sec. (n=40) in different ethnic groups.

Ethnic origin	Number of patients	Percentage in their group
Sindhi (High Flow)	1 out of 44	2.3%
Punjabi (High Flow)	3 out of 33	9%
Baloch (High Flow)	2 out of 8	25%
Pathan (High Flow)	2 out of 21	9%
MMI (High Flow)	none	0%
Sindhi (Low flow)	16 out of 44	27%
Punjabi (Low flow)	5 out of 33	15.6%
Baloch (Low flow)	2 out of 8	25%
Pathan (Low flow)	3 out of 21	14%
MMI (Low flow)	14 out of 52	36.4%

IMA: Internal mammary artery

MMI: Migrants from India.

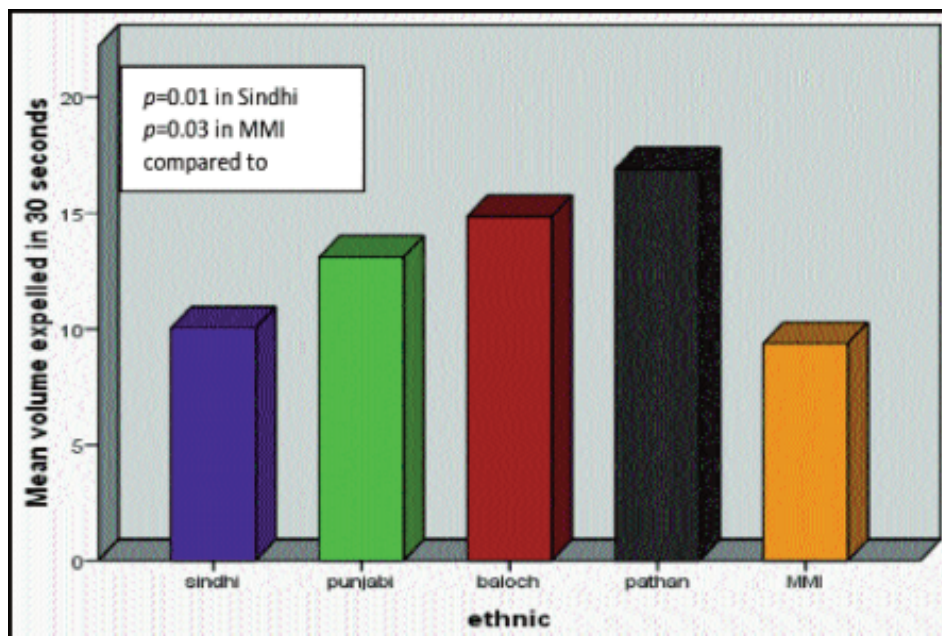
coronary artery lesion was present in 9(5.6%) patients.

Before observing the flow of IMA, the overall mean heart rate was 83 ± 17 per minute, systolic blood pressure was 104 ± 14 mm of Hg, diastolic blood pressure was 64 ± 10 mm of Hg, mean arterial pressure was 76 ± 12 mm of Hg, and central venous pressure was 7 ± 3 mm of Hg. Room temperature was also observed and found to be $31 \pm 5^\circ\text{C}$ at the time of study. The mean blood volume expelled by the patients in 30 seconds was 11.6 ± 9.7 ml. The minimum was 0ml per 30 seconds to 63 ml within the same period. Moreover, 40(25%) patients had less than 5ml of blood expelled in 30 seconds, 5 to 10 ml per 30 seconds was present in 58(37%) patients, and 10 to 20 ml in 35(22%) patients, 20 to 30ml in 17(11%) patients and more than 30 ml in 8(5%) patients.

The mean IMA flow was 9.3 ± 6 ml per 30 seconds among MMIs, 10 ± 8 ml per 30 seconds among Sindhis, 13 ± 11 ml per 30 seconds among Punjabis, 17 ± 14 ml per 30 seconds among Pathans and 15 ± 13 ml in 30 seconds among Balochs. Pathan patients had significantly higher flow compared to Sindhi and MMI patients (Table-1).

Of the 8(5%) patients with flow higher than 30ml per 30 seconds, 2(25%) were Baloch, 2(25%) were Pathans, 3(37.5%) were Punjabis, and 1(12.5%) was Sindhi. The flow of IMA was less than 5ml per 30 seconds in 40(25.3%) patients, of whom 16(40%) were Sindhis, 14(35%) were MMIs, 2(5%) were Baloch, 5(12.5%) were Punjabis and 3(7.5%) were Pathans (Table 2).

In patients with low flow, the IMA was used in 27(67.5%) patients and vein graft on left anterior descending artery (LAD) in 13(32.5%) patients. The findings showed that when the IMA used in the low flow condition, the response of the operation was not as good as where it was not used. In patients where the IMA was used with low flow, there were



IMA: Internal mammary artery
MMI: Migrants from India.

Graph: IMA flow in different ethnic groups of Pakistan.

significantly higher rate of intra-aortic balloon pump (IABP) used ($p = 0.028$), higher doses of inotropic drugs used ($p = 0.004$) and more number of low cardiac output syndrome (LCOS) ($p = 0.022$) as compared to the patients with vein grafts on LAD. There were more atrial fibrillations, deaths and re-admissions after discharge where low flow IMA was used, but it did not reach significant levels ($p > 0.05$).

Discussion

Coronary artery bypass operation is the one of the commonest performed operations in the world nowadays. CABG is one of the most common operation performed in US hospitals, accounting for 1.4% of all operating room procedures in 2011.⁸ In 2010, around 400,000 CABG operations were performed in the United States⁹ and similar numbers in Europe and Asian countries. CABG is also the most discussed and researched operation in the world.¹⁰

In this study we found that there are differences in flow of IMA among different racial groups of Pakistan. Amongst the five major population groups in Pakistan, the number of Punjabis is the highest (Punjabis 44.68% + Sariakis 8.38%), followed by Pashtun (Pathan) 15.42%, Sindhi 14.1%, MMI 7.57%, Balochi 3.57% and other populations 6.28%.¹¹ In this study, however, out of 158 patients the MMI patients were 33%, Sindhi were 28%, Punjabi were 21%, Pathan were 13% and Baloch were 5%. The IMA flow was significantly higher in the Pathan

patients (17ml per 30 sec). Balochi (15 ml/30 sec) patients also have higher flow compared to the Punjabi (13ml/30 sec), MMI (9.3ml per 30 sec) and Sindhi (10ml/30 sec) patients, but not reached to significant levels owing to less number of patients. Many studies show a higher risk of coronary heart disease in South Asian people,¹² however, there was no dissimilarity in the outcome after CABG.¹³ None of the studies have so far showed any differences in IMA flow in the different ethnic groups of the world or in Pakistan. Calibre of coronary vessels has been shown in the studies which are smaller in South Asian people,¹⁴ but differences in calibre of IMA and its flow was not mentioned in any of the studies.

In the present study, we used IMA in 92% of the patients irrespective of their age, ethnic origin and left ventricular

function. The reasons of the non-usage of IMA in 8% of the patients were either the dissection during harvesting or poor flow at the start, and five patients among them either had a very large heart to reach the pedicle to the graft or had the association with a diffuse distal graftable site. There are different reasons of non-usage or less usage of IMA in different studies. According to one study,¹⁵ the six reasons of non-usage include elderly patients (aged > 70 years), females, diabetics, patients having emergency CABG, patients with poor left ventricular function (ejection fraction < 30%) and patients with respiratory disease. The IMA use was 92% in this study.¹⁵ Tabata et al. collected the data of 541,368 patients over the period of three years and showed that the IMA was used in 92% of patients and reason for non-use was mostly in female patients and in non-white population.¹⁶ In our study, only 8 males and 5 female patients were the participants where we did not used the IMA. The majority comprised the MMI group (6 out of 52, 11.5%) and Sindhi population (4 out of 44, 9%) whereas only two Punjabi patients (2 out of 33, 6%) and one Pathan patient (1 out of 21, 4.7%) was in this category.

Many international studies mention the mean blood flow in the IMA around 60ml/min.^{17,18} In our study, the IMA flow was low at 11.6 ± 9.7 ml per 30 sec, which was less than half of the flow per minute as compared to international studies.

Low flow in IMA was used in 40 patients, which mainly comprised Sindhi and MMI participants. It was observed that when low flow IMA was used on LAD, it resulted in more complications than in those patients where vein grafts were employed. The usage of low flow IMA was successful in other studies¹⁹ as they showed improved long-term results with better patency and increase in diameter with time, provided that there were no mechanical damages.²⁰ Many studies showed better long- and short-term survival by using IMA as compared to vein grafts.²¹ However, those patients who received low flow IMA which either give some response to topical vasodilators still produced some complications in our study participants. Therefore, they must be used with precaution in certain groups of patients. Since most of our ethnic groups have low IMA flow, IMA should be employed but with due precaution. One major limitation of our study was that its results cannot be generalised as it was a single-centre study.

Conclusion

IMA flow was higher in Pathan and Baloch patients. Low flow IMA was more prevalent in MMIs and Sindhis. Literature supports the use of IMA associated with short- and long-term survival benefit, therefore, patients previously considered ineligible for IMA grafting may now be considered for receiving this procedure. Once low flow of IMA is established, it should be used with precaution, as there may be a higher need of mechanical and pharmacological support post-operatively. Further studies are warranted to prove the conditions where due precautions should be taken when using the IMA.

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Conflict of Interest: None.

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