OPEN HEART SURGERY AT A NEWLY DEVELOPED CARDIAC CENTER IN KARACHI: A STEP TOWARDS AFFORDABLE CARDIAC CARE IN PAKISTAN

Muhammad Musharraf¹, Taimur Asif Ali¹, Syed Saad Naeem², Muhammad Jawad³, Urooj Salahuddin⁴, Zara Shirazi⁵, Musa Karim¹

Address for Correspondence:
Zara Shirazi
Division of Cardiac Surgery, National Institute of Cardiovascular Diseases, Karachi Pakistan
Emails: zaramirza_fd@hotmail.com

1. National Institute of Cardiovascular Diseases, Karachi Pakistan.
2. Rhode Island Hospital, Brown University, Providence, USA

ABSTRACT

Objective: To evaluate the outcomes and cost-effectiveness of cardiac surgery performed in a newly developed center providing affordable surgical care.

Methods: This descriptive study was conducted at the Medicare Hospital Karachi, from January 2016 to October 2017. Patients undergoing open-heart surgery with cardiopulmonary bypass were enrolled, and those presenting with cardiogenic shock and off-pump cardiac surgeries were excluded. Data were prospectively collected on the designed questionnaire.

Results: A 127 consecutive patients, predominantly male, 72%, with an overall median age of 58±15 years were identified. Ninety percent had CABG, 5.5% had MVR, 1.6% had AVR, 0.8% had CABG+MVR, and 1.6% had CABG+AVR. A majority, 50.4%, had 1+2+3 grafts. Sixty percent had a CPB time between 60-90 minutes and ventilation of less than six hours in 88% patients. Peri-operatively 97% of patients received transfusion, 2.4% developed renal dysfunction, 1.6% sepsis, 3.2% arrhythmia, and 71% received inotropes. In-hospital mortality was 1.6%, ICU stay >5 days and hospital stay >8 days was found each in 1.6% of patients respectively.

Conclusion: We demonstrated impressive results compared with strong Western standards. Further comparative studies with greater sample size are required to assess the outcomes, survival, and cost-effectiveness in this region.

Keywords: Coronary artery bypass grafting (CABG), Outcomes, Cost-effectiveness
INTRODUCTION

Coronary artery bypass grafting (CABG) has been the main standard in the treatment and management of Coronary artery disease (CAD) around the globe. Till today it is marked as the best treatment option for patients with left main stem disease, with poor left ventricular function, and uncontrolled diabetes mellitus.\(^{1,2}\) Through 2020, CAD is expected to be the major cause of worldwide morbidity and mortality. Pakistan, being a part of Southern Asia has high rates of CAD, manifesting at quite an earlier age.\(^{3}\)

The major concern for all patients undergoing CABG is the expensive health care cost leading to financial stress in the common man household. For example, in 2007, about 408,000 CABG surgeries were performed in the United States (US), with a mean amount of charges for in-hospital care over $10,000.\(^{4}\) CAD cost plays a leading position in the entire expense of the healthcare system which as measured is around 40.7% and mostly cost was associated with in-patients facility which represents 70% of the healthcare expense and medicine treatment.\(^{5}\) During the past several decades’ efforts have been made in developed countries to contain healthcare costs by reducing the number of hospital readmissions and lowering the use of hospital resources for those already admitted by reducing the length of hospital stay. According to reported literature protocols and guidelines for patients who were having CABG operation in an effort to decrease hospital length of stay (LOS) have been highly successful. The median length of stay for CABG in the year 1988 to 2005 has reduced from eleven to eight days resulting in apparent cost savings in peri-operative care associated with the main procedure.\(^{6-8}\)

Since there are few studies available in Pakistan and in this region, which represent the information related to the cost of treatment of CAD, we took the initiative to evaluate the outcomes and cost-effectiveness of cardiac surgery performed in a newly developed center in Karachi, Pakistan.

RESULTS

This study was conducted in a newly developed cardiac center evaluating the post-procedural outcomes, i.e., blood transfusion, inotropic support, re-open, renal dysfunction, sepsis, arrhythmia, ICU stay, hospital stay, and mortality. One hundred and twenty-seven consecutive patients undergoing CABG were identified. Patients were predominantly male, 91 (72%), with an overall median age of 58±15 years. The ejection fraction of 40%-50% was found in 38% of the sample and overall in-hospital mortality was reported to be 1.6% (two). Baseline characteristics of patients are presented in Table 1.

In our sample 90% (114) of patients had CABG, 5.5% (seven) had mitral valve replacement, 1.6% (two) had aortic valve replacement, 0.8% (one) had CABG+MVR, and 1.6% (two) had CABG+AVR. A majority of the patients had 1+2+3 grafts, 50.4% (64). Sixty percent of patients had a cardiopulmonary pump time between 60 and 90 minutes and ventilation of less than six hours in 88%(112) patients. A majority of them received blood while undergoing cardiopulgia, 91%(116). Procedural details of the patients are presented in Table 2.

On evaluation of post-procedural outcomes, we found that 97% (123) of patients received blood transfusion, 2.4% (three) developed renal dysfunction (post-operative creatinine >1.5), 1.6% (two) had sepsis, 3.2% (four) had arrhythmia, 71% (90) of patients received inotropes; ICU stay of more than five days and hospital stay of more than eight days was found each in 1.6% (two) of patients respectively. Moreover, after identifying independent risk factors for these observed outcomes we observed that the odds of receiving blood transfusion were 1.39 times higher in males as compared to females (OR=1.39, p=0.61). Summary and impact of gender of procedural outcomes are presented in Table 3.
to work after the operation and are especially relevant in complications also had an impact on the ability of the patient management might be the reason for this reduction in equally distribute the patient burden amongst the newly and strengthening the primary care system. These efforts continuous improvement to the infrastructure of our hospital established center endorse the fact that we are providing places where people live and hospitals.9,10 After knowing less, more likely to be nonworking, and more towards the counterparts. If we compare they are older, education is populations. Current literature shows that the rural developing countries.11 Improved results from our newly eight days and a mortality rate of 1.57%. These findings are healthcare system like ours and have better health facilities but reliable setup. Similarly, a study conducted in Taiwan According to literature our neighboring country China has for CABG patients between tertiary care hospitals and newly disease presenting for CABG. Through our findings, we this background, in this study, we observed the outcomes of Keywords: Number of graft

| Gender | Total (n = 127) |
|--------|----------------|
| Male   | 91 [71.7%]    |
| Female | 33 [26%]      |
| Missing| 3 [2.4%]      |

| Age     | Total (n = 127) |
|---------|-----------------|
| Mean ± SD | 56.68 ± 11.65 |
| Median (IQR) | 58 (15) |
| Min-Max | 14 - 76 |
| Missing | 7 [5.5%] |
| Up to 50 years | 36 [28.4%] |
| 51 to 60 years | 40 [31.5%] |
| More than 60 years | 44 [34.7%] |

| Ejection Fraction | Total (n = 127) |
|-------------------|-----------------|
| Normal > 50%      | 45 [35.4%]      |
| Mild 40 to 50%    | 48 [37.8%]      |
| Moderate 30 to 40%| 17 [13.4%]      |
| Sever < 30%       | 4 [3.2%]        |
| Missing           | 13 [10.2%]      |

SD=standard deviation, IQR=interquartile range
Missing values are ignored while calculating the quantitative summary of the age variable

Table 2: Procedural details of the patients

| Type of surgery | Total (n = 127) |
|-----------------|-----------------|
| CABG            | 114 [89.8%]    |
| MVR             | 7 [5.5%]       |
| AVR             | 2 [1.6%]       |
| CABG plus MVR   | 1 [0.8%]       |
| CABG plus AVR   | 2 [1.6%]       |
| Missing         | 1 [0.8%]       |

| Number of graft | Total (n = 127) |
|-----------------|-----------------|
| 1               | 2 [1.6%]        |
| 1+2             | 23 [18.1%]      |
| 1+2+3           | 64 [50.4%]      |
| 1+2+3+4         | 25 [19.7%]      |

CABG = coronary artery bypass grafting; MVR = mitral valve replacement; AVR = aortic valve replacement

Pak Heart J 2020 Vol. 53 (01) : 82 - 87
| Valve Type | Frequency n [%] |
|------------|----------------|
| Mechanical | 4 [3.2%]       |
| Tissue     | 2 [1.6%]       |
| Missing    | 121 [95.3%]    |

| Pump Time | Frequency n [%] |
|-----------|----------------|
| Less than 60 minutes | 19 [15%] |
| 60 to 90 minutes | 76 [59.8%] |
| 90 to 120 minutes | 24 [18.9%] |
| 120 to 150 minutes | 1 [0.8%] |
| More than 180 minutes | 1 [0.8%] |
| Missing | 6 [4.7%] |

| Cardioplegia | Frequency n [%] |
|--------------|----------------|
| Blood | 116 [91.3%] |
| Crystalloid | 2 [1.6%] |
| Missing | 9 [7.1%] |

| Ventilation | Frequency n [%] |
|-------------|----------------|
| Less than 6 hours | 112 [88.2%] |
| More than 6 hours | 8 [6.3%] |
| Missing | 7 [5.5%] |

Table 3: Summary and impact of gender of procedural outcomes

| Event | Frequency n [%] | OR (Male/Female) | p-value |
|-------|-----------------|------------------|---------|
| Blood Transfusion | 123 [96.9%] | 1.39 | 0.61 |
| Mortality | 2 [1.6%] | 0.36 | 0.47 |
| Re-open | 1 [0.8%] | - | 0.27 |
| Renal Dysfunction (post op creatinine >1.5) | 3 [2.4%] | 0.73 | 0.61 |
| Sepsis | 2 [1.6%] | 0.36 | 0.46 |
| Arrhythmia | 4 [3.1%] | 0.72 | 0.61 |
| ICU stay of patient > 5 days | 2 [1.6%] | 0.36 | 0.46 |
| Hospital stay > 8 days | 2 [1.6%] | - | 0.07 |
| Inotropic used | 90 [70.9%] | 0.82 | 0.43 |

DISCUSSION

Pakistan is one of the densely populated countries in the world, and its current population is 207.8 million with a rise of 75.4 million people in 19 years according to provisional summary data of the 6th Population and Housing Census 2017. However, the quality of health care provided to patients varies considerably between urban and rural
populations. Current literature shows that the rural community is very much vulnerable than its urban counterparts. If we compare they are older, education is less, more likely to be nonworking, and more towards the economic downturn. Also, medical care given to rural populations can be a challenge because there are very fewer hospital specialists, providers and longer distances among places where people live and hospitals. After knowing this background, in this study, we observed the outcomes of a newly developed health center with excellent quality of treatment provided to patients having coronary artery disease presenting for CABG. Through our findings, we would like to compel the readers the fact that every individual should have equal opportunity to be treated regardless of their economic status. The difference in care for CABG patients between tertiary care hospitals and newly developed centers may be minimized or eliminated.

According to literature our neighboring country China has progressed a lot in population health facilities, increasing the insurance coverage, research facilities and strengthening the primary care system. However, residents of our country do not have health insurance and must pay for their health facilities; therefore, residents look for an affordable but reliable setup. Similarly, a study conducted in Taiwan reported that the urban population is more affordable and has better health care facilities than the people living in rural areas. Countries like Bangladesh and India have a similar healthcare system like ours and have better health facilities for urban dwellers suffering from cardiovascular diseases.

Our data reported in-hospital length of stay of no more than eight days and a mortality rate of 1.57%. These findings are consistent with statistics published in a study that discusses outcomes in patients undergoing CABG in developing countries. Improved results from our newly established center endorse the fact that we are providing affordable essential health care services, bringing continuous improvement to the infrastructure of our hospital and strengthening the primary care system. These efforts will improve the health outcomes in patients with CAD and equally distribute the patient burden amongst the newly developed hospitals providing quality care treatment. Enhanced surgical techniques and perioperative management might be the reason for this reduction in mortality along with reduced hospital LOS. Postoperative complications also had an impact on the ability of the patient to work after the operation and are especially relevant in countries like ours where job providers may not give financial support, and the patient must pay from their own pocket. Most of these aspects are not even considerations in developed countries where health insurance comes in to play. Therefore, patients residing in developing countries place their belief in healthcare staff, hence, it is designated that perioperative outcomes in potentially dangerous surgeries like CABGs, continue to improve.

A major priority for clinicians should be that each patient must have an equal right to get the best health potentials, without being disadvantaged due to low economic status. Quality has been the main foci in utmost developed countries in the past few years. However, cost remains a point of concern for the developing nations, as individuals are not insured in these regions and must pay on their own. Objective assessment and performance can be monitored by the establishment of a database on a national level so that the outcomes of each institution can be compared. Some newly developed centers with a skillful team of surgeons, anesthesiologists, perfusionists; post-operative care along with accurate preoperative diagnosis can provide adequate outcomes with less burden on the patient.

Quality treatment and measurements of outcome have become one of the critical emphases of recent healthcare improvements in Pakistan. International healthcare conferences and further overseas education give opportunities for Pakistani surgeons to get knowledge of novel cardiovascular disease-related treatments, as well as advancement in outcome research topics globally. Moreover, having higher CABG volume benefits the surgeon from the volume-outcome relationship more in cardiac surgery. Furthermore, our results show that care that is given like in the western health care system can be reached in a developing country and newly developed center providing high-class healthcare to their patients. We have very good cardiac surgery facilities, more great and advanced resources so that the patients who undergo CABG receive ideal possible support.

Finally, one more improvement needed is to decrease the difference in CABG care between large teaching hospitals and often non-teaching small hospitals in urban and rural areas. Our findings relied on an urban hospital that used to have more resources. Most of the health service providers are less qualified in rural areas. Numerous ways have been decided to upgrade competencies for rural health workers throughout the country, like continued medical education and on-hand workshops for government healthcare professionals.

**CONCLUSION**

This newly developed center in Karachi has indicated very impressive CABG results in comparison with strong international certified standards. This should stimulate other hospitals in the region to direct one’s hope to high levels of care. The postoperative circumstances are being curtailed in developing countries and the excellence of health care must progress without interruption to alleviate these problems.
Further comparative studies with a higher sample size are required to assess the outcomes, survival, and cost-effectiveness in this region.

**CONFLICT OF INTEREST:** Authors declared no conflict of interest

**DISCLOSURE:** none to declare

**FUNDING:** none to declare

**PATIENT CONSENT:** consent of the patient/guardian was taken

**REFERENCES**

1. Hussaini SA, Rasheed SZ, Baloch DMJ, Sultana R, Danish I, Hussaini SF. Prevalence of carotid artery disease in patients undergoing coronary artery bypass graft surgery at KIHD. Pak Heart J 2016;49:20-3.

2. Farkouh ME, Domanski M, Sleeper LA, Siami FS, Dangas G, Mack M. Strategies for multivessel revascularization in patients with diabetes. N Engl J Med 2012;367:2375-84.

3. Nishtar S, Wierzbicki AS, Lumb PJ, Lambert-Hammill M, Turner CN, Crook MA, et al. Waist-hip ratio and low HDL predict the risk of coronary artery disease in Pakistanis. Curr Med Res Opin 2004;20:55-62.

4. Roger VL, Go AS, Lloyd-Jones DM, Adams RJ, Berry JD, Brown TM, et al. Heart disease and stroke statistics—2011 update: a report from the American Heart Association. Circulation 2011;123:18-209.

5. Osman AM, Alsultan MS, Al-Mutairi MA. The burden of ischemic heart disease at a major cardiac center in Central Saudi Arabia. Saudi Med J 2011;32:1279-84.

6. Engelman RM, Rousou JA, Flack III JE, Deaton DW, Humphrey CB, Ellison LH, et al. Fast-track recovery of the coronary bypass patient. Ann Thorac Surg 1994;58:1742-6.

7. Swaminathan M, Phillips-Bute BG, Patel UD, Shaw AD, Stafford-Smith M, Douglas PS, et al. Increasing healthcare resource utilization after coronary artery bypass graft surgery in the United States. Circ Cardiovasc Qual Outcomes 2009;2:305-12.

8. Li Y, Cai X, Mukamel DB, Cram P. Impact of length of stay after coronary bypass surgery on short-term readmission rate: an instrumental variable analysis. Med Care 2013;51:45-51.

9. Hart LG, Salsberg E, Phillips DM, Lishner DM. Rural health care providers in the United States. J Rural Health 2002;18:211-31.

10. Moscovice I, Stensland J. Rural hospitals: trends, challenges, and. a future research and policy analysis agenda. J Rural Health 2002;18:197-210.

11. Zheng Z, Zhang H, Yuan X, Rao C, Zhao Y, Wang Y, et al. Comparing outcomes of coronary artery bypass grafting among large teaching and urban hospitals in China and the United States. Circ Cardiovasc Qual 2017;10:e003327.

12. Yu T-H, Hou Y-C, Tung Y-C, Chung K-P. Why do outcomes of CABG care vary between urban and rural areas in Taiwan? A perspective from quality of care. Int J Qual Health Care 2015;27:361-8.

13. Prabhakaran D, Jeemon P, Roy A. Cardiovascular diseases in India: current epidemiology and future directions. Circulation 2016;133:1605-20.

14. Islam AM, Majumder A. Coronary artery disease in Bangladesh: A review. Indian Heart J 2013;65:424-35.

15. Chassin MR. Achieving and sustaining improved quality: lessons from NewYork state and Cardiac Surgery. Health Aff 2002;21:40-51.

16. Khan AA, Jilani MH, Kazmi KA, Malik AM, Sharif H. Health economics of coronary artery bypass grafts versus percutaneous coronary intervention for revascularization of 3 vessel coronary artery disease in a resource-poor country. AKU 2014. https://ecommons.aku.edu/aku_symposium/2014_nhssr/PP/65/

17. Velebit V, Montessuit M, Bednarkiewicz M, Khatchatourian G, Mueller X, Neidhart P. The Development of Cardiac Surgery in an Emerging Country. Tex Heart Inst J 2008;35:301-6.

18. Boudourakis LD, Wang TS, Roman SA, Desai R, Sosa JA. Evolution of the surgeon-volume, patient-outcome relationship. Ann Surg 2009;250:159-65.