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ORIGINAL ARTICLE

Long-Term Survival Outcomes after Coronary Artery Revascularization Surgery of Bangladeshi Population: A Single Centre Study

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ABSTRACT

Background & objective : Coronary artery bypass graft (CABG) surgery has given symptomatic and structural release of coronary atherosclerotic heart disease. CABG has been performed frequently for more than 30 years in Bangladesh. But there are no nationwide studies on the rate of survival in Bangladesh. The present study was undertaken to find the post CABG surgery survival outcomes and association between risk factors and survival over long time span.

Methods: We studied 650 consecutive patients' post-operative clinical data retrospectively and survival outcome data were collected prospectively who had CABG surgery from 2010 to 2015 in Ibrahim Cardiac Hospital & Research Institute. Of the 650 patients, 84(12.9%) died after a median follow up of 4.9 years. Demographic, clinical, operative and postoperative characteristics were then compared between survived and died patients to find the factors associated with survival.

Result: Analysis revealed that younger patients were more likely to survive [RR = 1.1(95% CI = 1.0-1.2)] longer than those who have had their CABG at or > 55 years (p = 0.001). Males generally had a higher likelihood of survival [RR = 1.1(RR = 1.1(95% CI = 0.9-1.2)] than their female counterparts (p = 0.038). Non-diabetics tend to have a better survival [RR = 2.3(95% CI = 1.3-3.9)] than diabetics (p = 0.001). Non-smokers also have a higher chance of longer survival [RR = 1.5(95% CI = 0.9-2.2)] than the smokers. CABG patients without CKD enjoyed longer survival [RR = 1.4(95% CI = 0.9-2.2)] than CABG patients with CKD (p = 0.006). None of the operative and postoperative factors but hospital stay was associated with longer survival. The survived patients had a shorter mean hospital stay than the patients who died (p = 0.001). Analyses of the causes of death revealed heart disease to be the predominant cause (38%) followed by stroke (12%), CKD (8%) and other causes like cancer, liver disease etc. (42%).

Conclusion: Younger, male, non-smoker, non-diabetic patients may enjoy long-term survival following CABG surgery. Prediction of long-term survival can be used to determine the most appropriate post-discharge care strategies. This would undoubtedly help both patients and doctors to implement behavioral and therapeutic modifications to optimize benefit from surgery.

Key words: Coronary Artery Bypass Grafting (CABG), postoperative survival, factors influencing survival etc.

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INTRODUCTION:

Coronary artery disease (CAD) is presently the leading cause of death worldwide.[1] There has been huge improvement in the management strategies of heart disease in Bangladesh both in terms of pharmacological therapy and revascularization by either percutaneous coronary intervention or Coronary Artery Bypass Graft (CABG) surgery. But Bangladesh is still lagging behind in terms of secondary prevention by cardiac rehabilitation.[2] CABG surgery was introduced nearly five decades ago and it has become clear that this operation relieves angina pectoris and improves quality of life and prolongs survival after CABG surgery.[3-6] The prediction of 30-day or in-hospital mortality is popularly used to evaluate operative risk in cardiac surgery.[7–10] However; this short-term mortality does not provide adequate information to guide long-term post-surgery patient management.[11] 30-day mortality rates have declined over the last few decades due to advancements in surgical technologies and peri- and post-operative care. Improvement of long-term survival following cardiac surgery has now become a more concern to incorporate the management strategies for patients following CABG surgery.[12,13] Prediction of long-term survival can be used to determine the most appropriate post-discharge care strategies. This would, beyond doubt, help both patient and their doctor community to implement behavioral and therapeutic modifications to optimize benefit from surgery.[12]

In 2017, the total number of cardiac operations done in Bangladesh by 25 hospitals was 11,674 as reported by Bangladesh Society of Cardiothoracic Anesthesiologist.[14,15] Among them Ibrahim Cardiac Hospital & Research Institute (ICHRI) is a center of excellence in cardiac care in Bangladesh, where 828 cardiac operations were done during the period.[16] In-hospital morbidity and mortality of patients undergoing cardiac surgery have gradually fallen.[17] Short and mid-term survival and quality of life of patients after discharge from the hospital have also improved.[18-22] But long-term outcome data following CABG surgery is grossly lacking. Although mortality represents a hard end-point after surgery that is useful to benchmark the quality of operative surgery the patients desire a good long-term quality of life from their operation rather than simply a short-term survival. In addition, as patients are increasingly offered the choice of CABG, it is of utmost importance that the surgical community will offer their patients accurate data on both long-term survival and also the likely long-term quality of life from the surgery.[23]

The effective improvement in functional capacity following CABG leads to a better quality of life (QoL). Return to work (RW) is recently described as a main indicator of restored life functioning and state of well-being in patients who undergo CABG,[24,25] though, the return to work rate after CABG is influenced by a wide variety of cultural, social & economic conditions.[26,27] The postoperative re-admission rate is also one potential indicator of the long-term outcome of CABG. Most of the studies focused on the rate of early re-admission as a measure of the quality of medical care at the primary (index) hospitalization for CABG.[28-31] As yet there have been no reports on readmission rates in a long-term perspective. Long-term morbidity, hospital readmission, return to work and activities of daily livings (ADLs) after CABG have not been studied as there are difficulties in obtaining reliable data. Survival benefits have been demonstrated after CABG in certain groups of patients.[32] However, there are limited data available globally and in Bangladesh there is no data at all to help clinicians identify which patients are likely to have an improvement in their overall long-term outcomes following coronary revascularization surgery. So, the present study was intended to provide comprehensive data on the long-term survival rate, hospital readmission, return to work and state of well-being by ADLs in Bangladesh as well as to explore the association between risk factors and postoperative survival outcomes.

METHODS:

Using Cardiac Surgery Department Register Book isolated post CABG patients were identified, who were discharged between January 1, 2010 and December 31, 2015 from Ibrahim Cardiac Hospital & Research Institute (CHRI). However, patients who underwent emergency CABG surgery, CABG with valve or any great artery surgery with implanted ventricular assisted device were excluded. Data were collected on baseline demographics (age at operation, sex), anthropometric variables (weight and height) and preoperative risk factors (hypertension, hypercholesterolemia, diabetes, CKD, COPD, stroke, smoking status and renal dysfunction etc.), peroperative data (On or Off-pump CABG, number of grafts needed and cross-clamp time etc.) and also on post-operative clinical and surgical procedure including ICU and hospital stay. From patients their relatives' mobile numbers were collected and were contacted. A total of 1055 mobile calls were made; of them 650 responded and agreed to participate in the study by answering our structured questions. Then data on survival outcome were collected prospectively by telephone call. The primary outcome variable was post-CABG survival and secondary outcomes were hospital readmission, return to work and state of well-being assessed by ADLs.

Data were analyzed using the statistical analysis software SPSS, version 19.0 (IBM Corp, Armonk, NY). The test statistics used to analyze the data were descriptive statistics, Chi-square (χ^2) Test and Unpaired t-Test. While categorical data were compared between groups using Chi-square (χ^2) Test, continuous data were compared between groups using Student's t-Test. The level of significance was set at 5% and p-value < 0.05 was considered statistically significant.

RESULTS:

Baseline characteristics of the 650 patients are illustrated in Table-I. The mean age of the study patients was 56 ± 8 years. A male preponderance (88%) was observed in the series with male to female ratio roughly being 9:1. The mean Body Mass Index (BMI) was 25 ± 3.07 kg/m^2. The study subjects were generally hypertensive (79%), followed by diabetic (67%), dyslipidemic and smoker (39%). Over 40% had family history ischemic heart disease (Table I). Majority (95%) of the cases was operated on On-pump. The number of grafts needed was on an average 3 ± 1. The average cross-clamp time was 47 ± 20 minutes, while the average ICU stay and hospital stay were 3±1.6 and 9±1.8 days respectively (Table II). Nearly 90% of the patients attended postoperative physiotherapy training class following operation, 5% did not receive the training and 6% could hardly remember whether they received it (Table III). Evaluation of patients after a median follow up period of 4.9 years from the day of discharge demonstrates that majority (87.1%) remain survived. Over 60% of the patients returned to work and 15% required re-hospitalization. Overall 98% were involved in activities of daily living (Table IV).

Factors associated with survival:

Younger patients (patients who underwent CABG before 55 years) were more likely to survive [RR = 1.1(95% CI = 1.0 – 1.2)] longer than those who have had their CABG at or > 55 years (p = 0.001). Males generally had a higher likelihood of survival [RR = 1.1(RR = 1.1(95% CI = 0.9 – 1.2)] than their female counterparts (p = 0.038). Non-diabetics tend to have a better survival [RR = 2.3(95% CI = 1.3-3.9)] than diabetics (p = 0.001). Non-smokers also have a higher chance of longer survival [RR = 1.5(95% CI = 0.9 – 2.2)] than the smokers. CABG patients without CKD enjoyed longer survival [RR = 1.4(95% CI = 0.9 – 2.2)] than CABG patients with CKD (p = 0.006) (Table V). None of the operative and postoperative factors but hospital stay was associated with longer survival. The survived patients had a shorter mean hospital stay than the patients who died (p = 0.001) (Table VI). Mortality data analyses revealed that mortality rates were 2.1% at 1 year, 3.27% at 2 years,

8.04% at 3 years, 14.14% at 4 years, 16.84% at 5 years and 19.71% at 6 years (Fig-1). Analyses of the causes of death revealed heart disease to be the predominant cause (38%) followed by stroke (12%), CKD (8%) and other causes like cancer, liver disease etc. (42%) (Fig- 2).

Table I. Demographics characteristics, risk factors, peri and post-operative data (n=650)

Baseline characteristics	Frequency (%)	Mean ± SD
Age (years)	--	56±8
Sex		
Male	571(88.0)	--
Female	79(12.0)	--
Occupation		
Previously involved with work	468(72.0)	--
Retired	163(25.0)	--
BMI	--	25±3.07
Risk factors:		
DM	434(67.0)	--
HTN	516(79.0)	--
DL	388(60.0)	--
CKD	15(2.3.0)	--
COPD	4(1.0)	--
Smoking status:		
Ex-smoker	254(39.0)	--
Non-smoker	396(61.0)	--
Family history CAD	275(42.0)	--

Table II. Per- and post-operative (in-hospital) status (n=650)

Per- and post-operative (in-hospital) status	Frequency (%)	Mean ± SD
Operative procedure		
On-pump	617(95.0)	--
Off-pump	33(5.0)	--
Number of grafts needed	--	3 ± 1
Cross-clamp time (min)	--	47 ± 20
ICU stay (days)	--	3 ± 1.6
Total Hospital Stay (days)	--	9 ±1.8

Table III. Distribution of patients by long-term outcome (n=650)

Physiotherapy training	Frequency (%)
Received	578(88.9)
Not received	35(5.4)
Don't know	37(5.7)

Table IV. Distribution of patients by long-term outcome* (n=650)

Follow-up long term outcome	Frequency (%)
Survival rate	566(87.1)
Return to work	397(61.0)
Re-hospitalization rate	95(15.0)
ADLs	637(98.0)

* Multiple response

Table V. Association between characteristics of the patients & survival

Risk factors*	Outcome		p-value	Relative Risk (95% CI of RR)
	Survived (n = 566)	Died (n = 84)		
Age (years)				
< 55	247(92.5)	20(7.5)	0.001	1.1(1.0-1.2)
≥ 55	319(83.3)	64(16.7)		
Sex				
Male	503(88.1)	68(11.9)	0.038	1.1(0.9-1.2)
Female	63(79.7)	16(20.3)		
Diabetes				
Yes	365(84.1)	69(15.9)	0.001	2.3(1.3-3.9)
No	201(93.1)	15(6.9)		
Hypertension				
Yes	446(86.4)	70(13.6)	0.338	Not computed
No	120(89.6)	14(10.4)		
Smoking				
Yes	213(83.9)	41(16.9)	0.050	1.5(0.9-2.2)
No	353(89.1)	43(10.9)		
DL				
Present	339(87.4)	49(12.6)	0.786	Not computed
Absent	227(86.6)	35(13.4)		
CKD				
Present	9(60.0)	6(40.0)	0.006	1.4(0.9-2.2)
Absent	557(87.7)	78(12.3)		
Family history of IHD				
Present	243(88.4)	32(11.6)	0.402	Not computed
Absent	323(86.1)	52(13.9)		

Figures in the parentheses indicate corresponding %;
***Chi-squared (χ^2) Test** was done to analyze the data.

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Table VI. Association between characteristics of the patients & survival

Operative & postoperative factors*	Outcome		p-value
	Survived (n = 566)	Died (n = 84)	
Pumping status			
On-pump	539(87.4)	78(12.6)	0.355
Off-pump	27(81.8)	6(18.2)	
Number of grafts			
< 4	319(85.9)	64(14.1)	0.185
≥ 4	175(89.7)	20(10.3)	
Cross-clamp time (minutes)	47.1 ± 20.4	49.5 ± 22.9	0.312
ICU stay (days)	2.9 ± 1.4	3.1 ± 2.2	0.533
Total hospital stay (days)	8.5 ± 1.8	9.4 ± 2.2	0.001

Figures in the parentheses indicate corresponding %;
***Chi-squared Test** (χ^2) was done to analyze the data.

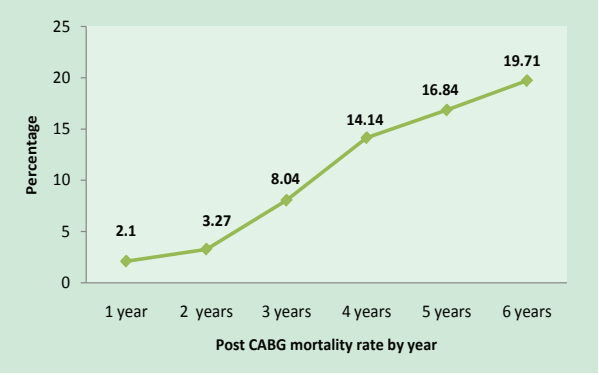

Figure-1: Post CABG mortality rate by year

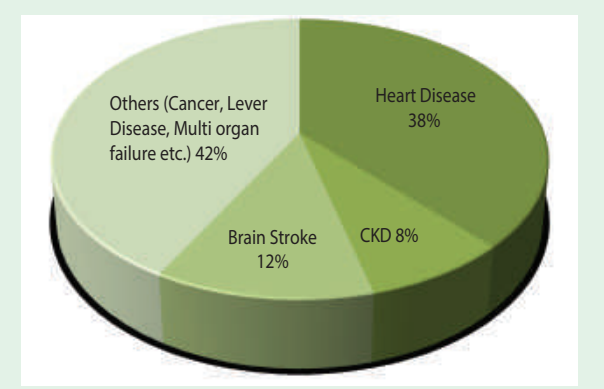

Fig. 2: Distribution of died patients by their causes of long-term mortality

DISCUSSION:

In the present study, the subjects who have had CABG surgery at ages 55 or > 55 years had higher long-term mortality. Dramatic impact of age on survival was evident in age-cohorts of patients undergoing surgical and percutaneous revascularization.[33] Studies also revealed older patients with higher all-cause mortality and other post-operative outcomes compared to younger patients.[34,35] An understanding of the efficacy of CABG in patients of different ages is, therefore, needed to help inform clinical decision making.[36]

Women have a worse long-term outcome after CABG than men which is consistent with the previous studies.[37] One reason may be that women in the present study were older than men (on an average > 1 year older) at time of surgery. Women more often require urgent surgery and have a smaller body surface area and luminal diameter of the coronary artery than men, which may lead to more challenging surgery, and could possibly explain our findings.[38,39]

However, impact of age associated mortality correlates on survival varies considerably. One would expect that the effect of age on mortality might be partially accounted for by other risk factors associated with the aging process, such as higher prevalence of diabetes mellitus, systemic hypertension and CKD. In the present study, diabetic patients carried significantly higher risk of long-term mortality than the non-diabetics. Similarly, previous studies showed diabetes mellitus to be independently associated with increased mortality among patients with ischemic cardiomyopathy and as an independent predictor of 5-year mortality and of lower 5-year cardiac-related event-free survival.[40,41] Smokers and CKD patients were also less likely to enjoylong-term survival as evident in the present study.

The prognosis of patients with ischemic heart disease has improved over the past 3 decades.[42] This improvement in survival occurred despite a concomitant increase in comorbidity in CABG patients over the past 30 years.[43] Possible explanations include improved surgical techniques, as well as wider use of post CABG medical treatments, such as statins and

aspirin.[44,45] Areas of future investigation include assessment of CABG-related morbidity, quality of life, and functional status.

LIMITATIONS

The 8-year time period that the patients in this study were recruited may introduce a time factor error. This is a common confounding factor of any large study over a prolonged period of time. LVEF was not found in discharge summary.

CONCLUSION:

Younger, male, non-smoker, non-diabetic patients may enjoy long-term survival following CABG surgery. Long-term survival outcome evaluation following CABG surgery have made cardiac surgeons motivated to refine their coronary revascularization techniques in order to maximize clinical effectiveness, limit costs and reduce invasiveness. Prediction of long-term survival can go a long way to determine the most appropriate post-discharge care strategies. This would essentially help patients and their doctors to implement behavioral & therapeutic modifications to optimize benefit from surgery.

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