ARTICLE

Profile and length of stay of coronary artery bypass graft patients in the Cape metropolitan area

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Study aim. To describe the profile and selected outcomes of coronary artery bypass graft (CABG) patients admitted to both private and public hospitals in the Cape metropolitan area.

Design. A prospective descriptive study design with a multi-centre observational approach was followed.

Method. Only patients undergoing isolated CABG surgery were included in the study. Demographic data, pre-operative medical status, and intra-operative and postoperative information were collected using a self-designed structured initial assessment tool. Relationships between different variables were analysed by means of analysis of variance (ANOVA), correlations, linear and logistic regressions.

Results. 245 patients were admitted to the seven hospitals that provide CABG surgery in the Cape metropolitan area. The mean age of the sample was 60 (±10) years. The mean length of stay (LOS) of the total cohort was 12.1 (±5.5) days, with patients in the state hospitals staying longer (13.4 (±7.1) days) than private patients (11.7 (±4.8) days). Patients aged ≥60 years were twice as likely to have a LOS >12 days (odds ratio 2.49; 95% confidence interval 1.33 - 4.65). The development of a pleural effusion or pneumothorax was associated with an increased LOS (p<0.01). At least one postoperative pulmonary complication (PPC) was reported in 65% of the population.

Conclusion. Patients in this cohort were younger than in developed countries. Age ≥60 years was a predictor of LOS of more than 12 days. Patients were most likely to develop a PPC on day 3 after CABG surgery.

Recent studies conducted internationally have shown that the typical patient undergoing coronary artery bypass graft (CABG) surgery is older than 70 years of age, a Caucasian (white) male, usually presents with multiple co-morbidities, and has an acute care length of stay (LOS) of 5 days after surgery.[1-5]

In developed countries such the USA and Japan CABG surgery is one of the most common major operations.[6,7] In South Africa, where health care services are provided by both the public and private health sectors,[8] the burden of cardiothoracic surgery is largely borne by the private sector, which performs 860 operations per million annually as opposed to 59 per million in the public sector.[8] Of our population of approximately 48 million, only 7.6 million (16% of the population) have access to medical aid.[9] The remaining 84% is solely dependent on the public health sector for specialised care such as cardiothoracic surgery.[8]

Only recently the former Minister of Health, Dr Tshabalala-Msimang, commented on the rising cost of health care, specifically in the private sector. She stated that there is little evidence that tariff increases have been accompanied by improvements in quality of care or health outcomes.[10]

According to Aggerwal *et al.*,[11] 'the careful study of cardiac patients' demographics is essential as it impacts on patient management at every stage of care'. Physiotherapists in this country therefore need to know the possible implications of demographic differences with regard to provision of care. The purpose of this study was to establish (*i*) whether patients undergoing CABG surgery in Cape Town had a similar demographic profile (age, gender, race) and outcomes (mortality, incidence of postoperative pulmonary complications and LOS) to their international counterparts; and (*ii*) whether patient profile and outcomes were similar for the private and public health care sectors.

Research methodology

Setting and study design

This study was conducted in five of the six private hospitals that currently provide CABG surgery as well as the two state hospitals in the Cape metropolitan area. The sixth private hospital was not included in the study because it was not fully operational at the time of data collection. A multi-centre prospective cohort observational study design was used.

Sample and sampling procedure

All patients who underwent isolated (revascularisation only) elective or emergency CABG surgery in the seven hospitals during the period 15 August - 15 November 2005 were included in the sample. Patients undergoing either elective or emergency surgery were identified prospectively from the patient register book or theatre list which is kept in the cardiothoracic intensive care unit.

Instrument

A structured initial assessment (SIA) tool was developed by the researcher for the purpose of this study (appendix A). On the basis of the current literature, the following categories were included: demographic data (age, gender, race), pre-operative medical status (cardiac, renal and pulmonary status, level of activity), intra- and postoperative information (anaesthetic time, duration of intubation), and the outcome measures commonly used, such as postoperative pulmonary complications (PPCs) and LOS. A pilot study of the SIA tool was performed a month before the data collection period.

Research procedures

Theatre lists and patient register books were checked daily by qualified physiotherapists working at each of the seven hospitals to identify patients scheduled for CABG surgery. Once identified, patients were assessed by physiotherapists and the SIA tool was completed. In emergency cases all information was collected postoperatively by the same physiotherapists. Intra-operative information was collected by the attending physiotherapist postoperatively. Extubation times were obtained from patients' ICU flow charts. In the private hospitals, radiological reports were checked daily by the attending physiotherapist for the occurrence of PPCs and only the date of the initial occurrence was documented. In the absence of radiological reports, as in the state hospitals, an independent radiologist reported on the chest X-rays retrospectively. The completed SIA tool was collected from each hospital by the researcher on a weekly basis and cross-checked for any missing data. Data from completed SIA tools were then captured onto a spreadsheet.

Statistical analysis

Means and standard deviations were calculated using the Statistica and Microsoft Excel programmes where applicable. To determine relationships between different variables, the following statistical techniques were used:

- **Analysis of variance (ANOVA)** to determine possible differences in average measurements between various groups. In cases where it appeared that the ANOVA assumptions were violated, non-parametric bootstrap techniques were employed.
- **Correlations** to determine the relationships between pairs of measurements.
- **Linear regression** to determine the combined relationships between measurements, e.g. for age and pleural effusion and LOS.
- **Logistic regression** to determine the combined effects of measurements on a categorical variable.
- A ***p*-value** of ≤0.05 was used to indicate statistical significance.
- **Probability calculations (odds ratios, ORs)** were calculated and significant risk was identified by 95% confidence limits around ORs where neither 95% confidence limits encompass the value of 1.

Ethical considerations

Approval for the study was obtained through the Committee for Human Research, Stellenbosch University. All patient information obtained remained confidential.

Results

A total of 254 patients were admitted to both private and state hospitals during the 3-month data collection period. More than 75% (*N*=187) of the data finally analysed were from private hospitals. A total of 9 patients were lost during the data collection period due to: (*i*) written consent not being obtained from 7 patients; (*ii*) the hospital records of 1 patient not being retrievable; and (*iii*) 1 patient refusing to participate in the study. Although 8 patients (private *N*=6, state *N*=2) died during the data collection period, their information was still used in the study as consent had been obtained prior to surgery. Therefore in total data for 245 patients were analysed.

Demographic and pre-operative medical status

The demographics of this population group, which included age, gender, race and body mass index (BMI), are depicted in Table I. Participants were predominantly male in both private and state hospitals.

Table I. Demographic and pre-operative medical history

	Total sample (*N*=245)	Private (*N*=187)	%	Public (*N*=58)	%
Age					
>70 yrs	52	43	23	9	15
<70 yrs	193	144	77	49	85
Mean age	60.9 (±10.0)	62.0 (±10.5)		59.0 (±9.7)	
Gender					
Female	54	37	20	17	29
Male	191	150	80	41	71
Mean BMI	28.4 (±4.5)	28.4 (±4.4)		28.3 (±5.0)	
Cardiac status					
Hypertension	165	115	62	50	86
Aortic stenosis	57	39	21	18	31
Unstable angina	189	147	79	42	72
Race					
White	169	153	82	16	26
Coloured	63	24	13	39	67
Black	9	7	4	2	3
Indian	4	3	2	1	2
Diabetic	68	50	27	18	31
Renal failure	9	4	2	5	8
Type of surgery					
Elective	187	145	77	42	73
Emergency	58	42	23	16	27
Health behaviour					
Smokers (yes)	157	113	61	44	76
Active lifestyle (yes)	86	77	41	9	16

The mean age for the total sample was 60.9 (±10) years, and mean age differed minimally between hospital types (Table I). While differences in age and BMI between the private and state hospitals were not statistically significant, racial groups did vary between the institutions.

Selected outcomes

Mortality and postoperative pulmonary complications (PPCs)

The mortality rate was 3% (*N*=8). The incidences of the four most common PPCs after cardiac surgery (atelectasis, pleural effusion, pneumonia and pneumothorax) are depicted in Fig. 1. Only 35% (*N*=86) of the total sample did not develop any PPCs after surgery. PPCs were commonly reported within the first 3 days after surgery in both private and state hospitals.

The incidence of the four PPCs varied minimally between hospital types (Table II). Patients could present with more than one PPC; however, there was no statistical significance on the outcome of LOS (Fig. 2).

No correlation was found between the risk factors (age, gender, smoking history, time under anaesthesia and length of intubation) and occurrence of any of the four postoperative pulmonary complications. However, non-linear regression indicated that longer duration of anaesthesia tended to be associated with postoperative atelectasis, and increased age to be significant in prediction of pleural effusion.

Length of stay

The mean LOS for the total sample was 12.1 days (±5.5). Mean length of stay for state patients was 13.4 days (±7.1) and that for the private patients only 11.7 days (±4.8). Although there was a significant relationship between age and LOS in the private hospitals, the correlation (r=0.23) was not strong (Fig. 3).

The sample was divided into the group of participants staying for ≥12 days and <12 days. Confidence intervals (95%) and ORs were calculated to ascertain whether the variables female gender, age and incidence of PPC were able to predict a LOS of more than 12 days (Table III).

Discussion

With respect to gender, pre-operative risk factors and health behaviours, the current study sample was similar to that of international studies conducted on CABG

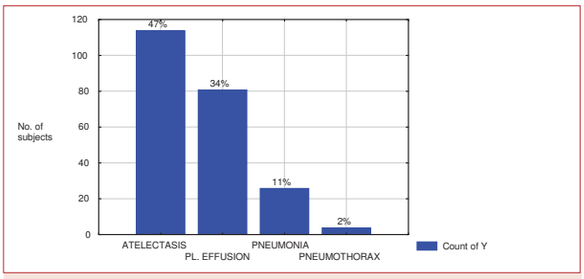

Fig. 1. Incidence of PPCs (N=245).

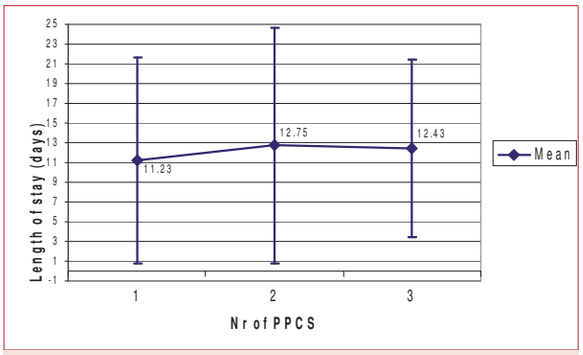

Fig. 2. Relationship between LOS and number of PPCs.

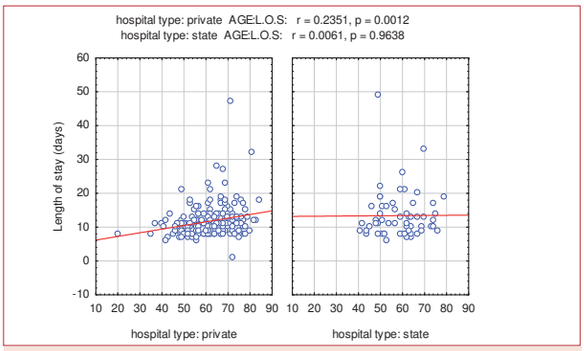

Fig. 3. Relationship between age and LOS – private v. state hospital.

Table II. Incidence of PPCs (%): private v. state

PPC	Private	State
Pneumonia	12	<1
Atelectasis	46	48
Pleural effusion	30	43
Pneumothorax	<1	<1

surgery patients.[1-3,5,11-13] With regard to the outcomes of PPCs and mortality, the current study reported similar findings as well.[14-16] However, two distinct differences in the profile and outcome of the current study emerged, namely patients presenting for CABG surgery at a younger mean age and longer acute care LOS than in international studies. The mean age of 60.9 years reported in the current study is 10 years younger than that in international studies.[1,3,5,12,13] The older ages of populations in international studies have been attributed to an increase in the mean age in the elderly population in westernised countries.[1,3,5] The range of minimally invasive procedures and pharmacological techniques to delay surgical intervention developed over the past decade has also resulted in the population in international studies being older. Although these techniques are also widely used in South Africa, the ageing population has not increased to the same extent as in westernised countries.

The mean LOS in the current sample was more than double that reported in the current international literature.[17] In developed countries, such as the USA and Europe, patients undergoing CABG surgery have a postoperative LOS of only 4 days in acute care settings.[2,5,12,17,18] In the current study, age older than 60 years was the only predictor of a longer LOS (>12 days; OR 2.49 (significant), CI 1.33 - 4.65). Having age as the only predictor for a longer LOS could be attributed to the omission of variables such as APACHE score, bypass time, and previous myocardial infarction from the SIA tool.

Efficient use of health care resources is receiving increasing attention as health insurers constantly investigate ways to diminish the cost of expensive elective procedures such as CABG surgery. Postoperative LOS has long been identified as 'one of the chief drivers of hospital resource consumption by CABG surgery patients'.[17] When comparing LOS in the private and state hospitals, no statistically significant difference ($p>0.05$) was seen (11.7 v. 13.4 days). A possible reason for the seemingly longer LOS in state hospitals could be that some patients come from outlying areas or neighbouring provinces and need to wait for state transport before they can be discharged home. At the same time, the shorter LOS in the current international literature should be viewed in context as patients are likely to be discharged to a step-down

Table III. Odds ratios for LOS

Variable	OR	Upper 95% CI	Lower 95% CI
Female gender	1.34	0.67	2.69
Age >60	2.49*	1.33*	4.65*
PPC	1.35	0.73	2.49
Female gender & PPC	1.39	0.59	3.23

*Significant values.

facility rather than home.[5,19] According to Lazar *et al.*,[19] patients who were discharged early (within 5 days) after CABG surgery spent on average an additional 10 days in step-down facilities. It must, however, be recognised that although step-down facilities allow for early discharge from acute care facilities, additional costs are still incurred. In the Cape metropolitan area there are only a few step-down facilities to which patients may be referred for prolonged care after CABG surgery. These facilities are exclusively private.

Reporting of PPCs after CABG surgery varies greatly between studies, with an incidence ranging between 6% and 88%.[15] This large range can be attributed in part to the variability of the PPCs reported after CABG surgery as well as variability in their definition.[15,20] The incidence and type of PPCs in the current study were no different to those in international studies, and did not negatively impact on the LOS or mortality rate of the sample. The question is therefore really whether the reporting of PPCs after CABG surgery is still valid or if we as therapists should be shifting our focus to a more holistic view using outcome measures such as health-related quality of life or functional capacity after CABG surgery.

Conclusion

The profile of CABG surgery patients in the Cape metropolitan area, while comparable to those in developed countries, none the less displayed two distinct differences, namely a younger population (<70 years of age) and a longer mean LOS, in both private and state hospitals. Although in the current study there were fewer admissions to state hospitals than to private hospitals, outcomes with regard to LOS and PPCs were similar, which may imply that management of CABG surgery patients in the two health care sectors in the Cape metropolitan area is comparable.

This study provides a very focused snapshot picture of the profile and outcome of patients admitted for CABG surgery in the South African context. It also raises interesting questions with regard to the postoperative management of these patients and the potential role of physiotherapy in reducing the LOS that need to be answered.

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1. Fuster RG, Montero JA, Gill Ó, *et al.* Trends in coronary artery bypass surgery: Changing type of surgical patient. *Rev Esp Cardiol* 2005; 58(5): 512-522.
2. Abramov D, Tamariz MG, Fremes SE, *et al.* Trends in coronary artery bypass surgery results: A recent, 9-year study. *Ann Thorac Surg* 2000; 70: 84-90.
3. Ferguson TB, Hammill BG, Peterson ED, DeLong ER, Grover FL. A decade of change-risk profiles and outcomes for isolated coronary artery bypass grafting procedures, 1990-1999: A report from the STS National Database Committee and the Duke Clinical Research Institute. *Ann Thorac Surg* 2002; 73: 480-490.
4. Scott BH, Seifert FC, Grimson R, Glass PSA. Octogenarians undergoing coronary artery bypass graft surgery: Resource utilization, postoperative mortality, and morbidity. *J Cardiothorac Vasc Anesth* 2005; 19(5): 583-588.
5. Engoren M, Arslanian-Engoren C, Steckel D, Neihardt J, Fenn-Buderer N. Cost, outcome and functional status in octogenarians and septuagenarians after cardiac surgery. *Chest* 2002; 122(4): 1309-1315.
6. Kurki TS, Kataja M, Reich DL. Emergency and elective coronary bypass grafting: Comparisons of risk profiles, post operative outcomes, and resource requirements. *J Cardiothorac Vasc Anesth* 2003; 17(5): 1-9.
7. Chen-Scarabelli C. Beating heart coronary artery bypass graft surgery: Indications, advantages and limitations. *Critical Care Nurse* 2002; 22(5): 44-58.
8. Department of Health, 2002. Report by Cardiothoracic surgeons. http://www.doh.gov.za/mts/reports/cardiosurgery.html (accessed 17 March 2005).
9. Statistics South Africa, 2001. Census 2001. http://www.statssa.gov.za/census01/html (accessed 20 April 2005).
10. Khumalo S. Manto firm over private healthcare. *The Mercury* 15 July 2008, p. 1.
11. Aggarwal SK, Fox SA, Stitt L, *et al.* The new cardiac surgery patient: defying previous expectations. *Can J Surg* 2006; 49(2): 117-122.
12. Aldea, GS, Gaudini JM, Shapira ÖM, Jacobs AK, *et al.* Effect of gender on postoperative outcomes and hospital stays after coronary artery bypass grafting. *Ann Thorac Surg* 1999; 67(4): 1097-1103.
13. Estafanous FG, Loop FD, Higgins TL, *et al.* Increased risk and decreased morbidity of coronary artery bypass grafting between 1986 and 1994. *Ann Thorac Surg* 1998; 65: 383-389.
14. Hulzebos EHJ, Van Meerteren NLU, De Bie RA, *et al.* Prediction of postoperative pulmonary complications on the basis of preoperative risk factors in patients who had undergone coronary artery bypass graft surgery. *Phys Ther* 2003; 83(1): 8-16.
15. Wynne R. Variable definitions: implications for the prediction of pulmonary complications after adult cardiac surgery. *European Journal of Cardiovascular Nursing* 2004; 3: 43-52.
16. Brooks-Brunn J. Predictors of postoperative pulmonary complications following abdominal surgery. *Chest* 1997; 111: 564-571.
17. Peterson ED, Coombs LP, Ferguson TB, *et al.* Hospital variability in length of stay after coronary artery bypass surgery: Results from the society of thoracic surgeon's national cardiac database. *Ann Thorac Surg* 2002; 74: 464-473.
18. Ghali WA, Quan H, Shrive FM, Hirsch GM. Outcomes after coronary artery bypass graft surgery in Canada: 1992/93 to 2000/01. *Can J Cardiol* 2003; 19: 774-781.
19. Lazar HL, Fitzgerald CA, Ahmed T, *et al.* Early discharge after coronary artery bypass graft surgery: Are patients really going home earlier? *J Thorac Cardiovasc Surg* 2001; 121: 943-950.
20. Pasquina P, Tramèr MR, Walder B. Prophylactic respiratory physiotherapy after cardiac surgery: systematic review. *BMJ* 2003; 327: 1739-1744.