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ORIGINAL ARTICLE

Impact of Socioeconomic Status and Rurality on Early Outcomes and Mid-term Survival after CABG: Insights from a Multicentre Registry

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Background We examined whether socioeconomic status and rurality influenced outcomes after coronary surgery.

Methods We identified 14,150 patients undergoing isolated coronary surgery. Socioeconomic and rurality data was obtained from the Australian Bureau of Statistics and linked to patients' postcodes. Outcomes were compared between categories of socioeconomic disadvantage (highest versus lowest quintiles, n= 3150 vs. 2469) and rurality (major cities vs. remote, n=9598 vs. 839).

Results Patients from socioeconomically-disadvantaged areas experienced a greater burden of cardiovascular risk factors including diabetes, obesity and current smoking. Thirty-day mortality (disadvantaged 1.6% vs. advantaged 1.6%, p>0.99) was similar between groups as was late survival (7 years: 83±0.9% vs. 84 ±1.0%, p=0.79). Those from major cities were less likely to undergo urgent surgery. There was similar 30-day mortality (major cities: 1.6% vs. remote: 1.5%, p=0.89). Patients from major cities experienced improved survival at seven years (84±0.5% vs. 79±2.0%, p=0.010). Propensity-analysis did not show socioeconomic status or rurality to be associated with late outcomes.

Conclusion Patients presenting for coronary artery surgery from different socioeconomic and geographic backgrounds exhibit differences in their clinical profile. Patients from more rural and remote areas appear to experience poorer long-term survival, though this may be partially driven by the population's clinical profile.

Keywords Coronary artery disease • Coronary artery bypass • Surgery • Rurality • Socioeconomic disadvantage

Introduction

Coronary artery disease is one of the leading causes of mortality and morbidity in the western world. Its medical and surgical management is largely concentrated in tertiary referral centres in major metropolitan areas throughout the world.

In Australia, patients from regional and remote areas experience poorer health outcomes. Indeed, mortality rates in

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regional and remote areas were 10-70% higher than in major cities with reduced overall life expectancy [1]. Similarly, socioeconomic disadvantage is associated with increased rates of cardiovascular risk factors such as obesity, dyslipidaemia and smoking. Compounding this is the fact that those from rural and socio-economically disadvantaged areas experience physical, financial and social barriers to accessing health care practitioners and services, thus further impacting upon health outcomes [2].

The centralised nature of cardiology and cardiac surgical services in Australia means there are substantial barriers to patient access, which has the potential to negatively impact upon surgical outcomes despite the efforts to uphold the quality of peri-operative inpatient care. As such, we sought to evaluate the clinical profile, early outcomes and late survival of patients presenting for coronary surgery, to identify whether rurality and socio-economic status were predictors of early and late outcome.

Methods

Data Collection

We performed a retrospective review of a multicentre database containing all adult cardiac procedures performed from July 1st, 2001 to December 31st, 2009 in 10 institutions.

Data was prospectively compiled as part of the Australian and New Zealand Society of Cardiac and Thoracic Surgeons (ANZSCTS) database project, which records all adult cardiac surgery procedures in the state of Victoria performed in public hospitals, and has been described previously [3]. Mid-term survival status of patients was obtained from the Australian National Death Index, which records all deaths within Australia.

Patient Sample

We identified 14,150 patients undergoing isolated first-time CABG from 2001-2009 across 10 centres in the State of Victoria in Australia. The State of Victoria has a population of approximately 5.7 million, making it the second-most populous State in Australia after New South Wales (7.4 million)

Patients' degree of socioeconomic disadvantage was determined by linking their residential postcode to the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) from the Australian Bureau of Statistics [4]. This is an index (scale of 1 to 10) incorporating a range of information about the economic and social conditions of people and households within areas defined by postcodes. Here, a low score indicates relatively greater disadvantage. To enable a sizeable group for statistical comparison, the deciles of socioeconomic disadvantage were collapsed into quintiles.

Rurality was measured by linking residential postcodes to the Australian Statistical Geography Standard – Remoteness Area (ASGC-RA) classification [5]. In this classification, postcodes are placed into five categories, RA1: Major Cities, RA2: Inner Regional, RA3: Outer Regional, RA4: Remote and RA5: Very Remote. The categories incorporate the physical distance of a location from the nearest urban centre including access to goods and services based on population size. Once again, to enable sizeable numbers for statistical analysis, the five categories were collapsed into three categories: Major Cities, Regional and Remote.

In the socioeconomic analysis, Outcomes were compared between the quintiles of most and least socioeconomic disadvantage (highest versus lowest quintiles, n= 3150 vs. 2469). The remaining categories were excluded for analysis to minimise heterogeneity and isolate the impact of socioeconomic disadvantage.

In the rurality analysis, comparisons were made across three categories of rurality (Major Cities vs. Regional vs. Remote, n=9598 vs. 3713 vs. 839). The regional group was excluded for the propensity-score analysis to enable a strictly two-group analysis.

Study endpoints

Our end points comprised of early mortality and morbidity in addition to long-term survival. Early outcomes included seven major early post-operative events. These were 30-day mortality, myocardial infarction (MI), stroke, new renal failure, prolonged ventilation (greater than 24 hours), return to the operating theatre, and readmission to hospital within 30 days. MI was defined as at least two of the following: cardiac enzyme elevation (creatinine kinase-myocardial band [CK-MB]>30 U/L or troponin>20 mg/L), new wall motion abnormalities, and new Q waves on at least two serial electrocardiograms. New renal failure was defined as at least two of the following: serum creatinine increased to >0.20 mmol/L, doubling or greater increase in serum creatinine over the preoperative value, and a new requirement for renal replacement therapy. We also examined a composite endpoint of 'mortality/any morbidity' which encompasses the events listed above.

Statistical analysis

Preoperative demographic and investigative data, operative variables and post-operative (30-day) mortality, morbidity and seven-year survival were compared between the study groups.

Categorical variables were expressed as frequencies and compared using the Fisher exact and chi-squared tests. Continuous variables were expressed as mean ± standard deviation and compared using the unpaired t-test. The Kaplan-Meier method was used to analyse survival. Multivariable logistic regression and Cox regression, both performed in a backward elimination fashion, were used to identify independent predictors of early and late outcomes respectively.

Propensity-score matching was performed to correct for differences in the clinical profiles of those patients with different socioeconomic and geographic backgrounds. A propensity-score was generated for each patient in the standard fashion by performing a logistic regression with the socioeconomic or rurality category as the dependent variable. Baseline clinical and investigative variables which are expected to influence cardiac surgery patient outcomes were included. These are displayed in Table 1. The c-statistic was calculated for the propensity model. Once generated,