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REVIEW

A Review of Coronary Artery Bypass Grafting in the Indigenous Australian Population

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Introduction Indigenous Australians experience poorer health outcomes than non-Indigenous Australians. Ischaemic heart disease is a leading contributor to the mortality gap which exists between Indigenous and non-Indigenous Australians.

Methods We reviewed the literature in regards to Indigenous Australians undergoing coronary artery bypass grafting (CABG) for management of ischaemic heart disease.

Results Younger patients with higher rates of preventable risk factors constitute the Indigenous Australian CABG population. Indigenous Australian females are over-represented in series to date. High rates of left ventricular dysfunction are seen in the Indigenous CABG cohorts potentially reflecting barriers to medical care or the influence of high rates of diabetes observed in the Indigenous Australian population.
The distribution of coronary artery disease appears to differ between Indigenous Australian and non-Indigenous CABG cohorts likely reflecting a difference in the referral patterns of the two population groups with diabetes again likely influencing management decisions.
Reduced utilisation of arterial conduits in Indigenous Australian cohorts has been identified in a number of series. This is of particular concern given the younger age structure of the Indigenous Australian cohorts.
Indigenous Australian patients suffer excess morbidity and mortality in the longer term after undergoing CABG. Ventricular dysfunction and excess comorbidities in the Indigenous Australian CABG population appear largely responsible for this.

Conclusion Excess morbidity and mortality endured by Indigenous Australians in the longer term following CABG appears largely contributed to by higher rates of ventricular dysfunction and comorbidities in the Indigenous Australian CABG population. Maximising internal mammary artery use and continued focus on strategies to reduce the impact of diabetes, renal impairment and heart failure in the Indigenous Australian population is essential to reduce the mortality gap experienced by Indigenous Australians secondary to ischaemic heart disease.

Keywords Indigenous Australians • Coronary artery disease • Coronary artery bypass grafting (CABG) • Cardiovascular risk factors

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Introduction

For the purpose of this paper the term Indigenous Australians is used to encompass both Aboriginal Australians and/or Torres Strait Islander peoples.

Indigenous Australians experience poorer health outcomes than non-Indigenous Australians and a significant mortality gap exists between the populations [1].

Ischaemic heart disease (IHD) represents the leading specific cause of death in the Indigenous Australian population [2]. Most recent estimates show IHD representing the greatest contributor to the disparity in life expectancy between Indigenous and non-Indigenous Australian males accounting for 18.8% of the mortality gap [2]. It also accounted for 9.5% of the mortality gap between Indigenous and non-Indigenous Australian females with diabetes accounting for 21.4% [2].

Cardiac surgery, in the form of coronary artery bypass grafting (CABG) may represent an integral part of the treatment regimen of a patient with more advanced coronary artery disease [3]. There is a relative paucity of data in relation to research on Indigenous Australians undergoing CABG. In addition, there is a lack of data reporting outcomes of Indigenous Australians undergoing percutaneous coronary intervention (PCI) and, therefore, the vast majority of data in regards to revascularisation outcomes in the Indigenous Australian population is from CABG series. Composing a narrative review of the available CABG literature forms the aim of our manuscript.

Materials and Methods

A broad search of the literature was undertaken to identify relevant research reporting on the outcomes of CABG in the Indigenous Australian population. The search was conducted utilising an electronic search of the PubMed database to 1 June 2016. Search terms utilised to identify all relevant studies included 'Indigenous' or 'Aboriginal' or 'Torres Strait Islander' and 'Australia' combined with 'ischaemic heart disease' or 'coronary artery disease' or 'coronary artery bypass grafting' or 'percutaneous intervention'. Following initial screening based on abstracts, the full texts of potentially relevant articles were obtained. Only English language papers reporting on the outcomes of CABG in the Indigenous Australian population were included in the review. The reference lists of all retrieved articles were examined in order to identify additional potentially relevant studies for inclusion.

Results

Eight studies thus far have investigated outcomes of Indigenous Australians undergoing CABG (Table 1).

The first series published was from Western Australia in 2004 [4]. In this series, records of patients undergoing surgery at a single centre between 1996 and 2001 were retrospectively reviewed. Indigenous Australian patients (CABG and valve surgery patients included) formed 2.3% (57/2518) of the surgical cohort. Forty-five (45) patients underwent isolated CABG. Two (2) patients underwent CABG along with mitral valve repair. The mean age of Indigenous Australian patients undergoing CABG was 49.5 years to 14 years younger than the non-Indigenous cohort. High rates of preventable risk factors were observed in the Indigenous Australian patients undergoing CABG. One of the two patients in the combined mitral repair group died perioperatively. Patient follow-up was difficult with only 41.1% of Indigenous Australian patients able to be contacted directly following a mean follow-up period of 2.93 years. Some form of patient follow-up was able to be obtained in 78% (n = 35) of CABG patients (including contact with general practitioner, community nurse and next of kin) with two of these patients being deceased. No direct comparison was made with the non-Indigenous group.

A single centre series from Melbourne reporting on ethnic diversity and perioperative outcomes of patients undergoing first time isolated CABG between 2001 and 2007 included 20 Indigenous Australian patients within a patient cohort of 645 (3.1%) [5]. In this retrospective review, Indigenous Australian patients were more likely to be smokers and have diabetes. Reduced utilisation of arterial conduit was noted in the Indigenous Australian cohort (60% vs. 94%; $p = 0.02$). This was likely due to a higher proportion of Indigenous Australian patients undergoing non-elective procedures (70% vs. 30%; $p = 0.02$) with a need to hasten conduit availability. In regards to postoperative morbidity, Indigenous Australian patients were more likely to develop postoperative respiratory failure, renal failure requiring temporary dialysis and have longer intensive care unit (ICU) and hospital stays compared with other ethnic groups. There was no excess in perioperative or 6-month mortality.

The majority of the research into outcomes of Indigenous Australians undergoing cardiac surgery is from Adelaide. Lehman et al. retrospectively reviewed cardiac surgical outcomes between 2000–2005 in Indigenous Australian patients at Flinders Medical Centre [6]. 283 Indigenous Australian patients represented 10.7% of the entire surgical cohort. The mean age of Indigenous Australian patients undergoing isolated CABG was 52 years, 13 years younger than non-Indigenous patients ($p \leq 0.001$). In regards to the surgical cohort as a whole (CABG and valve surgery patients), there was a higher proportion of Indigenous Australian females. Indigenous Australian patients were more likely to have comorbidities including diabetes and renal dysfunction and to be current smokers (Table 1). Indigenous Australian patients were more likely to have moderate-severe left ventricular dysfunction but overall, due to the younger age of the cohort, had a lower predicted perioperative mortality (median EuroSCORE 2.08 [IQR, 1.49–3.92] v 2.49 [IQR, 1.51–5.13]; $p < 0.001$). Although not statistically significant, higher operative mortality and higher late mortality (median follow-up 45 months) was noted in the Indigenous Australian cohort

Table 1 Surgical Series CABG in the Indigenous Australian Population.

Study	Years	Centre	Indigenous Australian CABG patients (proportion total CABG cohort)	Age		% Female		Excess risk factors/preoperative variables reported Indigenous Australian cohort	Perioperative mortality			Excess rerioperative morbidity in Indigenous Australian cohort	Follow-Up period (Yrs)	Long-Term mortality			MACCE (Long-Term)		
				IA	Non-IA	IA	Non-IA		IA	Non-IA	HR (95% CI) or p-value			IA	Non-IA	HR (95% CI)	IA	Non-IA	p-value
Kejriwal [4]	1996–2001	Perth	47 (2.3%)	49.5	63.4	33.3%[a]	NR	NR	2.1%	NR	N/A	NR	2.93	5.7%	NR	N/A	8.6%	NR	
Elahi [5]	2001–2007	Melbourne	20 (3.1%)	58.2	63.4	NR	NR	- Smoking - Diabetes	3.1%	3.1%	p = 0.48	- Respiratory failure - Dialysis - Prolonged ICU stay - Prolonged hospital stay	0.5	3.9%	3.8%	p = 0.68	NR	NR	
Lehman [6]	2000–2005	Adelaide	142 (7.3%)^Note isolated CABG patients	52	65	40.3%[a]	28%[a]	- Diabetes[a] - Renal dysfunction[a] - Current smoking[a] - Left ventricular dysfunction[a]	2.5%[a]	1.5%[a]	1.67 (0.74-3.75)[a]	Nil	3.75	12.7%[a]	10.9%[a]	1.41 (0.99–1.99)	NR	NR	
													5yr Mortality CABG	17.8%	10.6%	NR			
Alizzi [7]	1993–2008	Adelaide (NT patients)	252 (41.9%)	45.4[a]	60.7[a]	39.7%[a]	22.6[a]	- Heart failure[a] - Respiratory disease[a] - Renal disease[a]	2.1%[a]	1.2%[a]	p = 0.30	- Dialysis[a] - Composite endpoint (see text)[a]	NR	NR	NR	N/A	NR	NR	
Prabhu [8]	1998–2008	Adelaide	297 (10.7%)	52	65	29.6	22.7	- Diabetes - Smoking - Renal disease - Left ventricular dysfunction	1.3%	1.4%	p = 0.91	- Dialysis - Composite endpoint (see text)	7.5	27.6%	25.5%	1.30 (1.03–1.64)	NR	NR	
Matebele [9]	2002–2009	Brisbane	165 (2.3%)	55	NR	40.5%[a]	NR	NR	0.45%[a]	NR	N/A	NR	NR	NR	NR	N/A	NR	NR	
O'Brien [10]	NR	Multicentre-ANZSCTS Database	778 (2.1%)	55	66	32%	21%	- Smoking - Diabetes - Hypertension - Renal disease - Heart failure - PVD & CVD - Prior CABG	Nil significant difference			- Bleeding	NR	NR	NR	N/A	NR	NR	
Wiemers [12]	2008–2010	Townsville (North Queensland)	73 (20.9%)	55.6	63.2	35.6%	20.2%	- Current smoking - Diabetes - Dyslipidaemia - Renal impairment - Mod-severe LV impairment	4.1%	2.5%	p = 0.441	- Atrial fibrillation	3.25	11.0%	8.7%	1.35 (0.58–3.33)	36.7%	18.6%	0.005

Abbreviations: CAB, coronary artery bypass grafting; CVD, cerebrovascular disease; IA, Indigenous Australians; MACCE, major adverse cardiac and cerebrovascular events; N/A, not applicable; Non-IA, Non-Indigenous patients; NR, not reported, NS, not stated; NT, Northern Territory; PVD, peripheral vascular disease.

[a]Denotes figures from entire surgical cohort, not just CABG patients.

(2.5% vs. 1.5%; HR 1.67 (0.74–3.75) and (12.7% vs. 10.9%; HR 1.41 (0.99–1.99) respectively). When mortality was adjusted for EuroSCORE a significant excess in late mortality was evident in the Indigenous Australian cohort as a whole (HR 1.46 (1.03–2.07)). Five-year (5-year) survival for patients undergoing isolated CABG was 82.2% and 89.4% in Indigenous and non-Indigenous Australian patients respectively with the statistical significance of this not reported.

A second study from Finders Medical Centre investigated outcomes of all cardiac surgical patients referred interstate from the Northern Territory to the service over a 15-year period between 1993–2008 [7]. 835 patients were included with 423 (50.7%) Indigenous Australian patients. 42.3% of Indigenous Australian patients underwent isolated CABG procedures, again significantly less than the non-Indigenous cohort. CABG patients were not analysed as a separate group. Analysing the group as a whole, Indigenous Australian patients were again more likely to be female (39.7% vs. 22.6%; $p \leq 0.001$). Mean age at surgery was 45.4 years in the Indigenous Australian group compared with 60.7 years in the non-Indigenous group ($p \leq 0.001$). Significantly higher rates of congestive heart failure, respiratory disease and renal disease were evident in the Indigenous Australian cohort. Perioperative mortality was 2.1% for the Indigenous Australian group compared with 1.2% for the non-Indigenous group ($p = 0.30$). Postoperative renal failure requiring dialysis was more prevalent in the Indigenous Australian patients (5.7% vs. 0.7%; $p \leq 0.001$). Higher rates of a composite endpoint of perioperative morbidity and mortality were evident in the Indigenous Australian cohort (OR = 2.00 (95% confidence interval 1.18–3.42, $p = 0.01$)). There was no longer term follow-up performed for CABG patients.

More recently, further data has come from the Flinders Medical Centre [8]. Outcomes of consecutive patients undergoing isolated CABG procedures from 1998 to 2008 were retrospectively reviewed comparing the Indigenous and non-Indigenous Australian groups. A total of 2,748 patients were included in the study cohort with 297 patients (10.7%) being of Indigenous Australian origin. Indigenous Australian patients were again younger (52 vs. 65 yrs) with a reduced male:female ratio. Indigenous Australian patients were far more likely to reside in remote or very remote areas (53.8% vs. 4.9%). Higher rates of left ventricular dysfunction, smoking, diabetes and renal disease were observed in the Indigenous Australian cohort. Perioperative mortality did not differ between groups (1.3% Indigenous Australians vs. 1.4% non-Indigenous patients; $p = 0.91$). Excesses in postoperative dialysis (6.7% vs. 3.9%; $p = 0.02$) and a combined morbidity endpoint (stroke, dialysis, ventilation >24 hrs, sternal wound infection, reoperation and MI) (24.9% vs. 19.3%; $p = 0.02$) were observed in the Indigenous Australian group, however, following adjustment for propensity scores, these findings were no longer significant. Long-term data was again restricted to survival analysis. At a median follow-up of 7.5 years increased unadjusted mortality was observed in the Indigenous Australian cohort (HR = 1.30 (95% CI: 1.03–1.64, $p = 0.03$). Following adjustment with propensity scoring, the risk of excess mortality in the Indigenous Australian cohort was found to strengthen. However, when age was removed from the propensity score calculations mortality rates did not differ significantly between groups (HR = 0.89 (95% CI 0.70–1.14, $p = 0.37$) suggesting that comorbidities were responsible for much of the observed differences in actuarial mortality. This study provides valuable data demonstrating reduced actuarial survival in the Indigenous Australian cohort at a median follow-up of 7.5 years.

A study from The Prince Charles Hospital in Brisbane has provided a retrospective review of adult Indigenous Australian patients undergoing cardiac surgery in the unit from 2002 to 2009 [9]. A total of 220 Indigenous Australian patients (2.3% total surgical population) underwent surgery during the period. In this observational study, 75% of Indigenous Australian patients underwent CABG with a mean age of 55 years. Within the entire Indigenous Australian surgical cohort was a high prevalence of diabetes and current smoking rates. Perioperative mortality for all Indigenous Australian patients was 0.45%. Longer term follow-up was again in the form of survival analysis and demonstrated that 10% of the entire cohort had died. The duration of follow-up was not stated. Longer term morbidity data in the CABG group was limited to four patients with occlusion of bypass grafts 6 weeks–4 years following surgery.

Recently data reporting on perioperative outcomes of Indigenous Australian patients undergoing isolated CABG from the Australian and New Zealand Society of Cardiothoracic Surgeons (ANZSCTS) database project was published in the form of conference proceedings [10]. The ANZSCTS database, recording perioperative data, was commenced in 2001 in Victorian hospitals and has since expanded to include 20 of the 24 public hospitals and eight private hospitals performing cardiac surgery Australia-wide [11]. 778 Indigenous Australian patients formed 2.1% of the patient cohort who had undergone isolated CABG procedures recorded in the database. Indigenous Australian patients were on average 11 years younger (55 vs. 66 yrs) and more likely to be female. Significantly higher rates of current smoking, diabetes, hypertension, renal impairment, peripheral vascular disease, cerebrovascular disease, heart failure and prior CABG were present in the Indigenous Australian group. Rates of two and three vessel disease did not differ significantly between groups although rates of left main disease were lower in the Indigenous Australian cohort. The internal mammary artery was utilised less often in the Indigenous Australian cohort and less distal arterial anastomoses were performed. There was no comment made in regards to urgency of surgical procedures. Lower rates of postoperative inotrope use and renal impairment were observed in the Indigenous Australian group. This is surprising given higher rates of heart failure and renal impairment present preoperatively in the Indigenous cohort. The results are also in contrast to the excess rates of postoperative dialysis evident in above-mentioned studies [5,7,8]. Following propensity matching, rates of these postoperative complications became

similar between groups. Thirty-day (30-day) mortality rates in both unadjusted and propensity matched models did not differ between the patient groups.

Our group has recently completed a retrospective cohort study reporting on consecutive patients undergoing isolated CABG procedures at The Townsville Hospital from 2008 to 2010 (Table 1) [12]. Seventy-three (73) (20.9%) of the total isolated CABG population of 350 were Indigenous Australians. Indigenous Australian patients were 7.6 years younger than the non-Indigenous cohort and females were over-represented. Statistically significant excesses in rates of current smoking, diabetes, dyslipidaemia, renal impairment and moderate-severe left ventricular impairment were evident preoperatively in the Indigenous Australian cohort. Significantly lower rates of left main coronary artery stenosis were observed in the Indigenous Australian cohort along with non-significantly higher rates of three vessel disease. Reduced internal mammary artery utilisation was noted in the Indigenous Australian isolated CABG group although this was not statistically significant (78.1% vs. 86.6%; $p = 0.097$). Perioperative mortality did not differ significantly between cohorts. Patients were followed for a mean of 38.9 months with no significant difference in actuarial survival evident between cohorts. Despite survival being similar between both groups, Indigenous Australian patients who underwent CABG experienced major adverse cardiac and cerebrovascular events (MACCE) at almost twice the rate of their non-Indigenous counterparts at mid-term follow-up (36.7% vs. 18.6%; $p = 0.005$). Following adjustment for preoperative and operative variables, Indigenous Australian status was not independently associated with MACCE in the isolated CABG cohort (AHR 1.578 (0.637-3.910) $p = 0.324$). Independent associations with MACCE from the adjusted model were renal impairment ($p = 0.047$) and moderate-severe left ventricular impairment ($p \leq 0.001$). There also appeared to be an association between diabetes and MACCE although this result failed to reach statistical significance (AHR 1.812 (0.941–3.490); $p = 0.075$).

Discussion

Younger patients with higher rates of preventable risk factors constitute the Indigenous Australian CABG population (Table 1). Indigenous Australian patients undergoing CABG present 7.6–14 years younger than non-Indigenous Australian patients [4–6,8,10,12]. Despite the younger age of the Indigenous Australian CABG cohort, rates of comorbid conditions are far greater. Rates of diabetes over twice that of the non-Indigenous CABG cohorts have been reported [12]. Rates of renal impairment and current smoking are also significantly higher in the Indigenous Australian CABG population [5,8,10,12]. Excesses in these three conditions lead to significant mortality in the Australian Indigenous community and are repeatedly reported across various population settings [4,6,7,13–26].

Indigenous Australian females are over-represented in CABG cohorts in comparison to non-Indigenous females [8,10,12]. A reduced male:female ratio has consistently been reported in the Indigenous Australian population in studies reporting on the incidence of coronary heart disease events [16,17,27–30]. National mortality data has demonstrated greater discrepancies in coronary heart disease standardised mortality ratios for Indigenous Australian females than males comparing to the non-Indigenous population [14]. The high prevalence of diabetes in the Indigenous Australian population along with a general female disadvantage in terms of higher diabetes-related relative risk for major coronary heart disease events in diabetic women than in men are likely contributing factors [31,32].

Indigenous Australian patients undergoing CABG are more likely than non-Indigenous patients to have underlying moderate or severe left ventricular impairment or heart failure (Table 1) [8,10,12]. A number of factors may contribute. Indigenous Australian patients face a number of barriers to effective health care be these geographical, socioeconomic or health care related factors [26]. Reduced access to diagnostic and therapeutic cardiac procedures has been demonstrated in the Australian Indigenous population [16,21,25,33]. Rates of discharge against medical advice are 'considered an indicator of the responsiveness of hospitals to Aboriginal needs and of the quality of care they receive' and represent a further barrier to optimal medical treatment [28]. A recent statewide study from Western Australia (WA) investigating predictors of discharge against medical advice for patients admitted with an incident ischaemic heart disease event found Indigenous Australian status an independent predictor of discharge against medical advice (OR 2.3, 95% CI 1.5–3.5) [28]. The presence of these barriers to effective health care may lead to Indigenous Australian patients presenting for interventions late, already with ventricular dysfunction.

A second reason for excessive rates of left ventricular dysfunction in the Indigenous Australian CABG cohort may be the influence of diabetes. In a number of large CABG series, diabetic patients have been shown to have reduced left ventricular function when compared to non-diabetics [34–37]. Indigenous Australian patients undergoing CABG have been consistently shown to have higher rates of diabetes than non-Indigenous CABG cohorts (Table 1) [5,8,10,12]. More extensive coronary artery disease, a reduced ability to develop collateral circulation, autonomic denervation and silent ischaemia may all be factors which can contribute to the higher rate of left ventricular impairment in diabetic patients undergoing CABG [38–49].

The distribution of coronary artery disease has been shown to differ between Indigenous Australian and non-Indigenous CABG cohorts. Indigenous Australian patients undergoing isolated CABG appear to have lower rates of significant left main coronary artery stenosis when compared to non-Indigenous cohorts [10,12]. Higher rates of triple vessel disease have also been demonstrated in an Indigenous Australian isolated CABG cohort, although this result was not statistically significant (78.1% vs. 68.6%; $p = 0.148$) [12]. A number of

possibilities exist as to these observed differences. The first is that the pattern of coronary artery disease may in fact differ between the Indigenous Australian and non-Indigenous populations. Conference proceedings from the inaugural CSANZ Indigenous Cardiovascular Health Conference indicated that the majority of angiograms performed on Indigenous Australian patients in Darwin demonstrated multivessel disease and therefore there was a trend towards higher rates of CABG in this population [50]. This trend toward excess multivessel disease in Indigenous Australians undergoing coronary angiography may be consistent with high rates of diabetes in the Indigenous population in general and the propensity for diabetics to suffer with multivessel coronary disease [13,39–42]. Another possible explanation for these observed differences in coronary artery disease distribution is variability in the referral pattern of Indigenous Australian vs. non-Indigenous patients for surgical consideration. A number of studies have demonstrated a reduced ratio of PCI:CABG in the Indigenous Australian population [21,25,33,51–53]. Again, the excessive rate of diabetes in the Indigenous Australian population is a possible contributor to this observation. Results of the Bypass Angioplasty Revascularization Investigation (BARI) trial demonstrated a survival advantage for diabetic patients with multivessel disease undergoing CABG vs. percutaneous transluminal coronary angioplasty (PTCA) [54]. Subsequent studies have since supported these findings in diabetic patients and this has been reflected in a number of published guidelines on myocardial revascularisation [55–58]. High rates of diabetes in the Indigenous Australian population may therefore result in a larger proportion of Indigenous patients with multivessel disease being treated with CABG rather than PCI (Figure 1). This, in turn, would reduce the proportion of Indigenous Australian patients undergoing CABG for left main coronary disease which until only very recently has been 'regarded as the standard of care for significant left main disease in patients eligible for surgery' [57,58]. Indirect evidence supporting this comes from the only series to date reporting on PCI in the Indigenous Australian population [59]. In this series, describing patients from Far North Queensland undergoing PCI at The Townsville Hospital, Indigenous Australian patients were less likely to undergo multivessel interventions and less likely to have multiple stents inserted compared with the non-Indigenous cohort [59]. Another factor which may influence referral patterns in the Indigenous Australian population toward CABG rather than PCI is the requirement for dual antiplatelet therapy following coronary stent deployment. Given high rates of socioeconomic disadvantage and geographical remoteness in the Indigenous Australian population adherence to medication regimens may be difficult for some individuals [1]. Therefore some Indigenous Australian patients requiring revascularisation may preferentially be referred for CABG rather than multivessel PCI in the absence of diabetes due to concerns in regards to antiplatelet drug adherence.

Reduced utilisation of the internal mammary artery (IMA) as a bypass conduit in Indigenous Australian cohorts undergoing isolated CABG procedures has been demonstrated in a number of studies [5,10,12]. This is particularly concerning given the younger age structure of the cohorts. The use of an IMA as a bypass conduit has proven benefits in regards to reduction of long-term morbidity and mortality over the use of saphenous vein alone [60]. Racial disparities in the utilisation of the IMA are not isolated to the Australian population with patients from non-White races in the United States less likely to receive an IMA graft [61]. A potential explanation for not using an IMA as a bypass conduit may be patient instability and the need to hasten conduit availability. This may have been a contributing factor in one but not all series reporting this disparity in Indigenous Australian

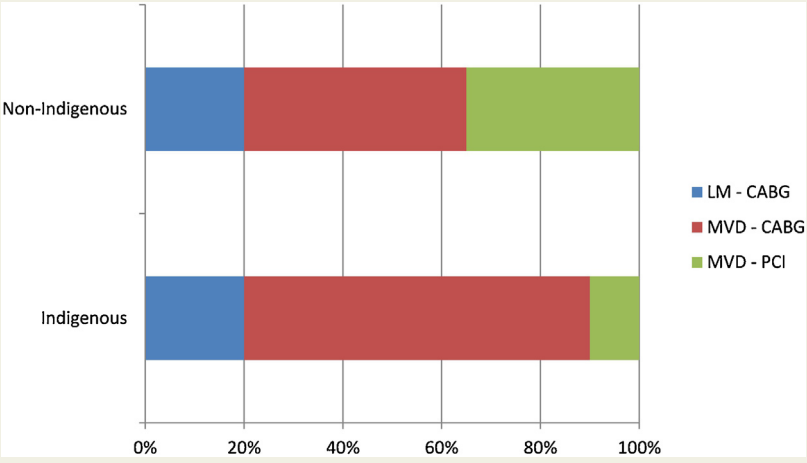

Figure 1 Potential referral pattern bias for reduced proportion of left main coronary artery disease and trend toward increased proportion of multivessel disease observed in Indigenous Australian CABG cohort.
Abbreviations: LM, left main coronary artery disease; CABG, coronary artery bypass grafting; PCI, percutaneous coronary intervention; MVD, multivessel coronary artery disease.

CABG cohorts [5,12]. Our group recently explored reasons for non-utilisation of the IMA as a bypass conduit in the Indigenous Australian population [12]. A number of patients (n = 4) did not receive an internal mammary artery graft due to the extensive nature of disease in the LAD system. Additionally, one patient with a left arm arteriovenous haemodialysis fistula did not have the LIMA harvested over concerns for potential coronary steal during haemodialysis [62]. Two patients were unstable and conduit harvest needed to be hastened. In three patients no reason was stated. Given the younger age structure of the Indigenous Australian CABG cohort and the benefit gained in regards to long-term morbidity and mortality with the use of IMA grafts, utilisation of the IMA in Indigenous Australian patients needs to be maximised.

Despite higher levels of comorbidity and left ventricular impairment in the Indigenous Australian CABG cohort, actuarial perioperative mortality has not been demonstrated to differ significantly between the Indigenous Australian and non-Indigenous CABG cohorts (Table 1) [5,8,10,12]. In contrast to this, increased morbidity and mortality has been demonstrated on limited longer term follow-up conducted in Indigenous Australian cohorts undergoing isolated CABG. Our group demonstrated rates of MACCE almost twice that of non-Indigenous patients at a mean follow-up period of 39 months (36.7% vs. 18.6%; p = 0.005) [12]. Prabhu et al. demonstrated excess long-term mortality in Indigenous Australians undergoing isolated CABG at a later stage of follow-up (median 7.5 years) (HR 1.30 (95% CI: 1.03–1.64; p = 0.03) [8]. Following adjustment for preoperative variables (and excluding age in the case of Prabhu's study) it appears other patient factors, particularly comorbidities and left ventricular function, are responsible for these poorer long-term outcomes rather than Indigenous Australian status per se. These findings highlight the importance of programs targeting both the prevention and management of diabetes, renal disease and heart failure in the Australian Indigenous population which may conceivably result in a reduction of the disparity in ischaemic heart disease outcomes between Indigenous and non-Indigenous Australians [63–65]. Additionally, further research into longer term morbidity and mortality outcomes post coronary revascularisation in the Indigenous Australian population is required.

Conclusion

Ischaemic heart disease is a leading contributor to the mortality gap between Indigenous and non-Indigenous Australians. Indigenous Australian patients suffer excess morbidity and mortality in the longer term after undergoing CABG. Excess comorbidities in the Indigenous Australian CABG population appear largely responsible for this. Maximising IMA use and continued focus on strategies to reduce the impact of diabetes, renal impairment and heart failure in the Indigenous Australian population is essential to reduce the mortality gap experienced by Indigenous Australians secondary to ischaemic heart disease.

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