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Ten Year Trends in Catheter Ablation for Ventricular Tachycardia Versus Other Interventional Procedures in Australia

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ABBREVIATIONS

AF - Atrial Fibrillation

AIHW - Australian Institute of Health, Welfare and Aging

CA – Catheter Ablation

MA – Medicare Australia

PCI - Percutaneous Coronary Intervention

VT – Ventricular Tachycardia

ABSTRACT

Aims

Major technological and procedural advancements have re-invigorated catheter ablation as an adjunctive therapy for drug-refractory ventricular tachycardia (VT). We examined temporal trends in VT ablations as compared to other interventional cardiovascular procedures namely, percutaneous coronary intervention (PCI) and atrial fibrillation (AF) ablation in Australia.

Methods and Results

A retrospective review of procedural numbers for VT ablations, AF ablations and PCI was performed from 2008/09-2016/17 the Australian Institute of Health, Welfare and Aging (AIHW) and Medicare Australia (MA) databases. Linear regression models were fitted to compare the trends in population-adjusted procedural numbers over the 10-year period. Data from the AIHW and MA sources respectively showed that (i) PCI had a 1.3% (AIHW data $P=0.15$) and 1.8% (MA data $P<0.001$) population-adjusted increment per year; (ii) AF ablations had a 12.7% ($P<0.001$) and 11.7% ($P<0.001$) per year population-adjusted increment and (iii) VT ablations showed a 18% ($P<0.001$) and 12.7% ($P<0.001$) per year population-adjusted increment. Growth of PCI was increasing at a lower rate than AF ablations ($P<0.001$ for both AIHW and MA sources). Growth of VT ablation was significantly higher than AF ablations and PCI [AIHW: 18% vs 12.7% ($P=0.004$) and 1.3%/year ($P<0.001$)].

Conclusion

Catheter-based VT ablation has increased significantly in Australia over the last decade, consistent with worldwide trends, and now surpassing all ablation procedures including AF ablation and PCI for CAD. This data highlight the provision of additional resources to match the increasing demand of VT ablation procedures in Australia.

Keywords

Ventricular tachycardia, atrial fibrillation, percutaneous coronary intervention, catheter ablation, coronary artery disease

INTRODUCTION

Sustained ventricular tachycardia (VT) and ventricular fibrillation (VF) is responsible for one-half of all deaths in patients with heart disease (1). Implantable cardiac defibrillators (ICD) prevent sudden cardiac death in patients with prior VT/VF or in patients at high risk of VT/VF (2). As a result, there has been a worldwide increase in ICD implants, with Australian data mirroring such trends showing a 16%/year increment (3). ICD recipients now survive to experience VT/VF resulting in recurrent ICD shocks, which are associated with poor quality of life, increased medical and psychological morbidity and an increased mortality (4). Catheter ablation is an established adjunct to anti-arrhythmic drugs for the management of drug-refractory ventricular arrhythmias. Multiple randomised control trials (RCTs) (5-8), and observational studies (9, 10) have demonstrated that CA reduces VT burden and recurrence. Recent technological advances in cardiac mapping and ablation have made the procedure more rapid, safe and efficacious than the past. As such ablation is recommended by multiple guidelines for the management of drug-refractory ventricular arrhythmias (11). Mirroring such recommendations, there has been a large growth of VT ablations worldwide (12-16). Whether similar trends are seen in Australia remains unknown. We have previously shown that catheter ablation of atrial fibrillation (AF), the most common cardiac arrhythmia in humans, has grown at an exponential rate, at up to 39.8%/year, when compared to other common interventional cardiovascular procedures such as percutaneous coronary intervention (PCI) (17). In this study, we sought to examine if national trends in VT ablation,

when compared to two other common interventional cardiovascular procedures namely, AF ablation and PCI procedures in Australia.

METHODS

We performed a retrospective data analysis on the total number of cardiovascular procedures including PCIs, all catheter ablations combined, and separately for AF ablations and VT ablations over the past 10 years from two major sources:

- (1) Australian Institute of Health, Welfare and Aging (AIHW)(18)
- (2) Medicare Australia database of statistics on procedural item numbers (MA)(19)

The AIHW data represents nationwide statistics combining procedures performed in both public and private sector, whereas MA data reflects nationwide private hospital activity alone (19). Percutaneous coronary interventions, all ablations combined, AF ablation and VT ablation data were extracted from these two data sources.

Australian Institute of Health, Welfare and Aging data

Cardiovascular procedure data cubes from years 2000/01 to 2016/17 on the AIHW website were individually searched. Figure 1 provides an example of the calculation derivations for each of the data cubes for the period of 2008/09.

Procedural data from the AIHW database is derived from the National Hospital Morbidity Database which is contributed to by each of the state and

territory health authorities in Australia. The data are derived directly from electronic confidentialized summary records for episodes of care in public and private hospitals in Australia. The proportion of missing data is negligible, representing 0.004% of cases per year (20). The database collects the following information: type of procedure, year of procedure, gender of patient, age group, and whether the procedure required same day or overnight admission. Procedure type is classified according to the second edition of the *International Statistical Classification of Diseases and Related Health Problems, 11th Revision, Australian Modification* (ICD-10-AM) and the 3rd to 9th editions of Australian Classification of Health Interventions (ACHI)(18).

Since the development of the AIHW database, the classification of ventricular ablation procedures has remained the same. As previously described (17), procedures classified as ‘ablation of arrhythmia circuit or focus involving two atrial chambers’ were considered most representative of AF ablations (Figure 1). It is important to highlight a change in atrial ablation procedure classification. From 2000/1 to 2007/8, procedures were classified as either: (i) ‘ablation of arrhythmia circuit or focus involving one atrial chamber’ or (ii) ‘ablation of arrhythmia circuit or focus involving two atrial chambers’ (from 2000/01 to 2007/08). In 2008/09 to 2016/17 as: (i) ‘catheter ablation of arrhythmia circuit or focus, not elsewhere classified’, or (ii) ‘catheter ablation of arrhythmia circuit or focus involving left atrial chamber’, or (iii) ‘ablation of arrhythmia circuit or focus involving both atrial chambers’ (in 2008/09 to 2016/17). For the purpose of the present analysis, we also calculated the numbers of all ablations combined which represented the sum of all atrial and ventricular ablation procedures (Figure 1). To address possible

errors due to changes in the coding classification of AF ablation prior to 2007/8 and post 2008/9, we only included post 2008/09 data.

Medicare Australia Database

Procedural data from the MA database is derived from billing claims made for procedures performed in the private hospital sector. The MA database collects information about type of procedure according to billing codes, patient age and gender and number of procedures performed in each state. Data from MA was derived on the basis of Medicare item numbers described by Medicare Benefits Schedule (MBS) online (19). To calculate data for 'all ablations combined', relevant MBS item numbers (19) included were: (i) '38287—ablation of arrhythmia circuit or focus or isolation procedure involving 1 atrial chamber'; (ii) '38290—ablation of arrhythmia circuits or foci, or isolation procedure involving both atrial chambers and including curative procedures for atrial fibrillation'; and (iii) '38293—ventricular arrhythmia with mapping and ablation, including all associated electrophysiological studies performed on the same day'. Of note, there is no specific billing code for tracking AF ablations alone. To calculate data for AF ablations, we used '38290—ablation of arrhythmia circuits or foci, or isolation procedure involving both atrial chambers and including curative procedures for atrial fibrillation'. To calculate data for PCIs, we included the following MBS item numbers (19): '38300—percutaneous transluminal coronary angioplasty (PTCA) of one coronary artery'; '38303—PTCA . 1 coronary artery'; '38306—stenting'; '38309—percutaneous transluminal coronary atherectomy'; and '38312—atherectomy'. To maintain consistency in the represented data, we separated

the population-adjusted procedural numbers to only include post 2008/09 data (due to the changes in procedure coding classification of AF in the AIHW database between 2007/08 and 2008/09).

Sub-analysis of Medicare Australia data

We also conducted a separate analysis restricting the number of ventricular ablation procedures (billing code: 38293) to only include patients aged > 55 years as a more representative group of patients with VT and SHD (as compared to idiopathic VT).

Australian estimated resident population

Online available yearly estimates of the resident population in Australia was extracted from the Australian Bureau of Statistics (22). A population-adjusted number of procedures performed per 1000 persons for the AIHW and MA databases were performed to account for yearly increases in population size.

Population-adjusted number of procedures for Year A (per 1000 persons):

$$= \left\{ \frac{\text{Absolute number of procedures for Year A}}{\text{Estimated resident population for Year A}} \right\} \times 1000$$

Statistical Analysis

The number of procedures performed per year was converted to a rate per 1000 population, based on the Australian Bureau of Statistics Estimated Resident Population of the corresponding year. A regression model was used with the log of the number of procedures performed per 1000 population, fitting an exponential growth curve to the underlying rate. The slope from the

regression was then converted to a percentage increase per year. A two-tailed $P < 0.05$ was considered to be statistically significant. Graphs were constructed by using R version 3.5.1

RESULTS

AIHW data

There has been a gradual decline in the number of all cardiovascular procedures over the 10-year period from 2008/09-2016/17 from 26.3 (n = 568, 015) to 24.4 (n = 597, 808) procedures per 1000 persons. This represents a statistically non-significant, 0.9% per year population-adjusted decrement [95% confidence interval (CI): -2.7 to 1.0% per year, $P = 0.309$; Table 1, Figure 2].

PCIs represented 7.2% of all cardiovascular procedures. PCIs increased from 1.68 (n = 36, 302) to 1.9 (n = 46, 720) procedures per 1000 persons over the 10-year period from 2008/09-2016/17, representing a 1.3% per year population adjusted increment (95% CI 0.3 to 2.3% per year, $P = 0.015$; Table 1, Figure 2).

When all ablation procedures were combined, they represented 1.6% of all cardiovascular procedures. Ablation procedures had increased from 0.30 (n = 6462) to 0.51 (n = 12, 530) procedures per 1000 persons over the 10 years, representing 7% annual population-adjusted increment per year (95% CI 6.5 to 7.5% per year, $P < 0.001$, Table 1, Figure 2).

Atrial fibrillation ablations represented 17.8% of all ablation procedures. The number increased from 0.044 (n = 941) to 0.108 (n = 2639) procedures per

1000 persons over 10 years from 2008/09-2016/17, representing a 12.7% per year population-adjusted increment (95% CI 10.0 to 15.5% per year, $P<0.001$; Table 1, Figure 2).

Ventricular tachycardia ablation represented 1.2% of all ablation procedures performed. The number increased from 0.002 ($n = 49$) to 0.007 ($n = 172$) procedures per 1000 persons over 10 years, representing a 18% per year population-adjusted increment (95% CI 13.6 to 22.5% per year, $P<0.001$; Table 1, Figure 2).

In the previous decade, all PCIs is increasing at a lower rate than all ablations, AF ablations and VT ablations (all $P< 0.001$). All ablations are increasing at a lower rate than AF ablations and VT ablations (all $P< 0.001$). AF ablations are increasing at a lower rate than VT ablations ($P= 0.004$).

Medicare Australia data

Percutaneous coronary interventions increased by 1.049 ($n = 22, 637$) to 1.238 ($n = 30, 394$) procedural per 1000 persons over 10 years, representing a 1.8% per year population-adjusted increment (95% CI 1.1 to 2.6% per year, $P<0.001$; Table 1, Figure 2).

All ablations increased from 0.096 ($n = 2068$) to 0.202 ($n = 4949$) procedures per 1000 persons over 10 years, representing a 10.4% per year population-adjusted increment (95% CI 8.7 to 12.0%, per year $P<0.001$; Table 1, Figure 2).

Atrial fibrillation ablation increased from 0.061 ($n = 1313$) to 0.094 ($n = 3497$) procedures per 1000 persons, representing a 11.7% per year population-

adjusted increment (95% CI 9.8 to 13.6% per year, $P<0.001$; Table 1, Figure 2).

Ventricular tachycardia ablation increased from 0.009 ($n = 193$) to 0.15 ($n = 545$) procedures per 1000 persons over 10 years, representing a 12.7% per year population-adjusted increment (95% CI 10.6 to 14.8% per year, $P<0.001$; Table 1, Figure 2).

Given the single billing reference code for ventricular tachycardia ablations, we excluded patients aged ≤ 55 years of age in a sub-analysis. In the restricted group aged > 55 years' age group had a population-adjusted increment in ventricular tachycardia ablations was 16.5% per year (95% CI 14.2 to 18.9%, $P<0.001$).

In the previous decade, all PCIs is increasing at a lower rate than all ablations, AF ablations and VT ablations (all $P< 0.001$). There is no evidence of a difference in rate of increase between all ablations and AF ablations ($P=0.105$) but there is for VT ablations ($P=0.011$). There is no evidence of a difference in rate of increase between AF and VT ablations ($P=0.250$).

DISCUSSION

Rapid advances in technology have made VT ablation a safe and efficacious procedure for symptomatic drug-refractory VT. Multiple international series have shown increasing utilisation of VT ablation procedures. Whether similar trends are observed in Australia are unknown. Two commonly performed interventional cardiovascular procedures, namely catheter ablation for AF and PCI for coronary artery disease, are ideal comparators for examining

procedural trends for VT. We used two publically available national databases to explore trends in VT ablations vs. AF ablations and PCI for CAD over the last decade in Australia. Our main findings were:

- (i) VT ablations represent a small overall proportion of all ablation procedures performed; however, procedural numbers have increased significantly over the past decade.
- (ii) Growth of PCIs, all ablations and AF ablations have increased over the last decade, but at a lower rate than VT ablations.
- (iii) Growth of VT ablations is significantly greater than AF ablations (AIHW data), all ablations and PCIs (both AIHW and MA data) over 10-year period.

Given the increased utilisation of VT ablation procedures in Australia, the present data has crucial implications for the tertiary centres developing VT ablation programs, highlighting the need for additional resource allocation, funding and staff training in the procedural management of this high-risk patient group. *Possible explanations for temporal trends in VT ablations vs other ablation procedures and percutaneous coronary intervention over the past 10 years*

Despite significant improvements in the management of predisposing conditions, especially coronary artery disease (CAD), the incidence of VT has increased when comparing older RCTs where the recurrence rate was 33% (5) to contemporary RCTs which has a recurrence rate between 42-45% (7, 8). In those with idiopathic VT, a recent population-based study found rates had increased from 12.7 to 16.2 (per 100,000) over a 6-year period (23).

Paralleling increasing rates of VT is recent local data showing a 3-fold increased rate of ICD implantation over a similar period (3) that incurs significant additional costs on the healthcare system. Certainly, additional strategies are required to reduce rates and healthcare expenditure, of which CA has emerged as a useful adjunctive therapy. Rises in ICD implantation rates is likely a major contributor to increases in VT detection and subsequent referral for catheter ablation. Improvements in medical therapy for ischaemic heart disease and heart failure have been shown to reduce mortality (24), meaning patients are surviving longer with arrhythmogenic substrate. Similarly, improvements in survival from ICDs terminating potentially lethal arrhythmias (2, 25) in conjunction with increasing rates of device insertion, translates to more patients with VT susceptible substrate. A consequence of prolonging survival is possibly increasing VT incidence and a subsequent referral for VT ablation in those that fail antiarrhythmic therapy.

Over the last decade, technological advancements in CA has progressed significantly, enhancing our understanding of the mechanism and localisation of ventricular arrhythmias. These include: (1) Refinement of 3D-electroanatomic mapping and high-density mapping techniques with rapid acquisition, (2) use of image integration allowing anatomical correlation to critical cardiac structures adjacent to sites of VA origins (eg aortic cusps, moderator band) (3), advancements in epicardial access and ablation and (4) advances in catheter ablation technology (for example, force sensing).

This progression has particularly focused on those with SHD and myocardial scar; a distinctly different group from those with idiopathic VT who

have much lower procedural success rates compared to the latter group. Recent figures show superior procedural outcomes in patients with idiopathic VT compared to those with SHD where acute procedural success is 50-70% compared to 80-90% (21, 26). Transitioning from pioneering work of subendocardial surgical resection of ischaemic scar containing abnormal electrograms (27), seminal work by Josephson and others (28) established the role of endocardial catheter mapping for VT. Since then, significant progression in mapping the critical circuit components (29). Implementation of electroanatomical mapping systems (EAMs) to characterise LV scar geometry and 'real-time' catheter location is now used almost exclusively in VT ablative procedures has been a significant advance in this field. Mapping is now greatly assisted by the development of multielectrode catheters with smaller electrodes and spacing capable of rapid, ultra-high density maps with elegant automatic annotation algorithms and improved spatial resolution (30). Integration of imaging modalities (for example, cardiac MRI) is also being increasing used to guide ablation with improved outcomes (31). A major paradigm shift in the current era has been a transition from a conventional "standard" procedure where VT must be induced to a "substrate-based" approach, avoiding unnecessary procedural risk caused by haemodynamic compromise from inducing VT. A substrate-based approach uses techniques to locate key components of the VT circuit in sinus rhythm (without the need to induce VT). A myriad of sophisticated techniques to more clearly refine critical areas within the arrhythmogenic substrate are on the horizon including sites displaying steep activation gradients and slowed conduction (32). Prior to the development of substrate-based mapping, the vast majority of VTs

were not able to be induced or not tolerated, making procedural outcomes poor and endpoints difficult to define. In addition, the increasing utilisation of haemodynamic support devices have been successful in facilitating otherwise unfeasible procedures in this high-risk group (33).

Evidence from RCTs and Observational Studies

Multiple randomized control trials (RCTs) (5-7) and observational studies (26, 34, 35) have been performed using different mapping and ablation strategies demonstrating the superiority of CA over antiarrhythmic therapy as it has been shown to reduce time to VA recurrence, time to recurrent VT, and electrical storms. Despite the perceived risk of major complications, rates in both RCTs and 'real-world' registries are low (~7%) (5-8, 26); and further reduced when performed in high-volume centres (>25 cases/year) (36) and substantially by an earlier recognition and referral to a VT ablation centre (37).

Health Care Benefit

CA confers significant upfront costs to an already stretched health-care budget, however, this is offset in future reduced expenditure. VT ablation also has a positive impact on healthcare resource utilisation; conferring abrupt slowing in cardiac rhythm-related medical expenditures with a median annual decrease post ablation of \$US 5,408 (38). This reduction is predominantly driven by recurrent hospitalisations. This is not a surprisingly finding given that a reduction in VT burden with CA decreases both hospitalisations and emergency department attendances by 25% and 15%, respectively (38). In a recent substudy of the Ventricular Tachycardia ablation versus Escalation of

Antiarrhythmic Drug Therapy in Ischaemic heart Disease (VANISH) RCT (39), CA resulted in greater quality-adjusted life years at a lower financial cost compared to amiodarone-escalated group. Similar to the excess cost burden of repeat CAs for AF (40), this saving was predominantly due to the cost of required future ablation procedures and associated costs antiarrhythmic side effects, particularly amiodarone.

When combined with increased ICD implant rates and estimated 30-50% recurrence of VT in follow-up, the burden of VA in ICD recipients has driven increased VT ablations worldwide. VT ablations performed in the United States (US) has grown rapidly. The US Medicare database examining >20, 000 ablations over a 12-year period has shown more than 3-fold increase in procedural numbers (14) and others have shown a substantial increase in the 10-year incidence of post-infarct VT ablation, from 2.8% in 2002 to 10.8% in 2011 ($P<0.001$) (16). Local data has shown large volume centres have also seen a 2-3-fold increase in VT ablation procedures, largely driven by increased procedures in ischaemic and non-ischaemic cardiomyopathies (41). Most tertiary Australian EP centres now have a VT ablation program; but given the diversity in procedural strategies and endpoints, a collaborative registry to appraise procedural numbers, techniques and outcomes is lacking.

Other Interventional Cardiovascular Procedures

AF ablation continue to rise in conjunction with a greater understanding of AF trigger mechanisms and evolution of atrial mapping and ablation techniques. Multiple RCTs show superiority of CA over antiarrhythmic therapy in those

with paroxysmal AF (42, 43) and in the expanding persistent AF population (44). Growth of CA in AF will also be influenced by recent evidence of emerging indications, such as those with AF and heart failure (45) and left ventricular systolic dysfunction (46). As shown in Figure 2, AF ablation is still substantially greater than VT ablation and increasing at approximately 12% per year population-adjusted increment. The significant difference in overall procedural volume is clearly dominated by AF ablation in Australia, however, we highlight the substantial growth of complex electrophysiological and ablation procedures, namely VT ablation.

Finally, the decline in PCI use in Australia is multifactorial. The impact of the Clinical Outcomes Utilizing Revascularization and Aggressive Drug Evaluation (COURAGE) trial (47) demonstrating no mortality benefit of PCI over medical therapy in patients with stable CAD is a likely to partly explain the decreasing growth of PCI in Australia. Based on this landmark study, trends highlight the decreasing use of elective PCI compared to increasing rates of its emergent use in acute coronary syndromes (48). The emergence of new generation drug-eluting stents (DESs) has increased both in Australia (49) and internationally (50) with clear reductions of in-stent restenosis (51) and overall improved clinical safety and efficacy (52) compared with bare metal stents (53), may have also contributed to the reduction seen in PCI growth.

CLINICAL IMPLICATIONS

The current data suggests the demand for VT ablation is increasing paralleling compelling data from contemporary RCTs and observational

studies demonstrating reductions in VT recurrence, and quality of life scores beyond that can be achieved with optimal antiarrhythmic therapy with a low rate of complications. It is important to consider this procedure in appropriately selected patients and should be performed in experienced centres as it is a prolonged procedure requiring sophisticated mapping and ablation equipment, intensive care and cardiothoracic back-up capable of haemodynamic support in cases of acute decompensation and the management of procedural-related complications. The increasing use of CA for VT shown in this study highlights the need for additional resources and infrastructure (including additional training) to meet the increasing demand if CA is to remain a superior and evolving treatment strategy in patients who are refractory or intolerant to medical therapy. A prospective, procedure-specific nationwide registry is needed to accurately assess procedural trends and provide greater insight of outcomes in an unselected 'real-world' population undergoing VT ablation.

STUDY LIMITATIONS

This study has several limitations. The use of different editions in the eight editions of ACHI databases in the AIHW from 2002/03 to 2016/17 may mean that data may not be comparable between years. A second database was used to limit bias from this possibility. To account for the change in AF ablation classification in 2007/08 to 2008/09, we only included trend analyses after 2008/09 to limit any potential error, focusing only on the previous 10-year period. The aforementioned reliance on coding algorithms to identify our target population where only one specific billing code exists to encompass all

VT ablations. It would be useful to separate VT ablations into subtypes based on the underlying aetiology as procedural outcomes are significantly different in patients undergoing VT ablation with scar-related VT compared to those without structural heart disease (idiopathic VT). We restricted the age in a separate analysis of the Medicare data to create a more representative group with structural heart disease but were unable to separate these cases entirely. Age stratification to differentiate structural versus idiopathic cases is a limitation of this study and can only be used as a general approximation, as although less common, older patients can present with idiopathic VT and vice versa. In addition, stratification of procedures based on repeat procedures is not available in the current data. It would also be useful to analyse outcome data (acute and long-term) in this group. Over the 10-year period, the average life expectancy has increased 0.9 and 0.6 years in men and women, respectively (54). Lack of age adjustment given this increasing population age may contribute to potential confounding in the population. Furthermore, gender differences in the observed temporal trends would be also relevant to discern in this patient cohort.

CONCLUSION

Temporal trends in cardiovascular procedures over the preceding 10-year period in Australia show exponential growth in VT CA, surpassing PCI and other CA procedures, including AF ablation. These findings have significant implications for additional provisional funding and infrastructure support for centres with already established or emerging VT ablation programs.

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FIGURES

Figure 1

A representative example from the AIHW database for 2008/09. *Other cardiovascular procedures include: procedures on the septum (n=2153), aortic valve (n=5346), mitral valve (n=3716), tricuspid valve (n=613), pulmonary valve (n=277), myocardium (n=20 279), pericardium (n=3030), other vascular sites (n=50 040), aorta (n=3907), arteries (n=45 348), veins (n=110 354), procedures on 'other' sites (n=56 839). Procedures on 'other sites' was a broad category that included procedures such as insertion, removal or adjustment of temporary and permanent pacemakers or defibrillators, heart and lung transplantation, diagnostic electrophysiology studies, right heart catheterization, procedures to control post-operative bleeding after heart surgery, other intra-thoracic procedures on heart without cardiopulmonary bypass, operative management of acute infective endocarditis during heart valve procedure, and re-operations for other intrathoracic procedures not elsewhere classified.

Figure 2

Fitted trend lines for population-adjusted number of procedures over 10-year period for AIHW (18) and Medicare Australia database (19).

TABLE LEGENDS

Table 1 : Population-adjusted numbers of procedures over the past 10 years from the AIHW and Medicare Australia databases. A compact letter display (a,b,c,d are used for each procedural group) demonstrates significant differences between the rate of increase between procedures. Within a database, procedures not sharing a letter are increasing at a significantly different rate ($p < 0.05$).

		Year				% increment/year	95% CI	P value
		2008/09	2011/12	2014/15	2016/17			
AIHW (procedures/1000 persons)								
All cardiovascular procedures		26.3 (568015)	22.6 (512895)	23.6 (560565)	24.4 (597808)	-0.9	-2.7 - 1.0	0.309
All PCIs	a	1.68 (36302)	1.7 (38575)	1.79 (42535)	1.9 (46720)	1.3	0.3 - 2.3	0.015
All ablations (absolute numbers)	b	0.3 (6462)	0.369 (8384)	0.446 (10624))	0.51 (12530)	7.0	6.5 - 7.5	< 0.001
AF ablations (absolute numbers)	c	0.044 (941)	0.061 (1397)	0.092 (2180)	0.108 (2639)	12.7	10 - 15.5	< 0.001
VT ablations (absolute numbers)	d	0.002 (49)	0.003 (79)	0.006 (150)	0.007 (172)	18.0	13.6 - 22.5	< 0.001
Medicare Australia (procedures/1000 persons)								
All PCIs	a	1.049 (22637)	1.141 (25937)	1.184 (28165)	1.238 (30394)	1.8	1.1 - 2.6	< 0.001

All ablations (absolute numbers)	b	0.096 (2068)	0.141 (3203)	0.187 (4438)	0.202 (4949)	10.4	8.7 - 12.0	< 0.001
AF ablations (absolute numbers)	bc	0.061 (1313)	0.094 (2127)	0.129 (3072)	0.142 (3497)	11.7	9.8 - 13.6	< 0.001
VT ablations (absolute numbers)	c	0.009 (193)	0.014 (321)	0.019 (450)	0.022 (545)	12.7	10.6 - 14.8	< 0.001
VT ablations > 55 years (absolute numbers)		0.005 (100)	0.008 (175)	0.011 (269)	0.015 (369)	16.5	14.2 - 18.9	< 0.001

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