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REVIEW

Mortality and Readmission Following Hospitalisation for Heart Failure in Australia: A Systematic Review and Meta-Analysis

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Background Heart failure (HF) is a common, costly condition with an increasing burden on Australian health care system resources. Knowledge of the burden of HF on patients and on the health system is important for resource allocation. This study is the first systematic review to estimate the mortality and readmission rates after hospitalisation for HF in the Australian population.

Methods We searched for studies of HF hospitalisation in Australia published between January 1990 and May 2016, using a systematic search of PubMed, Medline, Scopus, Web of Science, Embase and Cochrane Library databases. Studies reporting 30-day and/or 1-year outcomes for mortality or readmission following hospitalisation were eligible and included in this study.

Results Out of 2889 articles matching the initial search criteria, a total of 13 studies representing 67,255 patients were included in the final analysis. The pooled mean age of heart failure patients was 76.3 years and 51% were male (n = 34,271). The pooled estimated 30-day and 1-year all-cause mortality were 8% and 25% respectively. The pooled estimated 30-day and 1-year all-cause readmission rates were 20% and 56% respectively. There is a high prevalence of comorbidities in heart failure patients. There were limited data on readmission and mortality in rural patients and Indigenous people.

Conclusions Heart failure hospitalisations in Australia are followed by substantial readmission and mortality rates.

Keywords Heart failure • Mortality • Readmission • Australia • Hospitalisation

Introduction

Heart failure (HF) is a major health problem worldwide. It is estimated that more than 37.7 million people worldwide had symptomatic heart failure in 2010 [1]. Heart failure imposes a significant burden on both patients and health care systems, with costly hospitalisations and high mortality rates [2,3]. Despite plateauing or decreases in age-standardised HF hospitalisations nationally and internationally [4–7], the absolute number of HF hospitalisations is not decreasing and may even

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be increasing [5,7]. This may be due to increases in population or to population ageing. In this context, post-hospitalisation mortality and readmission rates have not demonstrated a similar decline [4].

Heart failure is a chronic debilitating disease with a 1-year mortality after hospital admission in other developed countries of 25–30% [8], higher than many common cancers [9]. Heart failure prevalence increases with age [10,11], with HF being the leading cause of hospitalisation in people aged greater than 64 years [12]. Treating HF is important to improve patient outcomes and decrease health system expenditure [13]. In addition, while HF patients have relatively low in-hospital mortality, they have high rates of post-discharge death and re-hospitalisation [4].

It is estimated that about 300,000 Australians had HF in 2008, with an estimated 30,000 new diagnoses each year [14] and 22,000 incident (first-ever) admissions [15]. Heart failure patients occupied more than 200,000 bed-days per year in NSW and 1.4 million bed-days in Australia, costing over one billion dollars [15,16]. Heart failure was the second leading cause of cardiovascular hospitalisations in 2012–2013 and was responsible for 57,450 hospitalisations as a principal diagnosis [17]. Despite the burden of HF, there are limited published data on mortality and readmission following HF hospitalisation in the Australian setting; indeed, a National Heart Foundation report mentioned the paucity of data regarding HF readmission rates [18]. Therefore, the aim of this study was, by systematically searching the published literature, to estimate the rates of mortality and readmission following HF hospitalisation in Australia.

Methods

Study Search

We systematically searched the following databases: PubMed, Medline, Embase, Cochrane library, Scopus and Web of Science. The advice of a university librarian was sought to ensure optimal search strategy. For HF, we used the terms: ''heart failure'' OR ''chronic heart failure'' OR ''congestive cardiac failure'' OR ''left ventricular dysfunction'' OR ''systolic heart failure'' OR ''diastolic heart failure'' OR ''heart failure with preserved ejection fraction'' OR ''heart failure with reduced ejection fraction''. For readmission, we searched the terms: ''readmission'' OR ''rehospitalisation'' OR ''rehospitalization'' OR ''re-admission'' OR ''re-hospitalisation'' OR ''re-hospitalization'' OR ''patient readmission''. For mortality, we searched ''mortality'' OR ''death'' and we used ''Australia''. We the used ''explode'' function where possible (see Additional File 1). We used the AND function to combine the search of heart failure terms AND readmission terms AND Australia, as well as heart failure terms AND Mortality terms AND Australia. We limited our search to articles published from 1 January 1990 to 1 May 2016, in humans, English language and adults. Two authors performed the search independently. We followed the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) protocol and guidelines [19,20].

Study Selection

The search process was undertaken by two investigators (MA and AD) independently and is outlined in Figure 1. We used Endnote X7 to organise the studies. Duplicates were removed by Endnote automatically and by manual review. Studies selected for inclusion in the final analysis had to report 30-day or 1-year readmission or 30-day or 1-year mortality in patients admitted with heart failure. Two independent investigators reviewed the studies for eligibility. Differences in study selection were resolved by discussion with a third investigator (AB). The major reasons for exclusion of studies are listed in Figure 1. These included studies that failed to meet the inclusion criteria, those with non-Australian data, animal studies, review papers, abstracts, and those including patients without HF.

Data Extraction and Summarisation

Relevant data from the included studies were extracted using a standardised data extraction form in Microsoft Excel. The fields included study type, sample size, study year, age and gender. The reported outcomes of mortality and readmission were extracted. In addition, comorbidities of diabetes mellitus, hypertension, ischaemic heart disease, chronic kidney disease, chronic respiratory disease and atrial fibrillation/flutter were extracted when available (Tables 1 and 2). Ejection fraction, HF type, medication and length of stay (LOS) were extracted when available. We combined the two arms of randomised controlled trials. One group published two papers with overlapping times [Teng et al., 2010, reported HF patients between 1990 and 2005 and Teng et al., 2014, reported outcomes between 2000 and 2009, both from the Western Australia Hospital Morbidity database [21,22]]. To avoid double counting, we only used the data between 1990 and 1998 in the former study.

Quality Assessment

For randomised controlled trials (n = 3) we used the Cochrane Collaboration's ''risk of bias'' assessment tool [23]. The Cochrane Collaboration's tool covers the domains of selection bias, performance bias, detection bias (outcome), attrition bias (incomplete outcome), reporting bias and other biases. High risk or unclear risk of bias for each domain is given a score of 0, while low risk of bias is given a score of 1, for a maximum best score of 6. For cohort studies (n = 10), we used a checklist of items recommended by Sanderson et al. [24]. The checklist covers the domains of selecting study population, measuring exposure and outcomes variables, design specific source of bias (excluding confounders), methods of controlling confounding, statistical methods (excluding control of confounding) and conflict of interest or funding. Each checkpoint was given a score of 0 to 1, which then summed into summary score, for a maximum best score of 6.

Statistical Analysis

We used a random effects model to pool proportions dead or readmitted at 30 days and 1 year across studies, as well as

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