International Journal of Surgery 33 (2016) 164–171

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Review

The role of minimal access valve surgery in the elderly. A meta-analysis of observational studies

Marco Moscarelli [a, b], Sam Emmanuel [c, *], Thanos Athanasiou [d], Giuseppe Speziale [b], Khalil Fattouch [e], Roberto Casula [d]

[a] Honorary Research Fellow, NHLI, Imperial College London, UK
[b] GVM Care and Research, Anthea Hospital, Bari, Italy
[c] St Vincent's Hospital, Sydney, Australia
[d] Department of Surgery and Cancer, Imperial College, Paddington, London, UK
[e] GVM Care & Research, Maria Eleonora, Palermo, Italy

HIGHLIGHTS

- Minimal access valve surgery is a safe alternative to the sternotomy approach in elderly patients.
- The approach demonstrates reduced mechanical ventilation time and reduced length of stay.
- Mortality is comparable to those undergoing a conventional sternotomy.
- Limitations for this approach include prolonged cardiopulmonary bypass and cross-clamp time.

ARTICLE INFO

Article history:
Received 11 February 2016
Received in revised form
14 April 2016
Accepted 24 April 2016
Available online 27 April 2016

Keywords:
Minimally invasive surgery
Mitral valve
Aortic valve
Statistics
Meta-analysis

ABSTRACT

Background: Minimal access valve surgery, both mitral and aortic, may be related to improvement in specific post-operative outcomes, therefore may be beneficial for the subgroup of the elderly referred for valve surgery.

Methods: A systematic literature review identified several different studies, of which 6 fulfilled criteria for meta-analysis. Outcomes for a total of 1347 patients (675 conventional standard sternotomy and 672 minimally invasive valve surgery) were assessed with a meta-analysis using random effects modeling. Heterogeneity, subgroup analysis with quality scoring were also assessed. The primary endpoint was early mortality. Secondary endpoints included intra and post-operative outcomes.

Results: In the context of elderly patients, minimal access valve surgery conferred comparable early mortality to standard sternotomy (odd ratio (OR) 0.79, CI [0.40,1.56], $p = 0.50$) with no heterogeneity ($p = 0.13$); it was also associated with reduced mechanical intubation time (OR 0.48, CI [0.30,0.78], $p = 0.003$) and reduced post-operative length of stay (weighted mean difference (WMD) −2.91, CI [−3.09, −2.74] $p < 0.00001$), however both cardio-pulmonary bypass time and cross clamp time were longer (WMD 24.29, CI [22.97, 25.61] $p < 0.00001$ and WMD 8.61, CI [7.61, 9.61], $p < 0.00001$, respectively); subgroup analysis demonstrated statistically significant reduced post-operative length of stay for both minimally invasive aortic and mitral surgery (WMD −2.84, CI [−3.07, −2.60] $p < 0.00001$ and WMD −2.98, CI [−3.25, −2.71] $p < 0.00001$ respectively).

Conclusions: Despite a prolonged cardiopulmonary bypass and cross clamp time, minimally invasive valve surgery is a safe alternative to standard sternotomy in the elderly, with similar early mortality, and improvements in intubation time as well as length of stay.

1. Introduction

Population ageing is a long-term trend, which began several decades ago, moreover the 'very old segment population' is growing at a faster pace than any other age segment of the

* Corresponding author. St Vincent's Hospital (Sydney), 390 Victoria Street, Darlinghurst, NSW 2010, Australia.
E-mail address: SamEmmanuel@Windowslive.com (S. Emmanuel).

http://dx.doi.org/10.1016/j.ijsu.2016.04.040
1743-9191/

European population: those aged 65 years or over will account for 28.7% of the European population by 2080 [1]. It is clear that, in the future, cardiac surgeons will have to deal with an even larger number of elderly patients than today. These patients may be more prone to develop peri-operative adverse events [2], hence strategies that can ameliorate such outcomes are always sought.

Catheter based technologies, while being available, are still limited to very high-risk or inoperable patients. Nevertheless, cardiac surgeons have been offering minimally invasive valve surgery (MIVS), both aortic and mitral, for several years with favorable results in the general surgical population [3] - these benefits may be also evident in patients with co-morbidities [4].

Current drawbacks of MIVS consist of an increased incidence of stroke, aortic dissection, longer cardio-pulmonary bypass (CPB) and cross clamp time (CCT). Some of the aforementioned drawbacks may be related to technical reasons and/or learning curve; moreover, there are no prospective randomized trials so far, comparing in an unbiased way MIVS and sternotomy (ST) in a context of elderly. As such, the majority of evidences comes from observational studies [2].

Aims of this meta-analysis are to identify, in the context of elderly patients, whether MIVS 1) can be as safe as the counterpart ST in terms of mortality 2), can be still associated with certain post-operative benefits as in the general cardiac population despite the risk of prolonged cardiopulmonary bypass and cross clamp time.

2. Material and methods

2.1. Literature search

Literature search was performed using PubMed, Ovid, Embase, Medline, and Cochrane databases using the MeSH terms 'minimally invasive/access mitral valve', 'minimally invasive/access aortic valve', and we included in the MeSH entry terms 'elderly', 'old', 'frail', 'elders', 'frail older', 'older adults', 'septuagenarian', 'octogenarian', 'nonagenarian'. In addition to this, our search was extended to include the clinicaltirals.gov database and 'grey' literature for further rigor. The 'related articles' function in PubMed was also used to ensure completeness. The literature search commenced on 06/11/2015 and the last date of the search was 1st December 2015 (Fig. 1); first paper scrutinized in Pubmed with mesh term 'minimally invasive/access aortic valve' was from 1966.

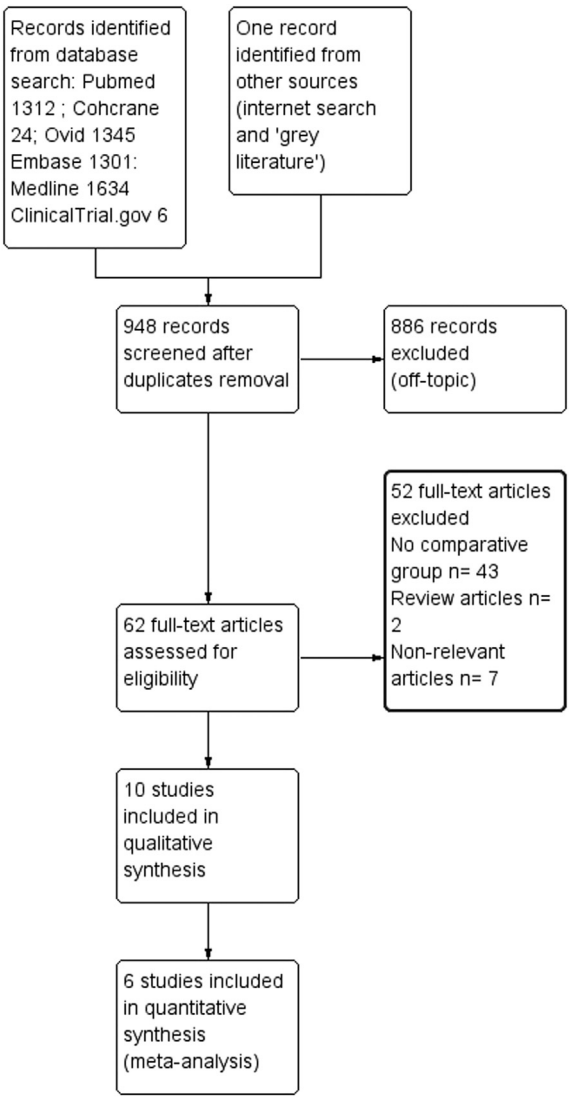

Fig. 1. Search strategy.

2.2. Inclusion and exclusion criteria

All articles reporting outcomes for MIVS (experimental group) and ST (control group) were included. Studies were excluded from the review if: (1) Inconsistency of data did not allow valid extraction; (2) data was duplicated; (3) if the experimental or control group was robotic mitral or aortic valve intervention and (4) the trial/study was carried out on animal models. Based on these criteria, two assessors (SE, MM) independently selected studies for further examination by title and abstract review. All potentially eligible studies were retrieved in full for further evaluation. Any disagreement was resolved by discussion with three senior authors (TA-RC-KF). Statistical concordance testing was performed using Cohen's Kappa coefficient to measure of inter-rate agreement.

2.3. Data analysis

Two Authors (MM, SE) independently extracted the following data from each paper using a predefined protocol including: first author; year of publication; study type; number of subjects and study population demographics. Specific outcome data was where possible for the following: (i) Primary endpoints: early mortality (including 30-day or in-hospital mortality) (ii) Secondary endpoints including: cardio pulmonary bypass time, cross clamp time, re-opening for bleeding, prolonged intubation time (defined as per more than 48 h), acute renal failure (defined as per creatinine >200 mg/dl or double the baseline value or need for dialysis), stroke, TIA, lung complications, post-operative length of stay.

Meta-analysis was performed in line with recommendations from the Cochrane Collaboration and in accordance with both PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and MOOSE (Meta-analysis Of Observational Studies in Epidemiology) guidelines [5,6]. Analysis was conducted by use of Review Manager® Version 5.1.7 for Windows (The Cochrane Collaboration, Software Update, Oxford, UK) and STATA v.11 statistical analysis software. Data was analyzed using a weighted DerSimonian–Laird with random effects model. Continuous data were investigated using weighted mean difference (WMD) as the summary statistic, reported with 95% confidence intervals (CI). The point estimate of the WMD was considered statistically significant at $p < 0.05$, if the 95% confidence interval did not include the value zero. Categorical variables were analyzed using the odds ratio (OR). An OR of <1 favored the treatment group and the point estimate of the OR is considered statistically