

## Modern Cardiac Surgical Outcomes in Nonagenarians: A Multicentre Retrospective Observational Study

**Authors :** Laurence Weinberg, Dominic Walpole, Dong-Kyu Lee, Michael D'Silva, Jian W. Chan, Lachlan F. Miles, Bradley Carp, Adam Wells, Tuck S. Ngun, Siven Seevanayagam, George Matalanis, Ziauddin Ansari, Rinaldo Bellomo, Michael Yii

**Abstract :** Background: There have been multiple recent advancements in the selection, optimization and management of cardiac surgical patients. However, there is limited data regarding the outcomes of nonagenarians undergoing cardiac surgery, despite this vulnerable cohort increasingly receiving these interventions. This study describes the patient characteristics, management and outcomes of a group of nonagenarians undergoing cardiac surgery in the context of contemporary perioperative care. Methods: A retrospective observational study was conducted of patients 90 to 99 years of age (i.e., nonagenarians) who had undergone cardiac surgery requiring a classic median sternotomy (i.e., open-heart surgery). All operative indications were included. Patients who underwent minimally invasive surgery, transcatheter aortic valve implantation and thoracic aorta surgery were excluded. Data were collected from four hospitals in Victoria, Australia, over an 8-year period (January 2012 - December 2019). The primary objective was to assess six-month mortality in nonagenarians undergoing open-heart surgery and to evaluate the incidence and severity of postoperative complications using the Clavien-Dindo classification system. The secondary objective was to provide a detailed description of the characteristics and perioperative management of this group. Results: A total of 12,358 adult patients underwent cardiac surgery at the study centers during the observation period, of whom 18 nonagenarians (0.15%) fulfilled the inclusion criteria. The median (IQR) [min-max] age was 91 years (90.0:91.8) [90-94] and 14 patients (78%) were men. Cardiovascular comorbidities, polypharmacy and frailty, were common. The median (IQR) predicted in-hospital mortality by EuroSCORE II was 6.1% (4.1-14.5). All patients were optimized preoperatively by a multidisciplinary team of surgeons, cardiologists, geriatricians and anesthetists. All index surgeries were performed on cardiopulmonary bypass. Isolated coronary artery bypass grafting (CABG) and CABG with aortic valve replacement were the most common surgeries being performed in four and five patients, respectively. Half the study group underwent surgery involving two or more major procedures (e.g. CABG and valve replacement). Surgery was undertaken emergently in 44% of patients. All patients except one experienced at least one postoperative complication. The most common complications were acute kidney injury (72%), new atrial fibrillation (44%) and delirium (39%). The highest Clavien-Dindo complication grade was IIIb occurring once each in three patients. Clavien-Dindo grade IIIa complications occurred in only one patient. The median (IQR) postoperative length of stay was 11.6 days (9.8:17.6). One patient was discharged home and all others to an inpatient rehabilitation facility. Three patients had an unplanned readmission within 30 days of discharge. All patients had follow-up to at least six months after surgery and mortality over this period was zero. The median (IQR) duration of follow-up was 11.3 months (6.0:26.4) and there were no cases of mortality observed within the available follow-up records. Conclusion: In this group of nonagenarians undergoing cardiac surgery, postoperative six-month mortality was zero. Complications were common but generally of low severity. These findings support carefully selected nonagenarian patients being offered cardiac surgery in the context of contemporary, multidisciplinary perioperative care. Further, studies are needed to assess longer-term mortality and functional and quality of life outcomes in this vulnerable surgical cohort.

**Keywords :** cardiac surgery, mortality, nonagenarians, postoperative complications

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