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## ORIGINAL ARTICLE

# Predictors of early operative mortality and long-term survival in octogenarians undergoing open and endovascular repair of abdominal aortic aneurysm

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**KEYWORDS**

Abdominal aortic aneurysm;  
Octogenarians;  
Open repair;  
Endovascular aneurysm repair;  
Operative mortality;  
Survival;  
Re-intervention

**Summary** *Background:* The study aims to report outcomes of open repair (OR) and endovascular aneurysm repair (EVAR) in octogenarians.

*Methods:* Consecutive patients aged between 80 and 89 who underwent OR or EVAR were identified from a prospectively collected departmental database. Short-term outcomes included 30 days mortalities and perioperative complications; long-term outcomes included overall survival and re-intervention using the Kaplan–Meier method. Logistic regression was used to identify predictors for operative mortality and Cox regression analysis was used to identify predictors for long-term survival.

*Results:* From January 1999 to December 2013, 53 underwent open repairs (23 emergency and 30 elective) and 115 underwent endovascular repairs (11 emergency and 104 elective). For **elective procedures**, 30 days operative mortalities were 6.7% and 0% in OR and EVAR respectively (Chi square test,  $p = 0.049$ ). For **emergency procedures**, 30 days mortalities were 39.1% and 27.2% respectively (Chi square test,  $p = 0.705$ ). Overall 5 years survival rates were 40.4% and 36.7% after OR and EVAR respectively. Rupture of aneurysm (Odd ratio 18.8, 95% CI 3.4–104.5,  $p = 0.001$ ) was the only predictor for 30 days mortality. Rupture of aneurysm (Hazard ratio 2.0, 95% CI 1.3–3.3,  $p = 0.003$ ), history of lung disease (Hazard ratio 1.7, 95% CI 1.0–2.9,  $p = 0.039$ ) and history of renal disease (Hazard ratio 2.1, 95% CI 1.4–3.1,  $p < 0.001$ ) were independent predictors for long-term overall survival.

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**Conclusion:** Decision of AAA repair in octogenarians should not be based on age alone. Both elective OR and EVAR had acceptable perioperative risk, but emergency repair, lung disease and renal impairment predicted poor long-term survival.

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## 1. Introduction

With an ever aging population, the number of patients with abdominal aortic aneurysm (AAA) will inevitably increase.<sup>1</sup> The decision to treat octogenarians with infrarenal aortic aneurysm purely based on chronological age is not appropriate, as it is often the biological age and co-morbidity of the patients that predict post-operative performances. It was perceived that the repair of infrarenal aortic aneurysms in patients more than 80 years of age may be associated with higher perioperative risks, but this is not the case as shown in multiple published series.<sup>2–10</sup>

The aim of this study was to report the short and long term outcomes of open repair (OR) and endovascular aneurysm repair (EVAR) in octogenarians at our tertiary referral vascular centre.

## 2. Material and methods

### 2.1. Study population

For the period from 1 January 1999 till 31 December 2013, consecutive patients aged between 80 and 89 underwent OR or EVAR for abdominal aortic aneurysms in our single-centre institution were retrospectively reviewed from our prospectively collected computerized departmental database. Patient selection for OR or EVAR were non-randomized.

### 2.2. Departmental policy on treatment

In the case of emergency, our strategy was to consider all patients unless patient categorically refused intervention or had advanced directory. For those who were haemodynamically unstable, they would be directly transferred to operating theater from the Accident & Emergency resuscitation room without computer tomography (CT) scan. For those with stable haemodynamics, they would undergo a contrast CT scan to evaluate anatomical suitability for emergency EVAR. Pre-operative planning was performed using the Digital Imaging and Communications in Medicine (DICOM) data sets imported into the TeraRecon Aquarius workstation (San Mateo, California). This allowed rapid appreciation of the 3D aortic anatomy which would be difficult to be evaluated on a 2D planar CT imaging. The mode of treatment will be determined accordingly.

Patients with asymptomatic AAA were treated when size of aneurysm was more than or equal to 5 cm. Other indications included rapid increase in size or painful aneurysm. Preoperative multi-disciplinary assessment and optimization were important, for pre-operative assessment and for consideration of EVAR unless anatomically

unsuitable. All EVARs were done by dedicated vascular surgeons in our hybrid endovascular operating suite (Siemens Artis Zee, Multi-axis Imaging System, Erlangen, Germany) situated in the Minimally Invasive Surgical Centre. All the patients would be nursed in high dependent unit/intensive care unit after operation.

### 2.3. Post-operative surveillance

Clinical and image follow up were performed routinely in all patients post aneurysm repair. We recommended duplex ultrasound at 1 week, and computer tomography (CT) scans or duplex ultrasounds six-monthly post procedure for 2 years, and then annually afterwards, unless if symptomatology demanded more frequent follow-up or admission to hospital.

### 2.4. Statistical analysis

Patients' and AAAs' baseline characteristics and follow up period were reported. Short-term outcomes measured 30 days mortalities and perioperative complications. Long-term outcomes measured overall survival and re-intervention using Kaplan–Meier analysis. Categorical data were presented as count and/or percentage and compared using Chi Square test, while continuous data were presented as mean and/or standard deviation and compared using student t test. Binary logistic regression was used to identify predictors for operative mortality. Cox regression analysis was used to identify predictors for long-term survival of variables included means of treatment, sex, American Society of Anesthesiologists (ASA) grade, comorbidities, size of aneurysm, proximal aneurysm extent, distal aneurysm extent and rupture or not. Statistical analysis was calculated by SPSS version 22. A p-value was two tailed and less than 0.05 was defined as statistically significant.

Definition of heart disease was any history of ischemic heart disease or arrhythmia, lung disease was any history of chronic obstructive airway disease, and renal disease was serum creatinine level equal or greater than 120  $\mu\text{mol/L}$ . Emergency repair was for treatment of ruptured cases only, while painful or rapidly expanding aneurysm was counted as elective repair.

## 3. Results

### 3.1. Baseline characteristics

Out of 913 AAA repairs during the study period, one hundred and sixty-eight octogenarians underwent repairs. Fifty-three underwent OR (30 elective and 23 emergency). Median follow up period for OR group was 36 months (range

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