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Original Article

Survival Following Endovascular Aneurysm Repair in the Octogenarian

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Abstract

Survival following elective Endovascular Aneurysm Repair (EVAR) in the Octogenarian

Aim: Increasing age is a recognized independent predictor of mortality in aneurysm surgery. However, the long term survival benefit in octogenarians following Endovascular Aneurysm Repair (EVAR) remains unclear despite supporting evidence of safe use.

Methods: Consecutive subjects who underwent elective EVAR for AAA in a single tertiary centre between 1st July 2000 and 31st January 2015 were identified and survival data extracted through hospital electronic records. Subjects were categorized into two cohorts based on age, Group 1 (G1): < 80 years and Group 2 (G2): ≥80 years. Primary endpoints of interest were (i) 30-day mortality; (ii) early and late aneurysm related deaths; (iii) overall survival at follow up at 31 March 2015.

Results: 266 patients (235 male, 88.3%) were included in the study. G1 comprised 195 patients (180 male, 92.0%), mean age 71.9 years (Standard Deviation (SD) 5.7) whilst G2 comprised 71 patients (55 male, 77%), mean age 83.2 years (SD 2.1).The mean AAA sac diameter were similar between groups (6.5cm v 6.3cm, p > 0.05). G2 had higher proportion of patients with chronic kidney disease (32% v 12%, p < 0.001). Thirty-day mortality: 3 deaths occurred in G1 and 1 in G2. The odds ratio for octogenarians developing post-operative 30-day complications was 1.99 (95% confidence interval (CI) 1.11-3.61, p = 0.02).

At follow up, 81 deaths occurred (G1: 55, G2: 26). Overall median survival was 91 months (Standard Error (SE) 4.6). Median survival in G1 = 92 (SE 16.6) months and G2 = 87 (SE 14.8) months. No survival differences were observed between groups on Kaplan Meier analysis (Log Rank, p > 0.05). Multivariate Cox proportional hazards model demonstrated that ASA scores more than 3 significantly predicted risk of mortality during follow up with hazard ratio of 3.97 (95% confidence interval 2.06 - 7.65).

Conclusion: Survival of selected octogenarian patients undergoing elective EVAR is comparable to younger co-hort of patients undergoing EVAR.

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Introduction

The population of the United Kingdom is ageing and this process is predicted to continue for the next few decades. The highest expansions in population based on age cohort observed are those of 85 years and over. By 2035, national projections estimate that 23% of the UK population will be over 65 years, and 5% of the population aged beyond 85 years [1]. Understandably, such shift in population demographics poses an unprecedented challenge to healthcare services, both financially and in clinical management of various elderly diseases care as well as care of the old.

Abdominal Aortic Aneurysms (AAA) is generally a disease of the ageing population where its prevalence increases significantly with age [2]. Increasingly as the nation ages, the demands on vascular services to provide treatment for non-rupture AAA in octogenarians too rises. This poses a clinical dilemma to clinicians. On one hand, we recognize increasing age as an independent predictor of mortality, postoperative complications, and the need for discharge to an extended care facility for both treatment options of AAA, open and Endovascular Aneurysm Repair (EVAR) not to mention the limited potential in remaining life years [3,4]. On the other hand, current evidences through randomized controlled trials do suggest safe EVAR use in octogenarians [5-8]. Although some controversies do remain regarding the generalisability of these evidences, this is enough to cause split opinions amongst field experts. Now, there are also epidemiological evidences which suggest a shift in incidence of AAA towards those over 75 years of age towards non-rupture [9]. With the uncertainty in choice of management in non-ruptured AAA in this cohort of patients, what remains certain is that understanding the potential gain in life years in these selected older patients post EVAR will guide future management pathways. We performed this study to evaluate the outcome of EVAR in the selected octogenarian patients in the north of Scotland.

Methods

A retrospective cohort review was performed on a prospectively maintained database comprising all patients who underwent EVAR for AAA in NHS Grampian, Aberdeen Royal Infirmary, Scotland, United Kingdom. Subjects who underwent elective EVAR procedure between periods 1st July 2000 to 31st January 2015 were selected to be included into this study. For the purposes of this study, selected subjects were stratified into 2 groups based on age - Group 1 (G1): < 80 years; Group 2 (G2): ≥80 years old at the time of EVAR.

For these patients, data including patient demographics, aneurysm morphology, post-operative morbidity, mortality and late mortality, and re-intervention were retrieved from hospital electronic records. Where available on hospital records, the cause of death was recorded for deceased subjects to assess whether death was directly related to aneurysm disease. Those where cause of death was unavailable were defaulted to have deaths unrelated to aneurismal disease.

Primary endpoints of interest were (i) 30-day mortality; (ii) early and late aneurysm related deaths; (iii) overall survival at follow up censored at 31 March 2015. Secondary endpoints identified include

30-days postoperative morbidity and the rate for re-intervention. Postoperative morbidity in this study included graft-related complication, myocardial infarction, respiratory tract infection, acute kidney injury and ischemic complications.

For statistical analysis, SPSS version 22 was used. Student's T test was used to analyze categorical variables. Chi square test was used to analyze difference between proportions. Kaplan-Meier method was used to analyze survival differences and cox proportional hazard ratios were used to analyze pre-operative covariates significantly affecting long-term survival. P value of < 0.05 was considered statistically significant.

Results

Patient demographics

A total of 266 patients were included in the study. Of these, 235 were male (88%). G1 comprised 195 patients (73%), mean age 71.9 (Standard Deviation (SD) 5.7) years. G2 comprised 71 patients (27%), mean age 83.2 (SD 2.1) years. G2 had a higher proportion of females compared to G1 (23% v 8%, p <0.01) and a higher proportion of patients with chronic kidney disease (32% v 12% respectively, p <0.001).

The mean AAA sac diameter were similar between both groups (6.5cm v 6.3cm, p > 0.05), as proportion of patients with ASA greater than 3 (4% v 7%, p >0.05) (Table 1).

Variable	Group 1 (n = 195)	Group 2 (n = 71)	p value
Males (%)	180 (92%)	55 (77%)	0.001
Mean age (SD)	71.9 (5.7)	83.2 (2.1)	-
ASA*>3 (%)	14 (7%)	3 (4%)	NS
Preoperative CKD**	24 (12%)	23 (32%)	<0.001
Mean AAA Sac Diameter (SD), cm	6.3 (1.0)	6.5 (1.1)	NS

Table 1: Patient Demographics.

*ASA score - American Society of Anaesthesiology Scale

**CKD - Chronic Kidney Disease, patients with eGFR of < 60 ml/min/1.73 m^2

Intra-operative details

No significant difference was observed intra-operatively (Table 2).

	Group 1	Group 2	p value
General anesthesia (%)	158 (81%)	54 (76%)	NS
Operative time (SD), min	141 (48)	150 (51)	NS

Table 2: Intra operative details.

Perioperative (30-days) mortality and morbidity

Perioperative complications are summarized in table 3. The length of postoperative hospital stay for G2 was significantly greater than G1, with median duration 4 days compared to 3 days (Interquartile Range (IQR): 2 - 6 vs 2 - 4, p < 0.001). We did not identify any significant difference in incidence of graft complications, cardiac events, postoperative respiratory complications, ischaemic events, post-operative haemorrhage, acute kidney injury or ischaemic events. However, patients in G2 had a significantly higher rate overall of experiencing postoperative complications (33.8% v 16.9%, p < 0.001). The odds ratio for octogenarians developing post-operative 30-day complications compared to non-octogenarians was 1.99 (95% confidence interval 1.11- 3.61).

Variable	Group 1 (n = 195)	Group 2 (n = 71)	p value
Median postoperative stay (IQR), days	3 (2 - 4)	4 (2 - 6)	<0.001
Graft complications (%)	6 (3.1%)	3 (4.2%)	NS
Myocardial Infarction (%)	2 (1%)	3 (4.2%)	NS
Respiratory tract complications (%)	7 (3.6%)	8 (11.2%)	0.02
Acute kidney injury (%)	15 (7.6%)	10 (14.1%)	0.09
Ischaemic complications (%)	1 (0.5%)	0 (0%)	NS
Missing data (%)	2 (1%)	0 (0%)	NS
Total morbidity (%)	33 (16.9%)	24 (33.8%)	<0.001

Table 3: Post EVAR (30 days) morbidity.

Late follow up and survival analysis

The re-intervention rate in this study cohort was 7.1%. No significant difference in rate of re-intervention was seen in either group (p > 0.05) (Table 4).

	Group 1	Group 2	p value
Embolisation	9	3	-
Extension	4	1	-
ReEVAR	2	0	-
Total reintervened (%)	15 (7%)	4 (6%)	NS
Multiple reinterventions	9	4	-

Table 4: Post EVAR reintervention.

For the entire cohort, median Survival (SE) was 89 months (12.3) with survival in G1: 92 (16.6) months and G2: 87 (14.8) months. Early and late survival analysis using Kaplan Meier method did not demonstrate any significant survival difference between the groups (Log Rank, p > 0.05) (Figure 1). One patient died of an aneurysm-related complication at 60 months due to a peri-aortic graft infection (Table 5).

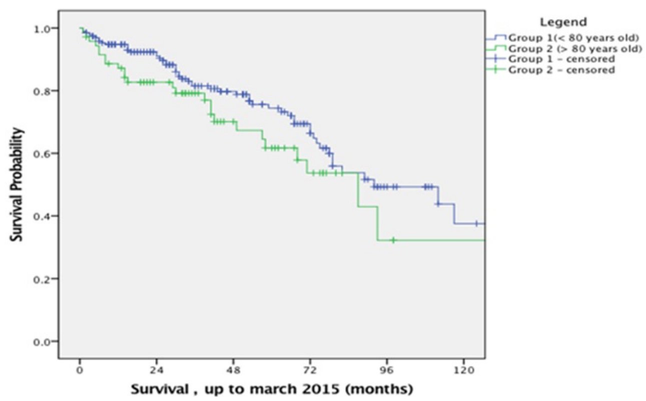

Figure 1: Kaplan Meier Survival Analysis after EVAR, up to April 2015, between octogenarian and non-octogenarian groups (Log rank, p = 0.10).

Number at risk	24	48	72	96	120
Group 1	178	163	152	143	141
Group 2	59	53	48	46	46

Variables	Group 1	Group 2	p value
30 day mortality	3	1	NS
Non-aneurysm related deaths at follow up	51	25	NS
Aneurysm related deaths at follow up	1	0	NS
Total deaths	55	26	NS

Table 5: All cause mortality.

Cox proportional hazard regression demonstrated that higher ASA scores as an independent risk factor for mortality, increasing hazard ratios by 3.9 fold. Other factors such as pre-existing CKD, age and re-intervention post EVAR were not found to be independent risk factors affecting survival (Table 6).

	Hazard ratios	95% confidence interval
Age > 80 years old	1.50	0.92 - 2.45
ASA score > 3	3.98	2.06 - 7.65
Chronic Kidney Disease	1.06	0.58 - 1.93
Re-intervention	3.60	0.88 - 14.74

Table 6: Hazard ratios.

Discussion

The incidence of non-ruptured AAA hospital admissions and non-emergency AAA repairs in those aged 75 years and over is significantly increasing and will continue as the population ages [9]. This shift in volume of octogenarians to vascular services poses significant challenges, particularly in aspects of case selection for surgery where balancing intervention free survival, risk of aneurysm related mortality and potential life expectancy gained from surgery is necessary.

In the UK, national screening program implemented offer routine AAA screening to men aged 65 years, where the disease is recognized to be most prevalent and screening most cost effective. In contrast, AAA in females of this age cohort is rare and therefore, found to not cost effective for a national screening programmed. Building on this, one observation noted in our study is the higher proportion of female within the octogenarian group. This shares the observation of others in the literature [10,11]. At a superficial level, this may simply represent an upward trend of AAA in female octogenarians. However, given the obvious absence of AAA screening in females, this is more likely to be a representation of a major selection bias in the population as a result of a male only national AAA screening programmed. Certainly, further epidemiological studies may be required to demonstrate this causal relationship.

Whilst there was no clear survival advantage observed in the octogenarian population, they had a significantly higher rate of developing postoperative complications than younger patients. This is in keeping with the findings reported in previous series and is considered to reflect the general level of co-morbidities and reduced physiological reserve [3,4]. Postoperative renal dysfunction is a significant complication following EVAR and represents the most common post-operative complication in patients under and over 80 years of age (8.4% vs 14.6%) [13,14]. These figures are higher than currently reported in the literature which may be due to underreporting in the literature and a lack of a standardized definition on the subject [14-16]. However, these complications did not translate into a higher 30-day mortality rate in octogenarian patients. Post-operative length of hospital stay amongst octogenarians was significantly longer than in the younger population, and is considered to be the result of both an increased rate of complications and also social circumstances.

In this study, we report comparable post EVAR survival rates in selected octogenarian patients to younger patient cohorts. It is important to highlight that the octogenarians included in the study (mean age (SD): 83 (2.1) years) were significantly older than the EVAR trial 2 participants. Octogenarian patients, representing 27% of our total EVAR cohort, were considered surgically fit following careful anaesthetic evaluation. This included routine blood tests, pulmonary function tests, electrocardiogram and/or myocardial perfusion scans followed by a consultant anaesthetist assessment. Further investigations or pre-operative interventions were carried out as necessary. Fifty-eight percent of our octogenarian population survived beyond 5 years, which compares favourably with general life expectancy amongst the population in our region although it is notably less than the 64 - 92% 5-year survival reported in other studies (3,4,11,12).

Another important aspect of EVAR is the necessity for continual post procedural lifelong surveillance and the possible need for re-intervention. For octogenarians whose lifespan is limited, survival free of intervention is of greater significance. This is challenging to achieve given poorer AAA anatomical suitability for EVAR in octogenarians to begin with [17]. In our study, we did not observe any difference of rate of re-intervention for endoleaks between both groups. Where quality of life post EVAR is concern, this represents an encouraging observation for octogenarians, where further re-interventions add on to the risk of morbidity. However, we also aware that this may be a representation of selection bias in our study, mainly due to the patient selection process for initial EVAR procedure.

We acknowledge that our study includes a carefully selected group of octogenarian subjects evaluated in a structured preoperative process that evolved over time without data available for those declined treatment. This is because no formal register was kept for patients declined of treatment. Despite this, we believe that our study is generalisable to other UK or European centers where patient sélection processes are similar. Our experience continues to support a structured multidisciplinary team approach in the selection of octogenarians to proceed to EVAR for AAA. We strongly support the statement from AAA patient groups in the UK that chronological age should not be the only factor affecting decision to treat [18].

Conclusion

EVAR is feasible in the octogenarian and both early and late survival rates are satisfactory. Advanced age alone should not exclude a subject from EVAR when possible.

Congress

Oral presentation in British Society of Endovascular Therapy (BSET) annual meeting June 2014

Conflict of Interest

None

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