HİTİT MEDICAL JOURNAL
HİTİT ÜNİVERSİTESİ TIP FAKÜLTESİ DERGİSİ

e-ISSN: 2687-4717 Cilt|Volume: 6 • Sayı|Issue: 1 - Şubat|February 2024

Early and Mid-term Results of Endovascular Treatment of Abdominal Aortic Aneurysm in Patients Over 65 Years of Age

65 yaş Üstü Hastalarda Abdominal Aort Anevrizmasının Endovasküler Tedavisinin Erken ve Orta Dönem Sonuçları

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Makale Bilgisi | Article Information
Makale Türü | Article Type: Araştırma Makalesi | Research Article
Doi: https://doi.org/10.52827/hititmedj.1359552
Geliş Tarihi | Received: 13.09.2023
Kabul Tarihi | Accepted: 20.11.2023
Yayım Tarihi | Published: 26.02.2024

Atıf | Cite As
Erol ME, Ünal EU. Early and Mid-term Results of Endovascular Treatment of Abdominal Aortic Aneurysm in Patients Over 65 Years of Age. Hitit Medical Journal 2024;6(1): 42-47 https://doi.org/10.52827/hititmedj.1359552

Hakem Değerlendirmesi: Alan editörü tarafından atanan en az iki farklı kurumda çalışan bağımsız hakemler tarafından değerlendirilmiştir.
Etik Beyanı: Ankara Bilkent Şehir Hastanesi Klinik Araştırmalar Etik Kurulundan onay alınmıştır (No. E1-19-161, 24-12-2019).
İntihal Kontrolleri: Evet - (iThenticate)
Çıkar Çatışması: Yazarlar çalışma ile ilgili çıkar çatışması beyan etmemiştir.
Şikayetler: hmj@hitit.edu.tr
Katkı Beyanı: Fikir/Hipotez: MEE, EUU Tasarım: EUU Veri Toplama/ Veri İşleme: MEE, EUU Veri Analizi: EUU Makalenin Hazırlanması: MEE
Hasta Onamı: Çalışma retrospektif bir çalışma olduğundan hastalardan onam alınması gerekmemektedir.
Finansal Destek: Finansal destek alınmamıştır.
Telif Hakı & Lisans: Dergi ile yayın yapan yazarlar, CC BY-NC 4.0 kapsamında lisanslanan çalışmalarının telif hakkını elinde tutar.

Peer Review: Evaluated by independent reviewers working in the at least two different institutions appointed by the field editor.
Ethical Statement: Approval of the Ankara Bilkent City Hospital Clinical Research Ethics Committee (No. E1-19-161, 24-12-2019).
Plagiarism Check: Yes - (iThenticate)
Conflict of Interest: The authors declared that, there are no conflicts in interest
Complaints: hmj@hitit.edu.tr
Authorship Contribution: Idea/Hypothesis: MEE, EUU Design: EUU Data Collection/Data Processing:MEE, EUU Data Analysis: EUU Article Preparation: MEE
Informed Consent: This manuscript is an orginal research article in retrospecitive fashion. No need for informed conset from patients
Financial Disclosure: There are no financial funds for this article.
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Early and Mid-term Results of Endovascular Treatment of Abdominal Aortic Aneurysm in Patients Over 65 Years of Age

Abstract

Objective: In patients over the age of 65, the most appropriate treatment modality for abdominal aortic aneurysms (AAA) is controversial, but the use of endovascular treatment methods is increasing. The aim of this study was to investigate the duration of intensive care unit stay, need for reintervention, and early and late mortality rates after endovascular treatment in octogenerians with abdominal aortic aneurysm.

Material and Method: A total of 220 patients who underwent endovascular aneurysm repair for abdominal aortic aneurysm under elective conditions were included in the study. Patients over 70 years of age constituted Group-1 (n=102) and those under 70 years of age constituted Group-2 (n=118). The groups were analyzed in terms of postoperative intensive care stay, need for reintervention, and early and late mortality rates.

Results: The ratio of males was higher in group 1 (94.5% vs. 84.9, *p=0.017*). Length of ICU stay was higher in group 1 (12 hours vs. 8 hours, *p=0.014*). All four cases of early mortality were in patients over 65 years of age (*p=0.031*). There was no difference between the groups in terms of follow-up period (32 vs. 31 months, *p=0.859*), late mortality (8% vs. 13%, *p=0.219*), or the need for secondary intervention (6% vs. 7%, *p=0.770*). There was no difference between the groups in terms of survival and the 3-year survival was 91% vs. 85%. (*p=0.199*).

Conclusion: In octogenerians, endovascular aneurysm repair can be performed with acceptable mortality rates and satisfactory mid-term outcomes.

Keywords: Abdominal, aortic aneurysm, endovascular repair.

Özet

Amaç: 65 yaş üstü hastalarda abdominal aorta anevrizmalarının en uygun tedavi yöntemi tartışmalıdır, ancak endovasküler tedavi yöntemlerinin kullanımı artmaktadır. Bu çalışmanın amacı, abdominal aorta anevrizması olan 65 yaş üstü hastalarda endovasküler tedavi sonrası yoğun bakım süresini, yeniden müdahale ihtiyacını ve erken ve geç dönem mortalite oranlarını araştırmaktır.

Gereç ve Yöntem: Elektif koşullar altında abdominal aorta anevrizması için endovasküler anevrizma onarımı uygulanan toplam 220 hasta çalışmaya dahil edildi. 65 yaşın üzerindeki hastalar Grup-1'i (n=102) oluştururken, 65 yaşın altındakiler Grup-2'yi (n=118) oluşturdu. Gruplar, postoperatif yoğun bakım süresi, yeniden müdahale ihtiyacı ve erken ve geç dönem mortalite oranları açısından analiz edildi.

Bulgular: Erkeklerin oranı grup 1'de daha yüksekti (94.5% vs. 84.9, *p=0.017*). Yoğun bakım süresi grup 1'de daha uzundu (12 saat vs. 8 saat, *p=0.014*). Erken mortalite gerçekleşen dört vakanın tümü 65 yaşın üzerindeki hastalardaydı (*p=0.031*). Gruplar arasında takip süresi (32 vs. 31 ay, *p=0.859*), geç dönem mortalite (8% vs. 13%, *p=0.219*) veya sekonder müdahale ihtiyacı (6% vs. 7%, *p=0.770*) açısından fark yoktu. Gruplar arasında yaşam süresi ve 3 yıllık yaşam oranı açısından fark yoktu, 3 yıllık yaşam oranı ise %91 vs. %85'ti (*p=0.199*).

Sonuç: Yaşlı hastalarda, endovasküler anevrizma onarımı kabul edilebilir mortalite oranlarıyla ve tatmin edici orta dönem sonuçlarıyla gerçekleştirilebilir.

Anahtar Sözcükler: Abdomial, aort anevrizması, endovasküler tamir.

Introduction

Abdominal aortic aneurysm (AAA) is an asymptomatic disease that is often detected incidentally and its frequency increase with age. In some cases, the first symptom may be aneurysm rupture.

AAA is currently treated with open surgical repair (OSR) and endovascular aneurysm repair (EVAR). The choice of these two treatment modalities is based on the patient's comorbid factors and the anatomical features of the aneurysm.

In older patients, the mortality and morbidity of OSR increases with the increase in comorbid factors. For this reason, EVAR has become the treatment of choice for AAA, especially in older patients, due to its minimally invasive nature and lower peri-operative complication rates (2). At the same time, the lower operative mortality and satisfactory early results of EVAR have led to an increase in its use in elderly patients and patients with comorbidities (3). Some studies have shown that EVAR has lower mortality and morbidity than surgical treatment in elective AAA patients with advanced age (4). While the technical success of EVAR in elderly patients is high, complication rates are also high (5).

The outcome of EVAR in patients over 65 years of age and those under 65 years of age is still a matter of debate.

In order to evaluate the safety and viability of EVAR in older patients, it is imperative to juxtapose the post-procedural outcomes of indiviuals within this age bracket against those under the age of 65. The aim of this study was to investigate the technical success, survival, and complication rates of EVAR in patients over 65 years of age.

Material and Method

This research was designed as a retrospective and observational study. A total of 220 patients who underwent EVAR under elective conditions for AAA between January 2015 and January 2020 were included in our study. The study was conducted in accordance with the Declaration of Helsinki and with the approval of the Ankara Bilkent City Hospital Clinical Research Ethics Committee (No. E1-19-161, 24-12-2019).

Patients included in the study were divided into two groups as those under 65 years of age (n = 102) and over 65 years of age (n = 118). Both groups were analyzed in terms of follow-up periods, early mortality, late mortality, need for secondary intervention, length of intensive care unit stay, and discharge times.

All EVAR procedures were performed by a dedicated cardiovascular surgery team in a hybrid operating room setting. Ankura stent-graft systems (Lifetech Scientific Corporation, Shenzen,China) were employed to all patients The procedures were performed under general or local-regional anesthesia according to the preference of the surgical team, anesthesiologist, and patient. Modular endografts were placed using standard methods. After the procedure was completed, a final angiography was performed. Type 1 endoleaks were treated with balloon angioplasty and placement of an extension graft when necessary; type 2 endoleaks were monitored during follow-up.

Postoperative follow-up was performed clinically and radiologically at discharge, 1 month, 6 months, 12 months, and then annually. Computed tomography examination and Doppler ultrasonography were performed for the first time at postoperative one month. If there was no type 1 or 3 endoleak in the initial evaluation, subsequent endoleak and sac diameter evaluations were performed only with Doppler ultrasonography (1). Type 2 endoleaks were evaluated using Doppler ultrasonography only, because they are considered benign endoleaks in the absence of sac enlargement. If there was a suspicion of sac enlargement on ultrasonographic examination, this finding was evaluated using tomography. Sac enlargement was defined as an increase of at least 5 mm compared to the preoperative diameter. When a secondary intervention, such as extension of stent-graft was required was required, contrast-enhanced angiography was performed only in the hybrid room.

Statistical Analysis

The variables were analyzed using both visual methods, such as histograms and probability plots, as well as analytical methods, including the Kolmogorov–Smirnov/Shapiro–Wilk tests to assess the normality of data distribution. Continuous variables that were normally distributed were presented as mean ± standard deviation, while non-normally distributed variables were presented as median values with their range. Categorical variables were expressed as percentages and numbers. The Mann–Whitney U test and Chi-square test were used to compare demographic parameters, operating variables, and follow-up data. Kaplan–Meier analysis was performed to demonstrate long-term all-cause mortality. The log-rank test was conducted to assess difference between groups. A *p-value of* < 0.05 was deemed statistically significant, and statistical analysis was performed using SPSS for Windows version 15.0 software program (SPSS Inc., Chicago, IL, USA).

Results

Distribution and demographic characteristics of the patients are presented in Table-I. The second table provides information regarding the procedural

details od the patients. Among both groups there were more male patients than female, and this finding was statistically significant Group-1 (*p=0.028*). In addition, the duration of intensive care unit stay was significantly shorter in patients younger than 65 years (*p=0.004*). All four cases of mortality seen in the early period were in patients over 65 years of age (*p=0.038*).

Table I. Demographic datas

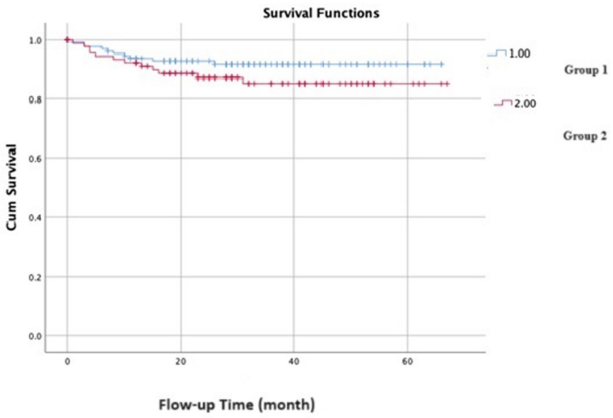
	Under 70 years old	Over 70 years old	*p value*
Age (year)	64.13±4.87	76.44±5.02	*< 0.001*
Gender (Male)	107 (94.7%)	92 (86.0%)	*0.028*
DM	30 26.5%	31 29.0%	*0.688*
HT	76 67.3%	78 72.9%	*0.362*
HL	34 30.1%	31 29.0%	*0.856*
COPD	25 22.1%	33 30.8%	*0.142*
PVD	11 9.7%	8 7.5%	*0.551*
CAD	39 34.5%	47 43.9%	*0.153*
CHF	3 2.7%	6 5.6%	*0.322*
Smoking	56 49.6%	53 49.5	*0.997*
TIA/CVE	5 4.4%	10 9.3%	*0.148*
Cancer	3 2.7%	3 2.8%	*1.000*
Symptom	37 32.7%	28 26.2%	*0.285*
EF (%)	52.88± 8.45	52.22± 9.10	*0.410*
Aneurysm Diameter(mm)	64.17± 14.01	66.27± 13.79	*0.127*
Procedure Duration (min)	146.78±43.36	142.79±56.53	*0.203*
Scopy Duration (min)	17.29± 12.02	17.63± 12.26	*0.827*
Opaque Quantity (cc)	64.10± 23.90	61.24± 25.19	*0.676*
IC Duration (hour)	8.20±24.28	11.40±19.22	*0.004*
Discharge Time (day)	2.58±2.38	2.74±2.44	*0.643*
Early Mortality	0 0.0%	4 3.7%	*0.038*
Follow-up (month)	33.85±16.94	35.32±16.94	*0.647*
Last pouch diameter (mm)	62.62±17.36	65.58±17.03	*0.312*
Late Mortality	10 8.8%	13 12.1%	*0.437*
Secondary Initiative	7 6.2%	8 7.5%	*0.719*

DM: Diabetes Mellitus **HT:** Arterial Hypertension **HL:** Hyperlipidemia
COPD: Chronic Obstrutive Pulmonary Diease **PVD:** Peripheral Vascular Disease
CAD: Coronary Artery Disease **TIA/CVE:** Transial İschemic Attack/Cerebrovascular Event
EF: Ejection Fraction

There was no significant difference between the two groups in terms of comorbid characteristics (diabetes mellitus, chronic obstructive pulmonary disease, hypertension, coronary artery disease, and peripheral artery disease).

No significant difference was found in terms of follow-up time (32 vs. 31 months, *p=0.859*)
There was no difference in late mortality (8% vs. 13%, *p=0.219*) and the need for secondary intervention (6% vs. 7%, *p=0.770*).

Figure I. Kaplan Meier Analysis of patients



In the last 5 years, a total of 220 EVAR patients were included in the study:

- Male gender predominates in patients under 70 years old compared to females (94.5% vs. 84.9%, *p=0.017*).
- Length of stay in the intensive care unit was longer for patients over 70 years old (12 hours vs. 8 hours, *p=0.014*).
- All 4 cases of early mortality occurred in patients over 70 years old (*p=0.031*).
- There was no significant difference in terms of follow-up duration for the patients (32 vs. 31 months, *p=0.859*).
- There was no statistically significant difference between the groups in terms of late mortality (8% vs. 13%, *p=0.219*) and secondary intervention rates (6% vs. 7%, *p=0.770*).

No difference was found between the two groups in terms of survival, and the 3-year survival was 91% vs. 85% (log-rank *p=0.199*) (Figure-I).

There was no difference in aneurysm diameters between the two groups (*p=0.127*).

Discussion

In patients with AAA of an advanced age with comorbidities, the treatment management and treatment process can be challenging. The aim of elective repair in patients with AAA is to prevent rupture, which can often be fatal.

In older patients, EVAR can be performed with acceptable mortality rates as we have shown in our study. At the same time, the mid-term survival rates of older patients after EVAR are satisfactory when compared with younger patients, which is demonstrated by our findings.

Current guidelines do not provide clear data on

the application of EVAR in elderly patients, and do not recommend EVAR only in patients with a life expectancy of two or three years (6).

In a surveillance study conducted in patients who were ineligible for AAA repair, it was shown that the risk of rupture increased in direct proportion with the diameter of the AAA annually (7). Therefore, prevention of rupture, which is the most deadly complication of AAA, should be considered the most important issue without question.

Endovascular treatment of AAA was introduced in 1990 and is becoming the main treatment option especially in patients with high comorbidity who are not suitable for surgical treatment (8). In various randomized controlled trials, patients who were anatomically suitable for EVAR and OSR, patients were compared in terms of early mortality and mid-term outcomes and similar results were obtained for EVAR and OSR (9).

In a 2016 study, it was shown that endovascular treatment of AAA was superior to OSR in terms of early survival but not in terms of late survival (10). In the same study, it was also shown that patients who underwent EVAR needed more re-interventions during long-term follow-up.

One of the main factors affecting the success of endovascular treatment is the patient having appropriate anatomical structure. Some studies have shown that in older patients, anatomical difficulties may negatively affect the results of endovascular treatment (11).

In the present study, the need for re-intervention was found to be low in patients of an advanced age who underwent EVAR, and there was no difference in mortality between the groups in the mid-term follow-up. Mortality occurred in four patients in the early period and all of these patients were over 65 years of age. The causes of these deaths were myocardial infarction in three patients and mesenteric ischemia in one patient. Myocardial infarction and cardiac complications may occur after EVAR and early troponin monitoring is recommended to recognize these conditions in the early period (12). Early troponin elevation after EVAR is considered a risk factor for early mortality. In the present study, two patients who died due to myocardial infarction also had elevated troponin levels measured on admission to the intensive care unit after the procedure.

No significant difference was found between the groups in terms of aneurysm diameter. Aneurysm diameter is the most important factor determining the risk of rupture. It was found that the risk of death and rupture was 11% when the diameter of the aneurysm was 5.1–6 cm, and this rate increased to 20% when the diameter was between 6.1–7 cm, and to 43% when the diameter was above 7 cm (7-13). The prevalence of AAA in the population over the age of 65 is approximately 1.5% (14). In a study conducted in a population aged 65–74 years, the incidence of mortality due to AAA was 36/100,000 people in the early 2000s, and this rate decreased to 10/100,000 people in 2015 (15). In this study, the reason for the decline in AAA-related mortality was stated as the increased frequency of screening, especially in the population over 65 years of age, and elective surgery before AAA rupture.

Complication rates for both OSR and EVAR are undoubtedly higher in the population over 65 years of age. In patients in this age group, the duration of hospitalization, intensive care unit stay, and need for blood transfusion were higher after OSR, whereas these rates were found to be lower in patients in the same age group who underwent EVAR (16).

Current guidelines do not provide clear recommendations for reducing age-related complications after EVAR (5). The results obtained in the present study showed that the early and mid-term outcomes for patients over 65 years of age who underwent EVAR were similar to those of younger patients and were acceptable. Management of patients with advanced age and minimization of procedural complications contribute to the survival of patients in this age group, as we have shown in the present study.

The most important limitation of the present study is that it was single-center study and retrospective in nature. Another limitation was that only patients treated with the endovascular method were included and patients who underwent surgical treatment were not analyzed. Hence, a comparison between EVAR and open surgical treatment could not be conducted.

Conclusion

With increasing technical experience in endovascular treatments, EVAR can be performed in patients over 65 years of age with additional comorbidities with satisfactory early and mid-term results.

References

1- Iscan HZ, Unal EU, Akkaya B et al. Color Doppler ultrasound for surveillance following EVAR as the primary tool.J Card Surg 2021;36:111-117.
2- Lagergren E, Chihade D, Zhan H et al. Outcomes and Durability of Endovascular Aneurysm Repair in Octogenarians. Ann Vasc Surg 2019;54:33-39.
3- Park BD, Azefor NM, Huang CC, Ricotta JJ. Elective endovascular aneurysm repair in the elderly: trends and outcomes from the Nationwide Inpatient Sample.

Ann Vasc Surg 2014;28:798-807.
4- Biancari F, Catania A, D'Andrea V. Elective endovascular vs. open repair for abdominal aortic aneurysm in patients aged 80 years and older: systematic review and meta-analysis. Eur J Vasc Endovasc Surg 2011;42:571e6.
5- Rueda-Ochoa OL, van Bakel P, Hoeks SE et al. Survival After Uncomplicated EVAR in Octogenarians is Similar to the General Population of Octogenarians Without an Abdominal Aortic Aneurysm. Eur J Vasc Endovasc Surg 2020;59:740-747.
6- Wanhainen A, Verzini F, Van Herzeele et al.Editor's Choice - European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms.Eur J Vasc Endovasc Surg 2019;57:8-93.
7- Western CE, Carlisle J, McCarthy RJ, Currie IC. Palliation of abdominal aortic aneurysms in the endovascular era. Eur J Vasc Endovasc Surg 2013;45:37e43.
8- Han Y, Zhang S, Zhang J, Ji C, Eckstein HH. Outcomes of Endovascular Abdominal Aortic Aneuyrsm Repair in Octogenarians: Meta-analysis and Systematic Review. Eur J Vasc Endovasc Surg 2017;54:454-463.
9- Geisbüsch P, Katzen BT, Tsoukas AI et al. Endovascular repair of infrarenal aortic aneuyrsm in octogenarians and nonoctogenarians. J Vasc Surg 2011;54:1605-1613.
10- Patel R, Sweeting MJ, Powell JT, Greenhalgh RM; EVAR trial investigators. Endovascular versus open repair of abdominal aortic aneurysm in 15-years' follow-up of the UK endovascular aneurysm repair trial 1 (EVAR trial 1): a randomized controlled trial. Lancet 2016;388(10058):2366-2374.
11- Pol RA, Zeebregts CJ, van Sterkenburg SM, Ferreira LM, et al. Outcome and quality of life after endovascular abdominal aortic aneurysm repair in octogenar- ians. J Vasc Surg 2014;60:308e17.
12- P J Devereaux, Bruce M Biccard, Alben Sigamani et al, Association of Postoperative High-Sensitivity Troponin Levels With Myocardial Injury and 30-Day Mortality Among Patients Undergoing Noncardiac Surgery. JAMA 2017;317:1642-1651.
13- VaitėnasG, Mosenko V, Račytė A, Medelis K, Skrebūnas A. Baltrūnas Abdominal Aortic Aneurysm Diameter versus Volume: A Systematic Review. T.Biomedicines 2023;11:941.
14- Wanhainen A, Hultgren R, Linné A, et al. Outcome of the Swedish nationwide abdominal aortic aneurysm screening program. Circulation 2016;134:1141e8.
15- Johansson M, Zahl PH, Siersma V, Jørgensen KJ, Marklund B, Brodersen J. Benefits and harms of screening men for abdominal aortic aneurysm in Sweden: a registry-based cohort study. Lancet 2018;391:2441e7.
16- Fonseca R, Rockman C, Pitti A, et al. Intermediate-term EVAR outcomes in octogenarians. J Vasc Surg 2010;52:556e60.