Predictive Factors for Abdominal Aortic Aneurysm Shrinkage One Year after Successful Endovascular Aneurysm Repair

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Background: Often, we experience cases of aneurysm shrinkage and no aneurysm shrinkage after successful endovascular aortic aneurysm repair, without postoperative endoleaks. We studied these cases to ascertain the predictive factors for aneurysm shrinkage.
Methods: From 2007 to 2014, we selected 255 cases that comprised aneurysm shrinkage (>4 mm) and no-shrinkage cases (shrinkage from 0 to 4 mm). Excluding 36 cases of endoleaks, 43 cases without 1-year follow-up computed tomography scan, and 3 cases of aortic dissection, we assessed 93 cases of aneurysm shrinkage (S group) and 80 cases of no aneurysm shrinkage (N group) at 1-year follow-up.
Results: No significant differences were found in sex, comorbidities (diabetes mellitus, chronic kidney disease, hemodialysis, and malignancy), and medications (antiplatelet drugs, anticoagulant drugs, steroids, and statins). Advanced age was a strong negative predictive factor for aneurysm shrinkage (N: 75.0 ± 1.0 vs. S: 72.1 ± 0.9 years; $P = 0.023$), and intraoperative endoleaks were more frequent in the N group (N: 31.3 vs. S: 9.7%; $P = 0.001$). Neck thrombus was more likely in the N group (N: 17.5 vs. S: 7.5%; $P = 0.045$), but it had a strong correlation with intraoperative endoleaks ($P = 0.008$). In the multivariate analysis, patient age and intraoperative endoleaks were predictive factors for aneurysm shrinkage.
Conclusions: Advanced age and intraoperative endoleaks were negative predictive factors for aneurysm shrinkage at 1-year follow-up after successful endovascular treatment without postoperative endoleaks.

INTRODUCTION

We often experience cases of abdominal aortic aneurysm (AAA) with no aneurysm sac shrinkage after successful endovascular aortic aneurysm repair (EVAR), even without endoleaks. The absence of aneurysm shrinkage is not a significant clinical problem because the goal of the EVAR treatment is to prevent aneurysm rupture; however, by assessing the predictive factors of aneurysm shrinkage, we may understand aneurysm formation or discover any unseen underlying problems of successful EVAR. We retrospectively compared no-shrinkage cases with shrinkage cases to find out the predictive factors of aneurysm shrinkage.

METHODS

From 2007 to 2014, we performed 341 EVARs, from which we retrospectively studied 255 successfully treated AAA cases without aneurysm enlargement. We defined ''shrinkage'' as shortening greater than 4 mm of the maximum AAA diameter and ''no shrinkage'' as maximum diameter shortening from 0 to 4 mm, by measured at 1-year follow-up computed tomography (CT) scan. We excluded 3

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Table I. Univariate analysis for predictive factors of aneurysm shrinkage

Predictive factors	N group ($n = 80$)	S group ($n = 93$)	P value
Characteristics			
Male/female	69/11	78/15	0.831
Age	75.0 ± 1.0 y/o	72.1 ± 0.9 y/o	*0.023*
Comorbidities			
Diabetes mellitus	15.0%	13.9%	0.826
Chronic kidney disease (estimated glomerular filtration rate < 60)	40.0%	37.4%	0.755
Hemodialysis	1.3%	2.2%	1.000
Malignancy	10.0%	14.0%	0.489
Medications			
Antiplatelet agents	45.0%	39.8%	0.538
Dual antiplatelet therapy (DAPT)	20.0%	20.4%	1.000
Anticoagulant	12.5%	7.5%	0.313
Steroids	6.3%	3.2%	0.474
Statins	30.0%	29.0%	1.000
Morphology			
Max. aneurysm diameter	50.2 ± 9.3 mm	53.4 ± 15.4 mm	0.107
Neck diameter	23.0 ± 3.2 mm	22.6 ± 2.9 mm	0.461
Neck length	37.7 ± 19.8 mm	33.5 ± 18.1 mm	0.148
Neck angle	35.4 ± 22.4°	33.2 ± 23.7°	0.526
Neck thrombus	17.5%	7.5%	*0.045*
Reversed taper shape	8.9%	8.6%	1.000
Preoperative inflammation			
WBC	6,500 ± 1,890/μL	6,220 ± 2,100/μL	0.367
CRP	0.507 ± 1.007 mg/dL	0.846 ± 1.977 mg/dL	0.246
Devices			
Within Instruction For Use (IFU)	63.7%	62.4%	0.876
Device selection			0.095
Endoleaks			
Intraoperative endoleaks	31.3%	9.7%	*0.001*
Type of endoleaks			0.699

Italic values of $P < 0.05$ are considered to be statistically significant.

cases of abdominal aortic dissection and 36 cases of evident endoleaks on postoperative contrast CT scans. We also excluded 43 cases, in the absence of contrast CT scan after procedures, which comprised inhospital death cases, drop-out cases before 1-year follow-up, and severe chronic kidney disease cases. In total, we evaluated 80 cases without aneurysm shrinkage (N group) and 93 cases with aneurysm shrinkage (S group) at 1-year follow-up. We collected preoperative data of serum white blood cell count and C-reactive protein (CRP) levels as representatives of inflammation. We also analyzed neck morphology such as neck diameter, length, angle, thrombus, and reversed taper shape. Neck thrombus was determined as more than 2 mm thrombus at the level of renal arteries. Intraoperative endoleaks were assessed by final angiogram during operation. We got informed consent from all patients for any kind of retrospective studies at the time of admission by the documents, and this study was approved by the Institutional Review Board of our hospital. Statistical analysis was performed using JMP11 (SAS Institute Japan, Tokyo), and statistical significance was set at $P < 0.05$. Data are expressed as means ± standard deviations. The χ^2 and Fisher's exact tests were used to assess whether a variable was significantly contributed to aneurysm shrinkage. The means of continuous variables were compared using Student's t-test. Multivariable logistic regression using purposeful selection was used to determine independent predictors of aneurysm shrinkage.

RESULTS

Mean aneurysm shrinkage at 1-year follow-up was 1.59 ± 1.52 mm in the N group and 11.49 ± 6.76 mm in the S group. Univariate analysis was performed (Table I). For patient characteristics,