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Case Report

Management and Outcome of Abdominal Aortic Aneurysms in End-Stage Renal Disease Patients: A Case Series

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Abstract

Aim: End-Stage Renal Disease (ESRD) patients on renal replacement therapy have increased cardiovascular morbidity and mortality rate and are at high risk for the development of Abdominal Aortic Aneurysms (AAAs). The aim of the present study was to investigate the management and outcome of AAAs in chronic hemodialysis patients.

Patients-Methods: During the period 2010-2015, an AAA was diagnosed in 19 ESRD patients. Thirteen out of them underwent Endovascular Aneurysm Repair (EVAR), 1 patient underwent Open Surgical Repair (OSR) and 5 patients were on regular follow-up.

Results: During the 6 year follow-up period, an endoleak was recorded in 7 out of the 13 aneurysms (36.8%). Endoleak was an early complication in one patient (14.3%) and late in six (85.7%) and was successfully managed with a repetitive EVAR in all cases. Five patients (26.3%) died including the patient who underwent OSR. The causes of death were sepsis in 3 patients (60%), device migration and aneurysm rupture in 1 patient (20%) and cerebrovascular accident in 1 patient (20%).

Conclusions: In end-stage renal disease patients with abdominal aortic aneurysms, EVAR is a safe therapeutic option with low both peri-operative and long-term morbidity and mortality.

Introduction

Patients with Chronic Kidney Disease (CKD), particularly those on renal replacement therapy, have increased cardiovascular morbidity and mortality rates and are at high risk for developing Abdominal Aortic Aneurysm (AAA). The latter is widely defined as dilatation of infrarenal abdominal aorta above 3.0 cm which is usually more than 2 standard deviations above the mean abdominal aorta diameter in both men and women [1,2]. In the general population, main risk factors associated with the development of AAA are black race, advanced age, male gender and smoking. Moreover, some studies demonstrated that body mass index, arterial hypertension, dyslipidemia, family history of AAA or history of other aneurysms (Marfan syndrome like) and cardiovascular disease are also significant risk factors [3,4]. In CKD the extremely high rates of cardiovascular disease and the increased incidence of AAAs are attributed to classic cardiovascular risk factors (such as hypertension, diabetes mellitus and dyslipidemia) which are over-represented in this patient population as well as to uremia-related risk factors including increased oxidative stress and chronic inflammation which are a common finding in uremia. However, studies up-to-date which investigated the management and outcome of AAAs in patients with CKD either on conservative treatment or on renal replacement therapy are scarce. The aim of the present study was to assess the management and long-term outcome of AAA in chronic hemodialysis patients.

Patients-Methods

From 2010 to 2015, 19 patients on regular hemodialysis in the Dialysis Unit of the University Department of Nephrology at Hippokratio General Hospital of Thessaloniki and in the Bioclinic Dialysis Unit of Thessaloniki were diagnosed with an infra-renal AAA. Depending on the aneurysm size, the latter was initially managed either surgically or conservatively with regular follow-up Computed Tomographic (CT) scans. Patients were followed-up for median of 66 months (range 4 to 132 months) after AAA repair. During this follow-up period 5 patients died. Each death was reviewed, all available medical information was recorded including hospitalization records and an underlying cause was assigned.

Table 1: Epidemiological and clinical characteristics of 19 hemodialysis patients with an Abdominal Aortic Aneurysm.

Parameters	Column1
Age (years)	74 (52-86)
Male gender	16 (84.2%)
Arterial hypertension	18 (94.7%)
Smoking	14 (74.0%)
Diabetes mellitus	4 (21.0%)
History of coronary artery disease	12 (63.0%)
Dyslipidemia	13 (68.0%)
Diameter of the aneurysm(cm)	6.53 (4-13)

Results are expressed as median value with range or number of patients and percentages as appropriate.

Statistical Analysis

Data are expressed as median with range or number of patients and percentages as appropriate. Survival analysis was performed using Kaplan-Meier method.

Results

The epidemiologic and clinical characteristics of the 19 hemodialysis patients with AAA are shown in Table 1. The mean age of the patients was 74 years (range 52-86 years) and the majority of them were male (84.2%), smokers (74.0%) and hypertensives (94.7%). Sixty three percent of the patients had a history of coronary artery disease, 68% had dislipidemia and 21% had diabetes mellitus. Following AAA diagnosis and depending on the aneurysm's size, 13 patients underwent endovascular aneurysm repair EVAR (Figure 1), one underwent open surgical repair and 5 patients were monitored regularly with annual CT scans. The mean aneurysmal diameter was 6.53 (range 4.0-13.0 cm), 6.41 cm (range 5, 5-13 cm) in patients who underwent surgical repair and 4.38 cm (range 4-4.8 cm) in patients under follow-up. In the latter patient group, the average annual increase of the aneurysm size was 0.18 cm.

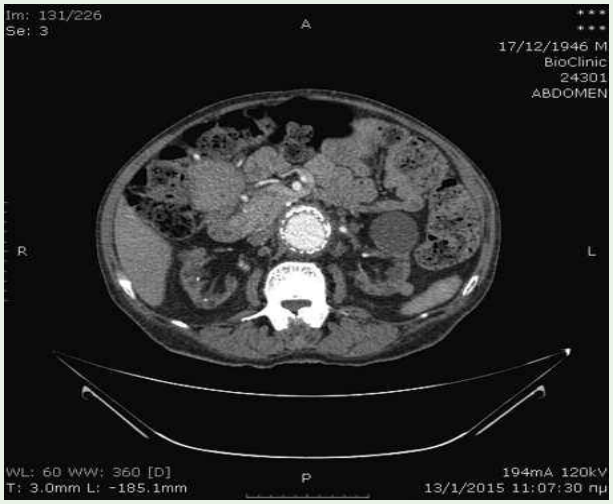

Figure 1: Abdominal Aortic Aneurysm managed with EVAR in a hemodialysis patient.

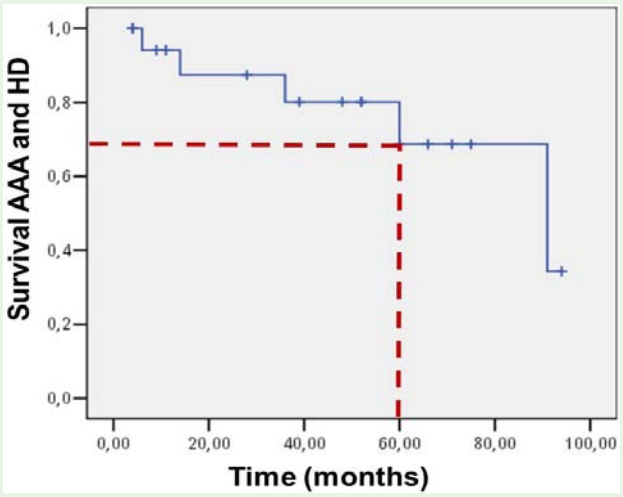

Figure 2: Kaplan-Meier survival curve of 19 hemodialysis patients after Abdominal Aortic Aneurysm repair.

Regarding the observed complications after EVAR, 7patients presented with endoleak in the aortic sac (36.8%), one with early endoleak (within 30 days) (14.3%) and 6 with late leak (median time 62 months, range 36-120 months) (85.7%). All the above patients underwent a new EVAR without any surgical complication. Migration of the endovascular stent and rupture of the aneurysm was observed in the patient who underwent open surgical aneurysm repair (5.3%), 38 months after surgery.

During the follow-up period, survival rate was 69% (Figure 2). Five patients (31%), including the patient who underwent an open surgical aneurysm repair died. The causes of death was septicemia in three patients (40%), migration of the endovascular stent and rupture of the aneurysm in one (20%) and cerebrovascular accident in one patient (20%).

Discussion

Abdominal Aortic Aneurysms (AAAs) can be asymptomatic and randomly detected in an imaging test performed with other indications, symptomatic or ruptured [2]. AAAs are usually diagnosed with CT scans or CT Angiography although Ultrasonography of the abdominal aorta (triplex) is a widely available, economic and non-invasive imaging test for their detection and follow-up. The latter method has approximately 100% sensitivity and specificity and since the measurements are made perpendicular to the longitudinal axis of the aorta, it provides the ability to measure both its external and internal diameters [2]. In the majority of the patients in the present study, AAA diagnosis was established with a CT scan performed for routine evaluation of polycystic kidney disease or for the investigation of recurrent abdominal pain. Moreover, in accordance with the findings of previous studies in the general population, the majority of our patients were male, smokers and hypertensives [2].

The management of an AAA usually depends on its size. Thus, according to current guidelines, AAAs with diameter smaller than 5.5 cm are managed conservatively, usually with an annual follow-up [2] while larger AAAs are managed surgically, either with open surgical or with Endovascular Aneurysm Repair (EVAR). Management

of patients in this study appeared to be consistent with the above guidelines as the median diameter of the aneurysms in patients treated surgically was 6.39 cm, while in those who were monitored was 4.38 cm. Moreover, the annual average increase of AAA diameter in the latter group was 0.18 cm, similar to the reported increase in previous studies of AAAs 3 to 5 cm in size [2,5].

To the best of our knowledge, up-to-date studies in hemodialysis patients investigating the management and outcome of AAAs in patients with CKD either on conservative treatment or on renal replacement therapy are scarce. Moreover, studies comparing the open and endovascular surgical method of AAA management in regard to short long-term patient outcome and survival in this patient groups are missing. However, previous studies in the general population and patients with pre-dialysis CKD showed that EVAR compared with open surgical repair was associated with better survival as perioperative mortality rate was 2% and 4% respectively [6,7]. However, the above superiority of EVAR in the early post-operative period, appeared to decrease gradually and finally the 5-year survival was approximately 70% independently of the applied surgical method [8]. Moreover, recent prospective studies suggested that compared with EVAR, open surgical repair of AAAs is probably more permanent and it is associated with better long-term survival [3]. Based on the above, the selection of the therapeutic method should be based on the evaluation of the open's surgery risk by evaluating patient's general condition and co-morbidities as well as the risks of AAA rupture and peri-operative complications of both methods [2]. Compared with general population, in CKD patients, particularly on dialysis, the open surgical approach has significantly higher peri-operative morbidity and mortality rates. This is attributed to the high prevalence of severe and extensive atherosclerotic vascular changes as well as the high prevalence of cerebrovascular disease, coronary artery disease, coagulation disorders and increased susceptibility to infections observed in these patient populations. Thus, in hemodialysis patients EVAR is usually the preferred method of repair of AAAs [3] and in accordance with the above, 94.7% of our patients were managed with EVAR.

The management of AAAs, with either open surgical repair or EVAR, is associated with the risk of developing acute kidney injury both in CKD patients and patients with normal renal function. This could be attributed to both surgical procedures during the operation and the administration of radio contrast agents. Previous studies demonstrated that the above risk was significantly higher in CKD patients compared with patients with normal renal function and had an inverse relationship with estimated Glomerular Filtration Rate (eGFR) [2]. In accordance with the above findings, in 26% of our patients with CKD stage V on conservative treatment, renal replacement therapy was permanently initiated in the immediate post-operative period (data not shown). In addition, interestingly a recent prospective study demonstrated that compared with open aneurysm repair, elective EVAR was associated with a significant decline in eGFR after a 5 year follow-up period. Moreover, the above decline was steeper in the first post-operative year and more pronounced in patients with AAA compared with a similar population with no AAA who underwent carotid endarterectomy [9].

The most important and common complication of EVAR is endoleak in the aortic sac which is defined as persistent blood flow within the aneurysmal sac but outside the endograft (stent). Endoleak often needs surgical management and it is a significant risk factor for aneurysm rupture [10,11]. In the majority of the cases. It is a late and asymptomatic complication and thus long- term patient follow-up with regular CT scans or angiography is recommended [2]. Previous studies in CKD patients showed that an endoleak is detected in approximately 25% of them during follow-up [2,12]. Of note, in our study in hemodialysis patients an increased incidence of endoleak (37%) was observed compared with studies in other patient populations which could be attributed to the significant co-morbidity of these patients. However, in the majority of the cases it was a late complication (86%), as in previous studies in other patient groups,. And moreover, it was successfully managed in all patients with a repetitive EVAR. Endograft migration, defined as movement of the stent over 10 mm in relation to the anatomic landmark in 3D CT scan using a central flow line, is another important complication of AAA repair [13,15]. It is usually asymptomatic and detected in routine repetitive CT scans and in most of the previous studies its incidence appeared to increase 2 years post-operatively. Of note, endoleak can lead to the increase of pressure into the aneurismal sac and consequently to its rupture. Several risk factors were found to be associated with endograft migration including morphology of the aneurism and of the aortic neck, accuracy of stent placement, enlargement of the aortic neck after surgery, failure of its proximal adhesion and stent characteristics [15-17]. Interestingly, only one patient in our study (5.3%), managed with open surgical repair, presented with stent migration and aneurism rupture which was and the cause of his death.

Previous retrospective studies in patients with AAAs and normal renal function suggested that 5- year survival after AAA repair was significantly lower in these patients compared with age- and gender-matched control subjects (60% *versus* 80%) [8,18-21]. The above was attributed to the increased prevalence of comorbid conditions in the former group including arterial hypertension, dyslipidemia and history of cardiovascular disease. Of note, in our study in hemodialysis patients, approximately 6 year survival after EVAR was similar to the recently reported 5 year survival rate of patients with AAAs and normal renal function [8]. The above findings support the concept that the same therapeutic options should be offered in hemodialysis patients with AAA as in all other patient groups. Finally, in previous studies in patients with normal renal function the most common causes of death following AAA repair were cardiovascular events (44%), malignancies (15%), aneurysm rupture (11%) and cerebrovascular accidents (9%) [22-24]. However, in our case series the main cause of death was septicemia. The above finding probably reflects the well recognized susceptibility of hemodialysis patients to infections which are the second cause of death of this population.

Conclusions

In conclusion, in end-stage renal disease patients EVAR appears a safe therapeutic option of AAA repair with low both peri-operative and long-term morbidity and mortality rates similarly to other patient populations. Larger additional studies are needed to confirm the above findings and to access probable differences in the incidence of complications and patient short- and long-term outcome between open surgical and endovascular aortic aneurysm repair.

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