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Original Research Article

Initial experience of endovascular aneurysm repair at the Dr. Eduardo Liceaga General Hospital of Mexico

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ABSTRACT

Background: Abdominal aortic aneurysm (AAA) is the permanent and irreversible dilation of the lower part of the aorta where the vessel expands, making it susceptible to rupture, which represents a high mortality incident.
Methods: A review of clinical records was carried out from September 2021 to March 2023, patients who were diagnosed with aortic aneurysm were included in whom endovascular exclusion of abdominal and thoracic aortic aneurysm was performed at the General Hospital of Mexico by the angiology vascular and endovascular surgery department.
Results: 18 endovascular repairs of aortic aneurysms were performed, of which 15.4% were female (n=6) and 84.6% male (n=12). The average proximal neck diameter in the thoracic aorta was 31 mm, average proximal neck diameter in infrarenal AAA 22.2 mm, average aneurysmal diameter in infrarenal segment 63.8 mm, thoracic 31 mm. Regarding the type of endovascular procedure, 11.1% were repaired with the fenestrated endovascular aneurysm repair (FEVAR) technique, and the same proportion with chimney endovascular aneurysm repair (ChEVAR), for a resolution with conventional EVAR of 77.7%. Complications occurred in 3 patients, 2 of which resulted in type 1a and 1b endoleaks that were reoperated and repaired with a proximal cuff, balloon angioplasty, and embolization of the aneurysmal sac with coils.
Conclusions: Aortic aneurysm remains a major cause of death in adults because of aortic rupture despite advances over the past two decades that have been made in the endovascular management of large, symptomatic, and ruptured. Timely treatment is essential to prevent rupture and poor patient outcomes.

Keywords: Aortic aneurysm, Abdominal aortic aneurysm, Fenestrated endovascular aneurysm repair, Chimney endovascular aneurysm repair, Thoracic endovascular aortic repair

INTRODUCTION

Abdominal aortic aneurysm (AAA) is the permanent and irreversible dilation of the lower part of the aorta where the vessel expands, making it susceptible to rupture, which represents a high mortality incident. The most used definition of AAA is a maximum abdominal aortic infrarenal diameter of ≥30 mm on ultrasound or computed tomography.[1] Prevention or emergent intervention of rupture has been carried out for decades by open surgery, but in recent years the endovascular aneurysm repair (EVAR), chimney endovascular aortic repair (ChEVAR), fenestrated endovascular aortic repair (FEVAR) and thoracic endovascular aortic repair (TEVAR) approach has been preferred.[2] Endovascular aneurysm repair has been widely accepted for the treatment of AAA due to its lower

postoperative mortality, shorter hospital duration, and rapid recovery compared with open surgical repair, which has been identified by clinical trials prospects that include EVAR-1, DREAM, SOBRE, and ACE.[3-6] However, the advantages of EVAR have gradually diminished over time due to a number of complications such as endoleak, defined as incomplete exclusion of the aneurysmal sac, was first proposed by White in 1996 and is classified between I-V.[7,8] Computed tomography (CT) is commonly used after EVAR primarily for follow-up surveillance, performed as the first postoperative imaging modality to evaluate the outcome of surgery, therefore, an endoleak can easily be observed, a classic sign of contrast agent overflow outside the stent.[9,10] Reintervention is required for type II endoleaks (T2EL), defined as the endoleak arising from the side branches of the excluded aneurysm, it represents the most common type of endoleak after performing an EVAR, incidence rates in T2EL of 10.2% have been reported and 29%.[11,12] However, not all T2ELs require reintervention, according to recent US guidelines and Europe suggest that a conservative approach may be appropriate for isolated T2ELs in which there is no sac expansion, while they recommend intervention when sac enlargement is >10 mm.[13,14] This recommendation differs from the pre-EVAR approach, in which a sac enlargement of > 5 mm for 6 months is considered to represent a relative indication for surgical treatment, making it very complex to predict which patients with T2EL will need reintervention afterward. EVAR treatment based on preoperative data, so studies have been carried out with the purpose of predicting the risk rate of reintervention in patients with T2EL to provide a new strategy for the management of T2EL even without conclusive results.[15]

The objective of this research is to demonstrate the experience of the angiology, vascular and endovascular surgery service of the General Hospital of Mexico in the endovascular repair of aortic aneurysms.

Risk factors

Risk factors include advanced age, male sex, smoking, family history of AAA, presence of other cardiovascular diseases (such as cardiac ischemia or peripheral artery disease), systemic arterial hypertension, and dyslipidemia.[16] The presence of certain metabolic alterations such as diabetes mellitus (DM), African American and Asian ethnicities have been associated with a reduced risk of AAA, smoking has been seen to be the most important modifiable risk factor; observational studies suggest that stopping smoking reduces the risk of developing an AAA and limits the growth of already established AAAs.[17-20] Therefore, the decreasing prevalence in AAA rates in the developed world from >5% to 1-2% in men ≥65 years of age can be explained, largely due to the fall in smoking rates.[21] The prevalence of AAA in women is lower than in men, although rates are variable in different populations and depend on the definition of AAA that is used, but it appears to be approximately 1% in women ≥70 years of age who have ever smoked.[22]

Risk of rupture

The main complication of AAA is rupture of the aorta, which usually leads to fatal bleeding in the retroperitoneum or abdomen, and is estimated to cause between 150,000 and 200,000 deaths each year worldwide.[23] The risk of AAA rupture is strongly related to the maximum diameter of the AAA and has been estimated to be approximately 1%, 3%, 4% and 6% per year in patients with AAAs of 40-54 mm, 55-60 mm, 60-70 mm and ≥70 mm in diameter respectively.[24] Although the largest clinical study including patients with large AAAs who were treated conservatively suggests much higher rupture rates of up to 30% per year for AAAs ≥70 mm in diameter.[25] Other less common complications of AAA include distal embolization, aortoenteric or aortocaval fistulas, and compression of the iliac vein resulting in deep vein thrombosis. Elective AAA repair ranges in perioperative mortality risk of 0.9% to 5%.[26] Several risk predictive models for perioperative mortality have been presented, including the scoring scheme of Eslami et al. In their study they used the vascular study group of New England (VSGNE) database and included variables such as aneurysm diameter, neck length, age, type of repair (open repair versus EVAR), female sex, myocardial disease, congestive heart failure, chronic obstructive pulmonary disease (COPD), and estimated glomerular filtration rate (eGFR) to predict perioperative mortality, therefore, this model has been recommended by vascular surgeons to help make informed decisions and recommendations on aneurysm repair by the National Academic Society of vascular surgery.[13,27] In clinical practice, several methods have been proposed to define, grade and evaluate the aneurysm site, with small variations, all of them take into account the following anatomical characteristics: proximal neck evaluation: includes determining morphology (straight, conical, inverted conical, bulging), length, diameter, angle, amount of thrombus, and calcification; aneurysm: the maximum diameter of the AAA is mainly evaluated, whether there are tortuosities, the most acute aortic angle, the amount of thrombus and calcifications; evaluation of the distal neck: diameter and length are mainly measured; and evaluation of common, internal and external iliac arteries.[28] Apart from the analysis of the aneurysm and the aortic necks themselves, which obviously need to be examined, the evaluation of the iliac arteries is of utmost importance and is included in all reports, because when they are poorly formed they can be an exclusion criterion for EVAR. In the presurgical planning protocol it is important to measure the diameter, length, evaluation of the presence of areas of stenosis/occlusion, length of the sealing zone, presence of tortuosities, more acute angles, amount of thrombus and calcification. The most common factor to rule out EVAR is considered to be the length and anatomy of the proximal neck, the presence of large areas of calcification, occlusion

and tortuosity of the iliac arteries are responsible for the majority of access complications during EVAR procedures.[29,30] According to Henretta et al unfavorable anatomy in the iliac arteries can lead to some type of complication in up to 47% of patients primarily an injury to the iliac arteries themselves or misalignment of the stent graft during deployment.[31] Nowadays, it is common knowledge that AAA anatomy influences the technical success of EVAR, the rate of endoleaks, stent migration, as well as the need for secondary interventions.[32]

METHODS

A review of clinical records was carried out from September 2021 to March 2023, patients who were diagnosed with aortic aneurysm were included in whom endovascular exclusion of abdominal and thoracic aortic aneurysm was performed at the General Hospital of Mexico by the angiology vascular and endovascular surgery department.

Selection criteria

39 patients with a diagnosis of aortic aneurysms were evaluated, of which 21 patients were excluded, 9 patients were given conservative management with follow-up and controls for not meeting criteria such as non-surgical diameters and clinically asymptomatic, 11 patients who were treated by open surgery and a patient with surgical criteria who did not accept treatment. The final sample of patients who underwent endovascular repair was 18 patients. All patients received informed consent.

RESULTS

18 endovascular repairs of aortic aneurysms were performed, of which were female 6 (15.4%) and male 12 (84.6%). Of these, 84.6% had some symptoms, abdominal pain being the most frequently presented symptom and were asymptomatic 7 (38.8%). 83.4% of patients presented with abdominal aortic aneurysm and 16.6% with thoracic aortic aneurysm. The average proximal neck diameter in the thoracic aorta was 31 mm, average proximal neck diameter in infrarenal AAA 22.2 mm, average aneurysmal diameter in infrarenal segment 63.8 mm, thoracic 31 mm. The average infrarenal aortic length was 124.2 mm. Average length for common iliac arteries were 71.3 mm right common iliac artery, 74.3 mm left common iliac artery.

Regarding the type of endovascular procedure, 11.1% were repaired with the fenestrated endovascular aneurysm repair (FEVAR) technique, and the same proportion with chimney endovascular aneurysm repair (ChEVAR), for a resolution with conventional EVAR of 77.7%. Complications occurred in 3 patients, 2 of which resulted in type 1a and 1b endoleaks that were reoperated and repaired with a proximal cuff, balloon angioplasty, and embolization of the aneurysmal sac with coils.

The third patient was a patient with iliac artery occlusion, which required reintervention, which consisted of performing a crossed femoro-femoral bypass to improve the flow of the affected lower extremity. The calculated 6-month survival reported in this case series was 83.3%.

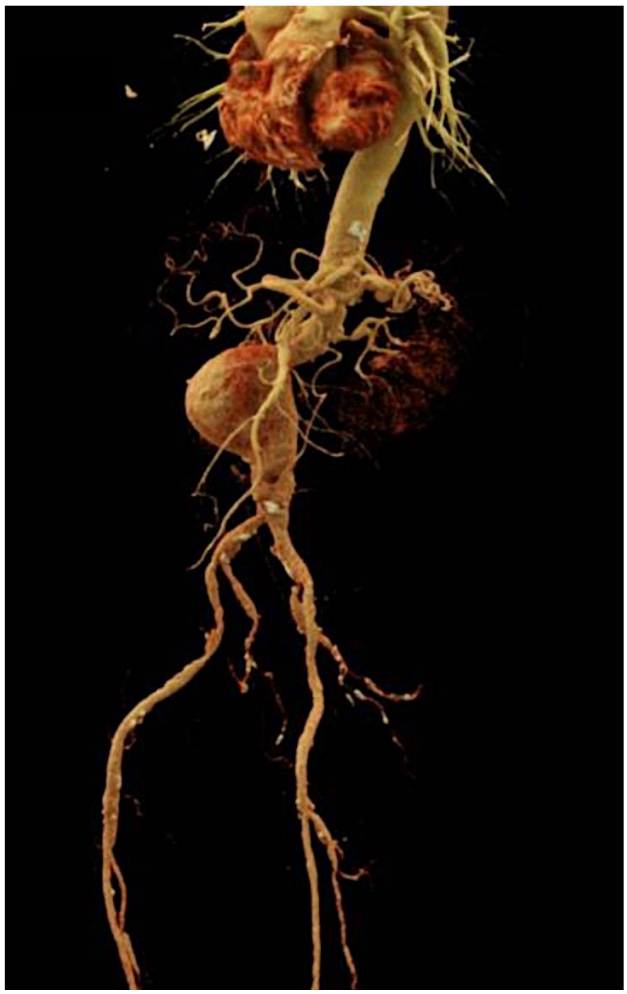

Figure 1: Angiotomography with three-dimensional reconstruction of abdominal aortic aneurysm.

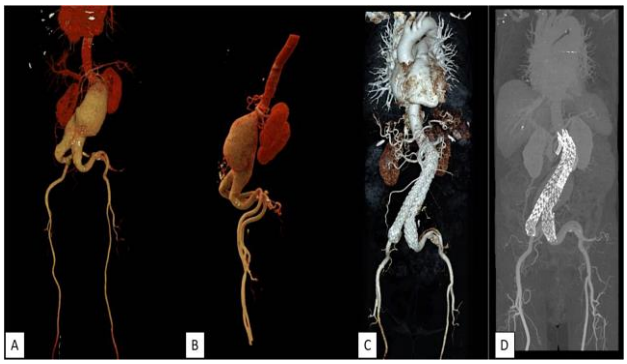

Figure 2: Abdominal aortic aneurysm (A and B) angiotomography with 3D reconstruction of abdominal aortic aneurysm; and (C and D) control angiotomography, postoperative endovascular exclusion with CHEVAR, ENDURANT II prosthesis.

Figure 3: Angiotomography with three-dimensional reconstruction of FEVAR, VALIANT prosthesis.

DISCUSSION

AAA describes a weakening and dilation of the abdominal aorta that most commonly affects the infrarenal part, recent studies suggest that a deficiency in the treatment of AAA is the absence of effective medical therapies to limit the growth of AAA, based on studies with animal and human models, AAA is believed to be the result of a combination of hereditary factors and environmental factors that stimulate an immune-mediated attack on the aorta.[1,17] Therefore, the clinical presentation usually presents with diffuse symptoms or asymptomatic unless complications occur and, therefore, it is usually diagnosed as a finding during imaging performed to investigate abdominal symptoms or in some cases by ultrasonography in screening programs for AAA. that run in some parts of the world.[33] It is known that abdominal aortic aneurysm rupture is one of the main causes of death in men over 65 years of age, to try to reduce mortality, rupture can be prevented by elective aneurysm repair since it has been seen that the risk of rupture is directly proportional to the size of the diameter.[34-36] Current treatment guidelines recommend that small, asymptomatic aneurysms be kept under observation as the risk of rupture is very low, while large aneurysms (≥5.5 cm in men; ≥5 cm in women) should be treated surgically.[37,38] Today, EVAR is the preferred option and the least invasive alternative to open repair, especially in elderly patients with comorbidities.[39]

Although the data are still unclear on whether patients considered frail should be treated with EVAR or not treated surgically, the EVAR-2 trial, in which patients considered unfit for open repair were randomly assigned to EVAR or no treatment surgical, showed no overall survival benefit for EVAR.[40] The imminent risk of aneurysm rupture as well as the risk of elective repair and life expectancy are crucial for the discussion of treatment options in patients with asymptomatic AAA.[26] Endovascular treatment of thoracic aortic pathology (TEVAR) represents a minimally invasive alternative to conventional surgery, and represents a reduction in morbidity and mortality that has led this technique to be the treatment of first choice in selected cases. It is a valid option for the treatment of thoracic aortic aneurysms and some cases of type B aortic dissections, as well as for aortic rupture, generally of traumatic origin.

Limitations

Limitations of this study include its conduct at a single hospital center, small sample size, lack of random variables, and absence of a randomized clinical trial design, which may affect the generalizability of the results and internal validity from the study.

CONCLUSION

AA remains a major cause of death in adults as a result of aortic rupture despite advances over the past two decades that have been made in the endovascular management of large, symptomatic, and ruptured AA. Timely treatment is essential to prevent rupture and poor patient outcomes.

Recommendations

Individualization of cases is essential for adequate surgical success. Careful planning of each CT scan, vascular access, and material to be used reduces the failure and complication rate. Knowledge and updating about the different devices and materials on the market as well as the results obtained in the long term offers us a greater number of therapeutic options. Previously evaluating the functionality of the patients and the control of risk factors allows for better patient selection and improved long-term results. Remember the indications for use (IFU) of the prostheses and avoid performing procedures outside of IFU in patients with long life expectancies.

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