CHIRURGIE VASCULAIRE / VASCULAR SURGERY

OUTCOMES OF ABDOMINAL AORTIC ANEURYSM REPAIR IN IMMUNODEFICIENCY VIRUS (HIV) POSITIVE PATIENTS

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Summary

Background: HIV-infected patients are at an increased risk for accelerated vascular disease. Abnormal endothelial function and aneurysmal dilation of the large arteries have been described; however, data is lacking on the outcomes of HIV-infected patients undergoing abdominal aortic aneurysm (AAA) repair on a national level.

Methods: This study is a retrospective analysis of hospital discharge data using the Nationwide Inpatient Sample Database from 2001 – 2009. HIV-infected patients undergoing abdominal aortic aneurysm repair were included.

Results: From 2001 to 2009, we identified 23 HIV-infected patients who underwent abdominal aortic aneurysm repair, with a mean age of 56 (±12). Of these, 14 (61%) had open repair, while 9 (39%) had endovascular repair; four of the open repair patients presented with ruptured AAA. There were two postoperative deaths after open repair (9% mortality), 1 death from the ruptured AAA open repair group and 1 death from the non-ruptured open repair group. Three cases in the ruptured open group had sepsis, and one patient had both respiratory and graft complications. In the non-ruptured open group, one patient developed sepsis and cardiac complications. There were no mortalities in the endovascular group, although 1 patient developed sepsis and 2 had cardiopulmonary complications.

Conclusions: Perioperative outcomes appear to be similar for HIV positive patients who undergo open and endovascular AAA repair compared to HIV negative patients.

Keywords: abdominal aortic aneurysm, repair, HIV

Introduction

More than 35 million people worldwide are currently living with HIV, and approximately 2 million people were newly infected with HIV in 2014.1 As highly active antiretroviral therapy (HAART) continues to prolong the lives of HIV-infected patients, cardiovascular disease (CVD) has emerged as an increasingly significant cause of morbidity and mortality in this patient population.2,3 CVD appears more prevalent in HIV-infected patients at a younger age, possibly due to accelerated atherosclerosis from traditional lifestyle risk factors, as well as immune activation and endothelial dysfunction related to HIV infection.2,4,5 Peripheral arterial disease, which is typically associated with elderly patients, affects HIV-infected patients at an average age of 48 years.6 Aneurysmal disease also been identified in HIV-infected patients, affecting 22% of patients who presented with vascular disease in one survey.7,8,9 The etiology of aneurysmal disease in patients with HIV, though inconclusive, appears to be distinct from HIV negative patients. The literature on the treatment of HIV positive patients with abdominal aortic aneurysm (AAA) is limited, and there is minimal data describing the clinical outcomes of HIV-infected patients undergoing AAA repair.2 The purpose of this study is to describe the outcomes of AAA repair in this patient population on a national level.

Material and methods

This study is a retrospective analysis of hospital discharge records using the United States of America's Nationwide Inpatient Sample (NIS) Database from January 2001 to December 2009. This cohort of patients was identified using the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) procedure code for either an open (38.44) or endovascular (39.71) AAA repair. Patients diagnosed with HIV infection (042, 079.53) and ruptured aortic aneurysms (441.1-441.9) were then identified. Inclusion criteria consisted of adult patients who underwent an open or endovascular AAA repair. There were no exclusion criteria.

Basic demographic characteristics of gender, age, year of procedure, and the presence of comorbidities were investigated. Preoperative comorbidities were defined as: cardiac, which included history of myocardial infarction (410.0-410.92, 412), congestive heart failure (428.0-428.43, 428.9), coronary artery disease or previous CABG or PCI (414.0- 414.3); renal, which included chronic kidney disease including dialysis dependent failure (585.1-585.9); diabetes mellitus type 1 and 2 (250.0-250.73, 250.4-250.63); and pulmonary, which included chronic obstructive pulmonary disease (490-506.4).

Postoperative outcomes such as mortality and postoperative complications were also determined. Postoperative cardiac (997.1), renal (997.3), respiratory (997.3), wound (998.32), and graft complications (996.1, 996.7) were included, as well as severe sepsis (995.92) or septic shock (785.52).

Results

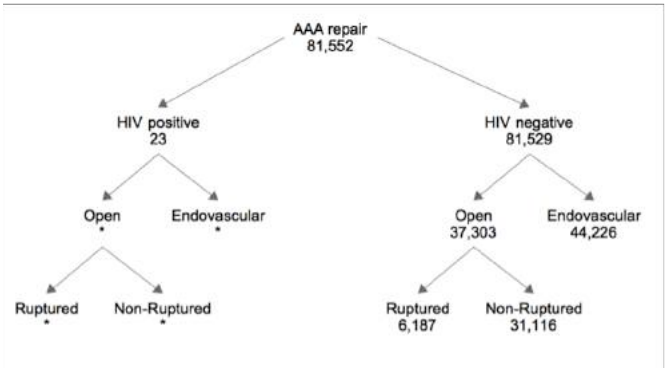
From January 2001 to December 2009, the NIS identified 81,552 adult patients who underwent repair of an abdominal aortic aneurysm (Figure 1). Twenty-three patients (0.02%) were identified as HIV positive. Of these patients, 14 (61%) were managed with open repair and 9 (39%) with endovascular repair. Four patients (28.6%) in the open group presented with a ruptured aneurysm. There were no ruptures in the endovascular group. Patient demographics for HIV positive and HIV negative patients are shown in Table I. Both patient populations were predominantly male with 83% in the HIV positive group and 78% in HIV negative group. HIV positive patients undergoing AAA repair presented at a mean age of 56 years (±10), compared to a mean age of 72 years (±10) for the HIV negative group. Despite their younger age, HIV positive patients had multiple cardiac (22%) and pulmonary comorbidities (17%). However, in comparison, nearly half of the patients in the HIV negative group (47%) had cardiac comorbidities, and a third (33%) had respiratory comorbidities.

The mortality rate for HIV positive patients was 9%, compared to 7% in HIV negative patients. In the non-ruptured open AAA group (n=10), one patient suffered sepsis and cardiac

complications and died post-operatively. In the ruptured open AAA group (n=4), three cases were complicated by sepsis, one patient had respiratory complications and one patient died. Of the nine patients in the endovascular group, one developed sepsis, one had cardiopulmonary complications, and one had a graft complication.

There were no deaths in the endovascular group. Table II compares of the outcomes of AAA repair for all HIV positive and all HIV negative patients. Unfortunately, the small sample size of the HIV positive group does not allow for meaningful statistical comparisons. Outcomes of non-ruptured open AAA repair (Table III) and non-ruptured endovascular AAA repair (Table IV) are also listed.

Figure 1. Patients who underwent AAA repairs from January 2001 to December 2009



**Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number*

Table I. Demographics of HIV positive and HIV negative patients

	HIV positive (n= 23)	HIV negative (n= 81,529)
Mean Age (years)	56	72 (±10)
Male Gender	83%	78%
Cardiac Comorbidities	*	47%
Renal Comorbidities	*	5%
Pulmonary Comorbidities	*	33%
Diabetes Mellitus	*	14%

**Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number*

Table II. Postoperative Outcomes of All Patients

	HIV positive (n= 23)	HIV negative (n= 81,529)
Mortality	*	7%
Cardiac Complications	*	5%
Respiratory Complications	*	3%
Renal Complications	*	3%
Graft Complications	*	4%
Wound Complications	*	6%

**Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number*

Table III. Postoperative Outcomes of Non-ruptured Open AAA Repair

	HIV positive (n= 23)	HIV negative (n= 6,187)
Mortality	*	6%
Cardiac Complications	*	7%
Respiratory Complications	*	6%
Renal Complications	*	4%
Graft Complications	*	2%
Wound Complications	*	7%

**Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number*

Table IV. Postoperative Outcomes of Non-ruptured Open AAA Repair

	HIV positive (n= 23)	HIV negative (n= 44,226)
Mortality	*	2%
Cardiac Complications	*	2%
Respiratory Complications	*	1%
Renal Complications	*	1%
Graft Complications	*	6%
Wound Complications	*	4%

**Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number*

Discussion

The management of patients with HIV has evolved significantly over the past three decades with life expectancies approaching that of the general population.[10] Cardiovascular disease, including cardiomyopathy, endocarditis, vasculitis and aneurysm formation, has emerged as a primary source of morbidity and mortality, with increased rates seen amongst HIV positive patients compared to age-matched HIV negative patients.[2,8,11,12,13]

Despite several clinical investigations suggesting the possibility of accelerated atherosclerosis in patients with HIV, the exact molecular and cellular mechanisms of HIV-mediated vascular disease are poorly understood at this time.14 Traditional risk factors such as smoking remain important to the development of CVD in this population.[12] Additionally, other factors may contribute to the increased incidence of CVD at a younger age that is seen in this patient population.[6] Antiretroviral therapy is known to cause a variety of metabolic changes, including dyslipidemia, insulin resistance, and lipodystrophy, which may contribute to the development of CVD, with an increased proportion of HIV-infected patients with hypertension, diabetes mellitus, myocardial infarction.[15,16] In particular, the toxicity of protease inhibitors have been implicated in causing cardiovascular injury leading to increase atherosclerotic progression.[4,17] Finally, HIV infection itself may cause an immune reaction and inflammation, leading to endothelial dysfunction.[18]

In addition to accelerated atherosclerosis, HIV-associated aneurysms have also been observed. These HIV positive patients tend to be younger than the general population, with atypical locations of aneurysms, and distinctive arteritic features.[13,19] HIV-associated aneurysms demonstrate involvement of adventitia and infiltration by acute and chronic inflammatory cells, and with sparing of the media and intima. The absence of atheroma and marked intimal thickening in aneurysm disease in young HIV positive individuals is suggestive of a possible infective or immune-mediated etiology.[20] The virus may directly enter the aortic adventitia, injuring and directly infecting fibroblasts, similar to the interaction of HIV with T-cells.[21] HIV associated leukocytoclastic vasculopathy within the vasa vasorum of large elastic vessels may ultimately lead to arterial wall damage and aneurysm formation. Children with vertically transmitted HIV infection have also been observed with aneurysmal dilations of the aortic root, as well as the cerebral artery, supporting the idea that vasculitis from infection or inflammation may be a key factor in the development of aneurysmal disease.[22,23]

Data on the management and outcomes of HIV positive patients with aneurysms is limited. Open aortic surgery in HIV positive patients appears to carry high perioperative morbidity and mortality rates, with reported postoperative complications in 33% of patients and in-hospital mortality rate of 15%.[2,7] Low baseline CD4 lymphocyte count and reduced serum albumin are risk factors for postoperative complications.[2] Patients with HIV/AIDS with lower CD4 counts also appear more likely to require an urgent operation and experience a complication with increased mortality.[24] However, in one series, HIV positive patients with multiple aneurysms of the thoracic and abdominal aorta were effectively treated using open surgery as well as endovascular techniques, suggesting that HIV-infected patients with long life expectancies can be treated with the same guidelines as patients without HIV.8 The results of our study reinforce this, with no in-hospital mortalities in the endovascular AAA repair group.

There are several limitations to our study. The low number of reported HIV positive patients who underwent an AAA repair between 2001 and 2009 did not allow us to perform any meaningful statistical analysis to compare these patients to the HIV negative population. It is possible that, as a limitation of the NIS database, all patients with HIV infection who underwent AAA repair were not captured. The NIS database uses ICD-9 codes that are entered based on patient procedures, comorbidities, and in-hospital diagnoses. If the correct ICD-9 codes were not properly inputted during the patient's hospitalization, then the patient would not be identified for inclusion.

Additionally, since the NIS database provides hospital discharge data, we were unable to obtain more specific details about the patients. For example, we cannot estimate disease progression based on CD4 lymphocyte count, which may predict postoperative complications in HIV patients undergoing aortic operations.[2] Long-term follow-up data is also not available from this database, thus any data after discharge, including rupture, re-operation, graft failure, or mortality, is not available. This information may have been helpful in understanding our data and correlating with the risk for postoperative outcomes.

In this study, there was a higher number of open to endovascular repairs (14 versus 9) performed from 2001 to 2009, with 8 out of the 9 endovascular repairs performed after 2005. The high number of open repairs could be due to the earlier time frame chosen for the study, which was prior to the increased use of endovascular abdominal aortic aneurysm repair. It is possible that, given the significant decrease in operative morbidity and mortality with contemporary endovascular techniques, perioperative outcomes for HIV-infected patients would also improve.[25]

Perioperative outcomes appear to be similar for HIV positive patients who undergo open and endovascular AAA repair compared to HIV negative patients. HIV positive patients with aneurysmal disease are younger than the general population. Our study suggests that patients with HIV and abdominal aortic aneurysmal disease undergoing endovascular intervention may have less morbidity and mortality compared to open surgery. Further prospective studies that include clinical predictors of surgical outcome in HIV patients with abdominal aortic aneurysmal disease are needed.

Conclusion

Perioperative outcomes appear to be similar for HIV positive patients who undergo open and endovascular AAA repair compared to HIV negative patients. Additional prospective studies are needed to optimize disease management and surgical outcomes for HIV positive patients.

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