PERIOPERATIVE INFECTION RATES IN PATIENTS WITH HUMAN IMMUNODEFICIENCY VIRUS/ ACQUIRED IMMUNODEFICIENCY SYNDROME COMPARED WITH PATIENTS WITH DIABETES MELLITUS

Jennifer A. D'Amico, DPM
Gonzalo Ballon-Landa, MD

INTRODUCTION

Human Imunodeficiency Virus (HIV) is a global problem. Since its discovery in 1983, over 40 million people have been infected with the disease. North America currently has 1.2 million men, women, and children infected with HIV/AIDS with 50,000 new cases being reported each year.[1-3] Patients are now living productive lives with this disease. In living, patients often have injuries and illnesses that require surgery. There has been no study looking at a comparison of 2 immunocompromised groups. This is a retrospective study looking at postsurgical infection rates at a community teaching hospital in HIV positive patients as well as age-matched patients with diabetes mellitus.

According to UNAids/WHO, approximately 2.5 million adults and children were newly diagnosed with HIV in 2007; 46,000 of them live in North America. The highest percentages of people infected with the disease are in highly populated locations, i.e., California (14%) and New York (18%).

HIV is a two-stranded retrovirus in the Lentivirus family, first discovered in 1983.[1-3] This retrovirus invades and replicates in the CD4 + lymphocytes, and as such, patients with HIV/AIDS will have CD4 lymphopenia. Connections have been made between CD4 counts and intraoperative complications.[4-6] In 1997 Lord reported that at a CD4 count <50/mcL in HIV-positive men undergoing anorectal surgery had significant problems with wound healing. In a case series by Huang et al of HIV-positive men undergoing radical prostatectomy, the infection complications (2 of 7 patients) were both in patients that had the lowest CD4 count. Of note, both these complications were in patients with CD4 counts >250/mcL.[7] In 2002, Grubert et al compared HIV-positive patients undergoing obstetric and gynecologic surgeries with procedure-and age-matched HIV- patients and found that patients with CD4 counts <200 had a 3-fold risk of infection.[8] However, the author has not found recent literature comparing 2 populations of immunocompromised patients.

Some have made the argument that HIV is no longer an acute illness, but a chronic disease. Access to Highly Active Antiretroviral Therapy (HAART) has given most of those that have access to the therapies a longer life expectancy. A better quality of life affords people the opportunity to have elective surgeries. These elective surgeries include but are not limited to cosmetic surgery, joint replacement surgery, and reconstructive forefoot and hindfoot surgery. Many physicians have a hard time counseling patients on the risks and benefits of elective surgery in the HIV-positive population because there is no adequate consensus as to the risk-benefit ratio of surgery and postoperative complications.

Patients with diabetes mellitus (DM) are a population where infection is a serious consideration for elective surgery.[9,10] Diabetes mellitus type II (DMII) is one of North America's major chronic diseases. Over 17 million people are living with diabetes mellitus in the US. Many surgeons will encounter far more diabetic patients in their surgical census than HIV-positive patients; however both populations are relegated to an immunocompromised state. This study retrospectively looks at the differences between DM and HIV in post surgical risks for infection with a control group of nondiabetic non-HIV/ Acquired Immunodeficiency Syndrome (AIDS) patients for completeness.

MATERIALS AND METHODS

After Institutional Review Board approval, a retrospective chart review was conducted of consecutive patients entering a single community-based teaching hospital. Commercially available coding software was used to obtain information on all in-patients with DM, HIV, AIDS, and a control group who underwent elective or emergent surgery, between January 1, 2005 and December 31, 2007. Age matching

was attempted by manually extracting the HIV/AIDS patient meeting our inclusion criteria and then searching for a patient with DM as well as a patient who was neither diabetic or HIV-positive who had a similar type procedure. Data extracted from the patient's hospital charts included age, sex, procedure performed, type of infectious complication, CD4 count, absolute neutrophils count, and HbA1c as indicated. The procedures were then stratified into emergent and nonemergent (Table 1).

RESULTS

A total of 76 men and 25 women were included in this study. Of the total population of 101, 37 were HIV-positive (which included 17 patients with AIDS). There were 39 patients with DM (4 Type I and 35 Type II). Of the 101 patients, 25 were neither HIV-positive nor diabetic. The average age of the HIV population was 44.1 years old, the AIDS population was 44.53, the DM population was 51.85 and the control group was 43.32. Using a one sample t-test, there was a significant difference in the ages of the DM population and the HIV/AIDS population, which will be accounted for in the discussion section. The average age for the entire population of these groups in the aforementioned time period are as follows: HIV-positive 45.93 years, AIDS 44.11 years, DM 59.78 and the control group were 47.87. Using a one sample t-test the population of diabetics in this study was significantly younger than that of the general diabetic population for the time period examined. The mean preoperative CD4 count was 369.19 for the 21 patients where data was obtained (range 10-1253). The mean preoperative viral load was 17170 for 10 patients ranging from 50-53000. The average HbA1c for the DM population was 7.36% in 20 of 39 patients (range 4.9-10.7).

The average length of stay for the HIV/AIDS patients was 5.27 days, DM patients averaged 4.87 days, and the control group averaged 5.36 days; with the total average length of stay for all populations being 5.14 days. An ANOVA showed no significant difference between lengths of stay in these 3 groups ([F 2,100] = 0.912; P > 0.5). Our patient population had an average of 2 comorbidities including hypertension, myocardial infarction, intravenous drug use, chronic kidney disease, hepatitis C, and tobacco usage. The most frequent type of surgery was open reduction internal fixation of a closed fracture with 55.3% of the total population.

Our review revealed 2 postoperative infections. The first infection was in a 37-year-old man who was classified

Table 1

INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria:
    HIV + by Labs or History
    AIDS documented CD4 < 400
    Diabetes Mellitus Type I
    Diabetes Mellitus Type II
    Inpatient status
    Elective Surgery
    Emergent/urgent Surgery

Exclusion Criteria:
    Non HIV +
    Non Diabetic
    HIV + with an infection needing surgery
    Diabetic with an infection needing surgery
    HIV + with infection present on same admission
        as surgery
    Diabetic with an infection present on same
        admission as surgery

as HIV/AIDS with a CD4 count of 339 and viral load of <400. He underwent open reduction and internal fixation of a closed ankle fracture. He developed cellulitis on postoperative day number 3 despite being given prophylactic Cefazolin 30 minutes prior to surgery. He was treated with intravenous Cefazolin with resolution of the cellulitis in 2 days. The second postoperative infection was in the control group. A 50-year-old woman with a history of tobacco and cocaine usage underwent open reduction internal fixation of her mandible. She developed cellulitis on postoperative day 2 and was treated successfully with intravenous Cefazolin. The second patient received prophylactic intravenous Cefazolin 30 minutes prior to beginning surgery. Our postoperative infection rate was 1.98 %(P = 0.523). This was not statistically significant. A MANOVA was performed with the independent variables being: age, sex, and group and the dependent variables being: infection, preoperative antibiotics, and length of stay. When comparing postoperative infection rates the P values were as follows, HIV patients versus DM patients P = 0.705; DM patients versus control subjects P = 0.543, and HIV patient versus control subjects was P = 0.938. All results showed no significant difference between the groups with regard to postoperative infection.

DISCUSSION

The significance of this article lies in the fact that the groups being compared were both relatively immunocompromised. Most articles that discuss HIV postoperative infections match the patients against non-HIV/non immuno-compromised controls.[7,11,12] Our study chose to look at the differences or lack there of in 2 populations of immunocompromised patient bases, HIV/AIDS and DM. Diabetes is an independent risk factor for postoperative complications.[10] Although poor glucose control (HbA1c >11.5%) has been implicated as a cause for the increased rate of infections[13] no consensus has been made as to the part HbA1c plays. The controversy in the literature aims at what role glucose control in the form of HbA1c has to contribute to post surgical outcomes.

In a study by Wilson et al,[14] the authors found no connection between HbA1c percentages and surgical site infections in 114 patients undergoing penile prosthetic placements. HIV/AIDS brings with it its own bias, mostly due to previous literature written within the early years of the epidemic before the discovery and availability of HAART. This literature reports a range of postoperative complication rates from 55% to 140%.[15-19] The advent of HAART has created an era in medicine in which HIV/AIDS is a livable disease.[20-22] The literature reports better postoperative outcomes for these individuals.[7,23] Arguments have been made that HIV/AIDS patients have longer hospital stays;[24] our cohort of HIV/AIDS patients had a longer average length of stay than the diabetic cohort but was relatively equivalent to the control group. The difference in length of stay was not significant. There is no definitive research as to why HIV/AIDS patients stay in the hospital longer. This would be an area worth studying.

Besides the risks of complications with regards to HIV/AIDS patients, transmission of the disease from patient to surgeon has been a consistent concern in the literature. Winslet et al discussed the impact of HIV on a general surgery practice in 2007 and spoke to the risk of surgical transmission of HIV. Their study spanned 16 years and a total of 772 surgical procedures, during the study time frame no healthcare worker acquired the disease through intraoperative transmission.[4]

Transmission of HIV/AIDS is a concern of the medical community.[6,15-17,25,26] Injury rates through percutaneous routes have been reported as high as 15% with an average of 5%, the most concerning of which is the hollow bore nee-dle which has been shown in the literature to have a 0.3% seroconversion rate. These statistics have gone down with the advent of more stringent universal precautions. The fact remains that most surgeons operate more cautiously on a patient with HIV/AIDS than with most other disease despite the fact that Hepatitis B and C are more readily transmissible.[17]

HAART is not without consequences and a recent article[6] discussed guidelines for elective surgery in the HIV/AIDS patient. The guidelines suggest obtaining an absolute CD4 T cell count, percentage of CD4 T cells, and viral load within 3 months of the scheduled surgery as well as a proper evaluation of the patient's nutritional status and assessment of patients neutrophils count. Although Hutchinson mentions that there is no definitive data suggesting patients get prophylactic antibiotics our study population had 99/101 patients receive antibiotic prophylaxis. The patients who developed an infection did receive antibiotic prophylaxis, which was not anticipated by the authors.

As a retrospective study, the power of the study could have been stronger if there were a larger cohort of patients. The total number of patients was relatively small, which does not allow significant data to be extrapolated. Follow up was limited to the current hospital stay because this was a review of the entire hospital and not a single surgeon. This lack of long-term follow up combined with the average length of stay of ~5 days does not allow for the lag time in development of a surgical site infection (typically 3-14 days). Critical data was not available for the entire population of patients. Only 9 of 36 HIV-positive patients had a viral load stated or recorded in their chart, and an HBA1c was recorded in the charts for 20 of 39 patients with diabetes.

ETHICAL/MORAL CONCERNS

Many articles have discussed the ethical responsibly of the surgeon to treat a patient who is in need; emergent cases will continue to be performed as need arises. The gray area that often presents a problem is elective surgery. Elective surgery is not life saving but almost always increases the patient's quality of life and may improve activities of daily living as well as boost a patient's self confidence and self worth. HIV-positive patients are living longer then they have ever before. Because HAART is available to the great majority of HIV-positive patients, surgeons will be faced with more patients requesting elective surgery. As physicians, we have an obligation to treat all patients that we encounter on a daily basis equally. It is illegal to discriminate on a patient's disability. The Americans with Disabilities Act considers HIV/AIDS a disability and as such, the patients have all the protections afforded them by that law.[12,15,27] Our duty as healthcare professionals is to treat every patient that walks through our door with respect.

Proper preoperative evaluation is essential in immuno-compromised patients, both those with HIV/AIDS and diabetes mellitus. Based on current literature, this work up should include CD4 cell count, absolute CD4 percentage, absolute neutrophil count, RNA viral load for the HIV/AIDS patient, and HbA1c in the diabetic patient. Nutritional status often gets overlooked in the preoperative work up. Albumin levels, along with standard preoperative electrolyte panels will help determine the patient's wound healing status. A detailed conversation concerning the risks benefits and alternatives of the specific procedure should discuss not only the risks of infection, thromboembolic disease, wound dehiscence, and pain but of transmission to the physician and operative staff.

Prevention of transmission should include universal precautions; double gloving, using personal protection equipment especially faceshields or glasses that protect from splatter. Handling instruments is the most likely source for transmission, suggestions such as limiting the personnel in training i.e., residents and medical students, passing instruments in basins(neutral zone) as opposed to handing them off, as well as using properly designed needle protection devices have been suggested and are in place in many institutions.[19,21]

This limited retrospective study of 101 patients has shown that there is no statistical difference between perioperative infection rates in HIV/AIDS patients and diabetic patients. Our study population had moderately advanced disease processes as evident by their average CD4 count and HBA1c respectfully and an average of 2 comorbidities. Despite this, only 2 patients had a peri-operative infection. The role that chemoprophylaxis played in the current study is unclear because the patients who developed a postoperative infection did receive the adequate dosage of chemoprophylaxis within the time dictated by operative protocol. More research and longer follow up periods are needed to fully evaluate the postoperative infection rates in both cohorts. However this study is a stepping stone in the new generation of treating HIV/AIDS as more of a chronic disease in which patients that have a need for elective surgery will be optimized for the procedure and be given a chance at as normal a life as possible.

REFERENCES

1. National Institute for Allergy and Infectious Disease. HIV infection and AIDS: An Overview 2005. URL: www.niaid.nih.gov/factsheets/hiv-inf.htm.
2. Centers for Disease Control and Prevention. HIV/AIDS Surveillance Report, 2006 and 2008. URL: http://www.cdc.gov/hiv/topics/surveillance/resources/reports
3. Kaiser Family Foundation. HIV/AIDS Policy Fact Sheet. 2007.URL: www.kff.org.
4. Lord RV. Anorectal surgery in patients infected with human immunodeficiency virus: factors associated with delayed wound healing. *Ann Surg* 1997;226:92-9.
5. Senel FC, JessenGS, Melo MD, ObeidG. Infection following treatment of mandible fractures: the role of immunosuppression and polysubstance abuse.*Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;103:38-42
6. Reyes-Teran G, Ponce de Leon S. T CD4+ cell count and their use in management of patients with HIV-1. *Rev Invest Clinc* 1993;45:363-70.
7. Norrish AR, Lewis CP, Harrison WJ. Pin-track infections in HIV-positive and HIV-negative patients with open fractures treated by external fixation. *J Bone Joint Surg Br* 2007;89:790-3.
8. Huang WC, Kwon EO, Scardino PT, Eastham JA. Radical Prostatectomy in patients infected with human immunodeficiency virus. BJU Int 2006;98:303-7.
9. Young WF, Axelrod P, Jallo J. Elective spinal surgery in asymptomatic HIV-seropostive patients. *Spine* 2005;30:256-9.
10. Harris HW, Shecter WP. Surgical risk assessment and management in patients with HIV disease. *Gastrointestinal Clin N Am* 1997;26:377-91.
11. Dronge AS, et al. Long-term glycemic control and postoperative Infectious complications. *Arch Surg* 2006;141:375-80.
12. Chou L, Reynolds MR, Esterhai JL Jr. Hazards to orthopedic trauma surgeon: occupational exposure to hiv and viral hepatitis [review]. *J Ortho Trauma* 1996;10:289-96.
13. Smith E. Surgery in HIV-1 and HIV-2 antibody positive patients. *J Nat Med Assoc* 1990;82:551-3.
14. De Graaf R, Houwelling H, Van Zessen G. Occupational risk of HIV infection among Western health care professionals posted in AIDS endemic areas. *AIDS Care* 1998;10:441-52.
15. Hamilton JB. Human Immunodeficiency virus and the orthopedic surgeon. *Clin Ortho Rel Research* 1996;328:31-3.
16. Wastell C, Corless D, Keeling N. Surgery and Human Immunodeficiency Virus-1 infection. *Am J Surg* 1996;172:89-92.
17. Herruzo-Cabrera R, et al. Sugical Site Infection of 7301 traumatologic inpatients (divided in two sub-cohorts and validation): Modifiable determinants and potential benefit. *European J Epi* 2004;19:163-9.
18. LaPorte DM et al. Human Immunodeficiency Virus testing for elective orthopedic procedures: results in a community based hospital. *Orthopedics* 2001;24:52-5.
19. Tran et al. Predictors of operative outcomes in patients with Human Immunodeficiency Virus Infection and Acquired Immunodeficiency Syndrome. *Am J Surg* 2000;180:228-33.
20. Wong KC, Leung KS. transmission and prevention of occupational infections in orthopaedic surgeons. *J Bone Joint Surg Am* 2004:86:1065-76.
21. Klatt EC. Surgery and Human Immunodeficiency Virus Infection: indications, pathologic finding, risks and risk prevention. *Int Surg* 1994;79:1-5.
22. Dua RD, Wajed SD, Winslet MC. Impact of HIV and AIDS on surgical practice. *Ann R Coll Surg Engl* 2007;89:354-8.
23. Davidson SP et al. Perioperative guidelines for elective surgery in the Human Immunodeficiency Virus-Positive patient. *Plastic Recon Surg* 2008;121:1831-40.
24. Saltzman DJ, Williams RA, Gelfand DV, Wilson SE. The surgeon and AIDS: twenty years later. *Arch Surg* 2005;140:961.
25. Horberg MA et al. Surgical Outcomes in Human Immunodeficiency Virus-Infected patients in the era of Highly Active Antiretroviral Therapy. *Arch Surg* 2006;141:1238-45.
26. Jones S, Schechter CB, Smith C, Rose DN. Is HIV Infection a risk factor for complications of surgery? *Mount Sinai J Med* 2002;60:329-33.
27. De Boer AS, et al Risk assessment for surgical-site infections in orthopedic patients. *Infect Control Hosp Epi* 1999;20:402-7.