Original Article

Treatment of postoperative infectious complications in patients with human immunodeficiency virus infection

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BACKGROUND: Antibiotics are widely given for surgical patients to prevent infection. Because of the lack of study on the rational use of antibiotics in patients with human immunodeficiency virus (HIV)-infected during surgical procedures, we analyzed the risk factors affecting postoperative infectious complications in HIV-infected patients and explore the rational use of perioperative antibiotics.

METHODS: This retrospective study consisted of 308 HIV-infected patients, 272 males and 36 females, who had undergone operation at the Shanghai Public Health Clinical Center from November 2008 to April 2012. The patients were divided into postoperative infection and non-infection groups. Their age and clinical variables were compared. The correlation between surgical incision, surgical site infection (SSI) and postoperative sepsis was analyzed. Prophylactic antibiotics were used for patients with type I and II incisions for less than 2 days. Patients with type III incisions were given antibiotics until the infection was controlled. Antiretroviral therapy (ART) was prescribed preoperatively for patients whose preoperative CD4 count was <350 cells/ μ L. For those patients whose preoperative CD4 count was <200 cells/ μ L, sulfamethoxazole and fluconazole were given preoperatively as prophylactic agents controlling *Pneumocystis carinii pneumonia* and fungal infection.

RESULTS: A total of 196 patients developed postoperative infectious complications, and 7 patients died. Preoperative CD4 counts, ratio of CD4/CD8 cells, hemoglobin level, and postoperative CD4 counts, hemoglobin and albumin levels were risk factors of perioperative infection in HIV-infected patients. Patients with a preoperative CD4 count <200 cell/ μ L, anemia, a postoperative CD4 count <200 cell/ μ L or albumin levels <35 g/L were correlated with a higher rate of perioperative infection. There was a significant correlation between SSI and the type of surgical incision. The rate of SSI in patients with type I surgical incision was 2% and in those with type II surgical incision was 38%. All the patients who received type III surgical incision developed SSI, and they were more likely to develop postoperative sepsis.

CONCLUSIONS: HIV-infected patients are more likely to develop postoperative infectious complications. The rational use of antibiotics in HIV-infected patients could help to reduce the rate of postoperative infectious complications in these patients.

KEY WORDS: Human immunodeficiency virus; Acquired immunodeficiency syndrome; Perioperative period; Surgical site infection; Antibiotics

World J Emerg Med 2014;5(2):103–106

DOI: 10.5847/wjem.j.issn.1920-8642.2014.02.004

BACKGROUND

Antiretroviral therapy (ART) has significantly improved the life expectancy of patients with human immunodeficiency virus (HIV) infection and those with

acquired immune deficiency syndrome (AIDS).^[1] With the increase of HIV-infected patients in recent years, the demand for surgical treatment of HIV-infected patients has been increasing.^[2–5] At the same time, antibiotics

are widely used to prevent the HIV infection in patients during the operations. Due to the lack of research on the rational use of antibiotics in HIV-infected patients during surgical procedures, this study aimed to analyze the risk factors of postoperative infections and explore the rational use of antibiotics in these patients.

METHODS

Definitions

The Centers for Disease Control and Prevention (CDC) definition for wound classification of surgical site infection (SSI) was used. SSI was defined as an infection that occurred within 30 days after the surgery. The patients had the one or two of the following features: (i) purulent drainage from the surgical incision; (ii) organisms isolated from an aseptically obtained culture of fluid or tissue from the surgical incision; (iii) the absence of pain, tenderness, localized swelling, redness, or heat. SSIs were also classified into incisional, deep incisional and organ/space.

Data collection

Clinical data from the HIV-infected patients who had undergone surgery from November 2008 to April 2012 were retrieved using a computerized patient record system. Inclusion criteria: HIV-infected patients were identified and diagnosed by the Centers for the Disease Prevention and Control in various locations. HIV tests were carried out via ELISA or Western blot. Upon admission, all of the patients had records of disease histories, physical examinations, preoperative and postoperative routine examinations, and immune function tests.

Patient group and study method

Infectious complications were retrospectively studied in 308 HIV-infected patients who had undergone surgery from November 2008 to April 2012 at the Shanghai Public Health Clinical Center. Surgical site infection (SSI) was identified through bedside surveillance and postoperative follow-up. Demographic and clinical information entered a database including type of surgical procedures, age, peripheral blood cells, plasma albumin, CD4 count, and CD4/CD8 ratio. The study was conducted according to the *Declaration of Helsinki* and approved by the Ethics Review Board of Shanghai Public Health Clinical Center (International index IORG0006364).

Statistical analysis

Data were analyzed using SPSS 16.0 statistical software (SPSS Inc., Chicago, IL, USA). Results of

all continuous data were presented as mean±standard deviation. Continuous variables were compared using an independent *t*-test. Univariate analysis of the categorical outcomes was carried out using the chi-square test. $P<0.05$ was considered statistically significant.

RESULTS

Altogether 196 patients developed postoperative infectious complications (sepsis or SSI), whereas 141 patients developed SSI and 121, sepsis. There were no deaths during surgery. Three patients with *Pneumocystis carinii* pneumonia before surgery and 4 patients with abdominal infection died within one month after operation. The types of surgical operations were listed in Table 1. The risk factors of postoperative infectious complications in HIV-infected patients were analyzed, and the preoperative CD4 count, CD4/CD8 ratio, serum hemoglobin level, and postoperative CD4 count, serum hemoglobin, and albumin level differed between the groups with and without postoperative infectious complications (Table 2). Univariate analysis of the risk

Table 1. Types of surgical procedures in HIV-infected patients

Surgical procedures	Total
Abdominal surgery	76
Perianal surgery	64
Skin tumor removal	59
Orthopedic surgery	30
Purulent drainage	27
Urinary operation	14
Others	38

Table 2. Risk factors of postoperative infectious complications

Variables	Group A	Group B	P
Age	47.1±13.6	40.2±12.1	0.000*
Preoperative			
CD4	362.9±283.6	211.2±161.7	0.000*
CD8	781.2±448.9	722.1±457.3	0.335
CD4/CD8	0.49±0.29	0.34±0.29	0.000*
WBC (×10 ⁹ /L)	5.47±2.37	5.86±2.91	0.239
Hemoglobin (g/L)	129.3±21.7	121.5±25.9	0.009*
Platelet (10 ⁹ /L)	187.4±85.7	208±103.6	0.081
Albumin (mg/L)	45.5±11.2	43.5±11.8	0.197
Postoperative			
CD4	311.8±136.6	199.7±161.4	0.000*
CD8	719.6±399.9	678.6±389.9	0.591
CD4/CD8	0.51±0.29	0.87±4.98	0.655
WBC (×10 ⁹ /L)	6.77±2.96	6.38±3.61	0.438
Hemoglobin (g/L)	121.1±20.3	112.2±25.1	0.011*
Platelet (10 ⁹ /L)	207.7±104	192.9±112.5	0.355
Albumin (mg/L)	44.5±11.0	40.2±10.9	0.012*

Group A: patients without postoperative infectious complications; Group B: patients with postoperative infectious complications.

*Statistical significance.

Table 3. The categorical outcomes of risk factors

Variables	Group A	Group B	P
Preoperative CD4 count			0.000*
<200 cells/ μ L	25	108	
$\geq$ 200 cells/ μ L	86	89	
Preoperative anemia			0.038*
Yes	32	80	
No	79	117	
Postoperative CD4 count			0.000*
<200 cells/ μ L	17	125	
$\geq$ 200 cells/ μ L	94	72	
Postoperative anemia			0.056
Yes	49	120	
No	62	77	
Postoperative albumin level			0.002*
<35 g/L	14	67	
$\geq$ 35 g/L	97	130	

Group A: patients without postoperative infectious complications;

Group B: patients with postoperative infectious complications.

*Statistical significance.

Table 4. The number of SSIs according to the type of surgical incisions

Variables	SSIs	Non-SSIs	P
Clean	2	94	0.000*
Contaminated	120	73	
Dirty	19	0	

*Statistical significance.

Table 5. The correlation between SSIs and sepsis

Variables	Sepsis	Non-sepsis	P
SSIs	69	72	0.002*
Non-SSIs	52	115	

*Statistical significance.

factors showed that patients with a preoperative CD4 count below 200 cells/ μ L, anemia, or a postoperative CD4 count below 200 cells/ μ L, and an albumin level below 35 g/L had a higher incidence of infectious complications after surgery (Tables 3–5).

DISCUSSION

Immune function and infectious complications of HIV-infected patients

HIV virus can destroy CD4+ T cells while reducing their number. It is universally accepted that CD4 counts are a valuable marker of disease progression in HIV and AIDS patients. When CD4 counts decrease to the level of lower than 200 cells/ μ L, patients are more likely to develop opportunistic infections and infectious complications after surgery. It has been reported that the incidence of postoperative infectious complication was 55% and the mortality rate 30% for patients after abdominal surgery.^[6] We analyzed the associated risk factors of postoperative infectious complications in HIV-infected patients and found that

the preoperative CD4 counts, CD4/CD8 ratios, serum hemoglobin levels, postoperative CD4 counts, and serum hemoglobin and albumin levels were indicators of postoperative infectious complications. Furthermore, patients with a preoperative CD4 count <200 cells/ μ L, anemia, a postoperative CD4 count <200 cells/ μ L, or serum albumin level <35 g/L had a higher incidence of infectious complications after surgery. We also found that patients with SSIs were more likely to develop postoperative sepsis.

Basic principles of using perioperative antibiotics

Patients with clean incisions are not encouraged to use antibiotics, but no report about it is available in immune-compromised patients. In patients with contaminated incisions, antibiotics should be used accordingly; antibiotics must be administered to patients with dirty incisions to control infection. The best period of prophylaxis treatment is one hour before surgery or at the beginning of anesthesia. One dose is sufficient. If the operation lasts more than 3 hours, patients should be given another dose during the operation and antibiotics should be administered to those patients for 1 to 2 days after operation. At present, there is no guide for the use of antibiotics in HIV-infected patients during the perioperative period. We usually administer antibiotics to HIV patients with a clean incision for 2 days after surgery. Patients with infectious complications must use antibiotics until their infections are completely controlled. HIV-infected patients at a low risk of developing infectious complications can use antibiotics as common patients.

Treatment of postoperative infectious complications in HIV-infected patients

SSI is still one of the main factors causing patient mortality after surgery.^[7] It is the third most frequently reported nosocomial infection, which is most commonly seen in surgical wards.^[8] The mortality of patients with sepsis is 30% to 40%, and up to 50% for patients with severe sepsis or septic shock.^[9,10] The mortality can reach up to 70% for elderly patients or patients with basic diseases.^[11] It has also been reported that the mortality of patients with nosocomial infections is twice as that of patients without nosocomial infections.^[12] HIV-infected patients are more likely to develop infectious complications after surgery than normal patients due to their deficiency in immune function. Patients with incisional infections do not require long-term use of antibiotics but they should keep incisions clean. In

patients with deep incisional or organ space infections, purulent tissue should be removed quickly and antibiotics should be administered. For those patients whose preoperative CD4 counts were <200 cells/ μ L, antibiotic and antifungal medication (sulfamethoxazole and fluconazole) should be administered preoperatively as a prophylaxis against *Pneumocystis carinii* pneumonia and fungal infection.

The mortality of HIV-infected patients undergoing surgery in our hospital was 2.2%, which is significantly lower than that reported previously. Surgeons should pay attention to occupational exposure and aseptic technique in order to reduce SSIs and surgical trauma. To reduce the incidence of infectious complications and mortality, surgeons should have multidisciplinary knowledge and conduct reasonable anti-infection treatments.

ACKNOWLEDGEMENT

We gratefully acknowledge the support of the Sanofi-Aventis from Shanghai Institutes for Biological Sciences scholarship program.

Funding: The study was supported by grants from the National Science Foundation of China, Shanghai Pasteur Foundation, Shanghai "Rising Star" program (10QA1407900), Novo Nordisk-Chinese Academy of Sciences Foundation.

Ethical approval: This study was approved by the institutional ethics committee.

Conflicts of interest: We have no conflicts of interest to report.

Contributors: Liu BC proposed the study and wrote the paper. All authors contributed to the design and interpretation of the study and to further drafts.

REFERENCES

- 1 Broder S. The development of antiretroviral therapy and its impact on the HIV-1/AIDS pandemic. *Antiviral Res* 2010; 85: 1–18.
- 2 Stock PG, Barin B, Murphy B, Hanto D, Diego JM, Light J, et al. Outcomes of kidney transplantation in HIV-infected recipients. *N Engl J Med* 2010; 363: 2004–2014.
- 3 Baker CA, Clark R, Ventura F, Jones NG, Guzman D, Bangsberg DR, et al. Peripheral CD4 loss of regulatory T cells is associated with persistent viraemia in chronic HIV infection. *Clin Exp Immunol* 2007; 147: 533–539.
- 4 Foo E, Sim R, Lim HY, Chan ST, Leo YS, Wong SY. Abdominal surgery in human immunodeficiency virus (HIV) infected patients—early local experience. *Ann Acad Med Singapore* 1998; 27: 759–762.
- 5 Dellinger RP, Levy MM, Carlet JM, Bion J, Parker MM, Jaeschke R, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: 2008. *Crit Care Med* 2008; 36: 296–327.
- 6 Deneve JL, Shantha JG, Page AJ, Wyrzykowski AD, Rozycki GS, Feliciano DV. CD4 count is predictive of outcome in HIV-positive patients undergoing abdominal operations. *Am J Surg* 2010; 200: 694–699; discussion 9–700.
- 7 Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology and prevention. *J Hosp Infect* 2008; 70 Suppl 2: 3–10.
- 8 Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999; 20: 250–278; quiz 79–80.
- 9 Shapiro NI, Howell M, Talmor D. A blueprint for a sepsis protocol. *Acad Emerg Med* 2005; 12: 352–359.
- 10 Cheng B, Xie G, Yao S, Wu X, Guo Q, Gu M, et al. Epidemiology of severe sepsis in critically ill surgical patients in ten university hospitals in China. *Crit Care Med* 2007; 35: 2538–2546.
- 11 Martin GS, Mannino DM, Eaton S, Moss M. The epidemiology of sepsis in the United States from 1979 through 2000. *N Engl J Med* 2003; 348: 1546–1554.
- 12 Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Control Hosp Epidemiol* 1999; 20: 725–730.

Received December 11, 2013

Accepted after revision May 3, 2014