Management Algorithm for Surgical Patients Infected with Human Immunodeficiency Virus

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Objective: The purpose of this study was to establish the risk factors which influence the postoperative evolution of surgical patients infected with human immunodeficiency virus (HIV), and to conceive a management algorithm based upon these factors.
Methods: We have performed a bidirectional transversal study on a group of 73 HIV-positive patients who had undergone 104 surgical procedures during 2006–2010 in the university medical center of Tîrgu Mureș. We studied risk factors such as the number of CD4 T-cells (LTCD4) < 100/µl, anemia, thrombocytopenia, hypoproteinemia, leukopenia, wasting syndrome, ASA (American Society of Anesthesiologists) score, Altemeier class and NNISS (National Nosocomial Infections Survey Systems) score. We defined any registered postoperative complication, as well as all deaths within the first 30 days from surgery as poor outcome. We used GraphPad statistical program, Fisher test for the statistical analysis of data, we interpreted p <0.05 as statistically significant, for a CI of 95%.
Results: We have registered a total of 15 complications, 5 deaths. Risk factors associated with poor postoperative outcome were LTCD4 <100/µl (p=0.03) wasting syndrome (p=0.0001), ASA score > 1 (p=0.01), Altemeier class > II (p=0.0001), NNISS score 1 (p=0.0001).
Conclusions: HIV-infected patients with emergency surgical pathology will benefit of surgical treatment when the anesthetic risk does not overpass the surgical risk, while patients who require elective interventions will be operated after the correction of risk factors.

Keywords: HIV, surgical treatment, risk factors, management

Introduction

Currently, the prevalence of Human Immunodeficiency Virus (HIV) infection in Romania is progressively rising each year [1]. This can be attributed both to the increasing number of newly-diagnosed cases and to the improved efficacy of the advancing medical therapy. Surgical involvement in the care of HIV-positive patients has grown, with procedures ranging from diagnostic to palliative [2,3]

The literature on postoperative complications is descriptive and inconsistent and it does not support a firm conclusion on the association between complication rates and HIV serological status or disease stage. The ultimate outcome of surgery in HIV-infected patients is most likely to depend upon many independent variables and not just the underlying viral infection or disease stage [4]. The purpose of this study was to explore the nature of surgical procedures performed on the HIV-infected population, to establish the risk factors and, considering all these, to create an algorithm for the management of surgical patients.

Methods

We performed a cross-sectional, bidirectional study on 73 patients with HIV who underwent surgery between 2006 and 2010, a total of 104 procedures.

To insure the same case definitions, diagnostic methods, operatory techniques, hospital circumstances and the same therapeutic team, we included in this study only those Hiv-infected patients monitored in the Regional Center of Fight against AIDS Mureş (RCFAM) who underwent surgical procedures in the university center of Tg-Mureş. We excluded from the study: HIV-positive patients monitored in RCFAM who underwent surgical treatment in other medical centers (Sibiu, Bucuresti, Great Britain) and HIV-infected patients monitored in RCFAM who had indications for surgical treatment, but the procedure could not be performed due to anesthetic risks and vital organ insufficiencies or dysfunctions. We studied the incidence and character of surgical interventions, the risk factors which can influence postoperative evolution in HIV-infected patients: the number of CD4 T-lymphocytes ≤ 100 / µl [5,6], white blood cell count / mm3 (L) ≤4000/ mm3 , the number of platelets (Tr) / mm3 ≤ 150000/ mm3 , hemoglobin level (Hgb) ≤12g% [7], total serum proteins (P) ≤ 6g%, body mass index (BMI) ≤16 (wasting syndrome), ASA (American Society of Anesthesiologists) score, Altemeier classification, NNISS (National Nosocomial Infections Survey Systems) score. We defined poor outcome as intra- and postoperative complications cumulated with the deaths within the first 30 days following surgery. We correlated risk factors with postoperative poor outcome. We used GraphPad statistical program, Fischer test for the statistical analysis of data, we interpreted p < 0.05 as statistically significant, for a CI of 95% [8].

The studied group consisted of 44(60.3%) female patients, 29 (39.7%) male patients, with an average age of 22 years, a median of 20 years, a minimum of 8 months and a maximum of 55 years; 54 (74%) were nosocomially infected with HIV. Most patients (85%) were in the advanced stage of disease, according to the 1993 CDC Atlanta case definition [9].

At the time of the surgical intervention, 14 patients had HIV-associated infections or tuberculosis, 2 patients had type 2 diabetes mellitus under insulin treatment, one patient – latent syphilis, one – HIV cardiomyopathy. 15

Table I. Risk factors in surgical patients

Risk factor	Number of procedures in patients at risk	%
LTCD4 <100/μL	36	34
Thrombocytopenia	26	25
Anemia	54	51
Hypoproteinemia	6	5
Leukopenia	25	24
Wasting syndrome	36	35

patients had acute lung disease and 2 had Cryptococcus neoformans meningoencephalitis at the time of the surgical procedure.

Results

Out of a total of 83 patients with surgical problems, 10 were treated conservatively, or in other medical centers, while the 73 remaining patients who required surgical treatment formed the population of our study. Most surgical interventions were performed for diagnostic and therapeutic purposes – 35%, followed by prophylactic interventions 28%; aesthetic procedures were the least frequent – 2%.

We distributed the surgical procedures based on the purpose and the year of the intervention, as shown in Figure 1.

The number of surgical interventions, distributed according to the time of their execution, reveals a significant annual increase in diagnostic, therapeutic and prophylactic interventions. Emergency surgery was performed only in 13% cases, while 87% cases underwent elective surgical interventions. The risk factors of the patients at the time of the surgical intervention are shown in Table I.

The results of ASA, Altemeier and NNISS scores calculated for each surgical procedure and the evolution of patients according to their scores are displayed in Figure 2.

In all 104 surgical procedures, we have registered 15 complications, out of which 2 intraoperative and 13 postoperative complications. The main features of the patients with poor outcome are displayed in Table II.

Table III. The effect of risk factors on postoperative evolution in HIV-positive surgical patients

Risk factor	p	OR	VPP%	VPN%	RA%
LTCD4<100/μl	0.031	1.27	36	89	21.25
Viral load > 30000 copies/μl	0.751	–	–	–	–
Leukopenia	1	–	–	–	–
Thrombocytopenia	0.26	–	–	–	–
Anemia	0.08	–	–	–	–
Hypoproteinemia	0.08	–	–	–	–
Wasting Syndrome	0.0001	12.44	44	91	91.93
ASA1/ASA1+2+3	0.01	4.19	28.07	91.48	76
ASA1+2/ASA3+4	0.001	9.5	55.55	88.37	89.47
ASA1+2+3/ASA4	0.193	–	–	–	–
AltemeierI/AtemeierII+IV	0.628	–	–	–	–
AltemeierI+II/AltemeierIV	0.001	21	100	84	95
NNISS0/NNISS1+2	0.0001	9.28	52.63	91.56	89
NNISS0+1/NNISS2	0.0001	36	86	100	97

Table II. Clinical and immunological features of patients with poor postoperative outcome

Complications	No.	STD C3	LTCD4 <100	L	T	A	HP	W
Intraoperative complication	2	1	1	0	0	1	0	1
Superficial postoperative complication	8	5	4	2	1	5	0	7
Early postoperative complication independent of the surgical site	1	1	0	0	0	0	0	0
Deep surgical site complication	3	3	3	1	3	3	1	3
Late postoperative complications	1	1	1	0	0	1	1	1
Early death	4	4	3	3	2	3	1	3
Late death	1	1	1	0	1	1	0	1

Intraoperative complications were registered in two patients; intraoperative hemorrhage during thoracoplasty, which required hemostatic intervention, and an episode of paroxystic tachycardia during birth by C-section in a patient with HIV cardiomyopathy, medication solved. Early superficial postoperative surgical site complications (within the first 30 days following surgery) were noticed in 8 patients – 8 procedures. Only one patient developed an early postoperative complication independent of the surgical site, but associated to the intervention – a urinary infection associated to the urinary catheter. Two patients who had underwent 3 invasive thoracoabdominal interventions, with multiple risk factors, developed deep surgical site complications. Early deep complications appeared in pa-

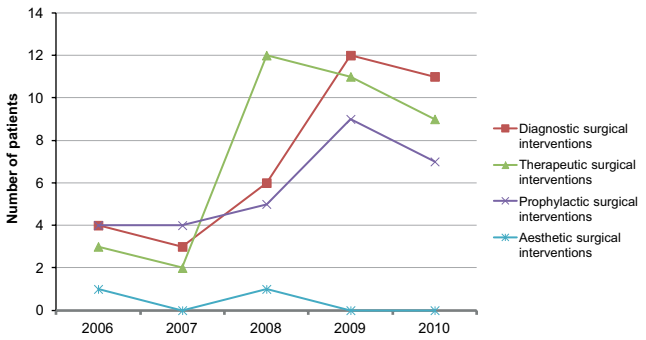


Fig. 1. Surgical interventions distributed by purpose and year of the procedure

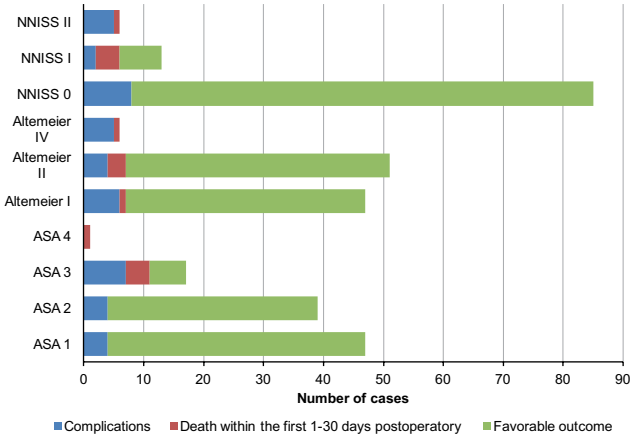


Fig. 2. ASA, Altemeier, NNISS scores and patients' evolution

tients with severe immune suppression, wasting syndrome, hypoproteinemia, anemia or thrombocytopenia. Late postoperative complication appeared in a single patient, with multiple risk factors, as shown in Table II, in which the diagnosis of HIV infection was set just before surgery.

Four patients died within the first 7 days following low or medium complexity surgery, mainly due to their severely altered status, HIV-associated pathology, intercurrent or opportunistic infections. One death was registered within the 8–30 day interval after surgery, in a severely immune suppressed patient, with wasting syndrome hypoproteinemia, anemia, thrombocytopenia, who required a second emergency surgical intervention for a juxtacecal cold abscess.

We used the Fisher test and calculated the probability that a risk factor influences the patient's outcome.

Discussions

Along the 104 surgical procedures that we studied, we registered 15 complications (14.42%), out of which 66.66% were postoperative superficial surgical site complications.

Two patients, undergoing 3 invasive thoracoabdominal interventions, developed deep surgical site complications – 2.88% of all interventions, 25% of the complications. They had several risk factors, such as LTCD4 <100/μl, wasting syndrome, leucopenia and severe associated pathology, such as Multi-drug-resistant disseminated tuberculosis.

Late postoperative complication appeared in a single patient, diagnosed with HIV infection previously to the surgical procedure, which counts for 0.96% complications of all the surgical interventions and 8.33% of all complications. At the time of the intervention, she was recently diagnosed with HIV infection, anemic, hypoproteinemic, with LTCD4 <100/μl and wasting syndrome.

Early death was registered in 4 patients (3.84% procedures, 5.74% patients), while late death appeared in 1 patient (0.96% procedures, 1.35% patients). In Flum et al's study, 33% patients died [10]. No deaths were registered during the first 24 hours following surgery.

The number of LTCD4 was determined in every patient. The average value of LTCD4 was 236/μl, with DS=186, CI 95% = 200–273, with a minimum of 4/μl, a maximum of 844/ μl and median = 210/μl (the patient under 6 years was excluded from this calculation).

Thirty-six procedures were performed in patients with LTCD4 <100/μl. By using Fisher test, we correlated the number of LTCD4 <100/μl with the appearance of complications and the result was not statistically significant. The evolution toward complications in surgical HIV-infected patients was not influenced by LTCD4 count lower than 100/μl. The result was concordant with other observations from the literature [2,11], but it was not concordant with the experience of other authors [11,12,13].

By correlating the number of LTCD4 <100/μl with the deaths registered within the first 30 days following surgery, we have obtained a statistically significant result, p=0.047. Low LTCD4 count <100/μl (with severe immune suppression) was correlated with death in HIV-infected patients, with an OR=8.37, PPV=11.11% NPV=98.52%, RA%= 88.05%, a result similar to that obtained by Albaran et al. [14]. Because of this, we have cumulated deaths and complications and thus followed the effect of LTCD4 on postoperative evolution.

We defined poor outcome as the intra- and postoperative complications cumulated with deaths produced within the first 30 days after surgery. We thus obtained p=0.031, which is statistically significant, with OR=1.27, PPV=36%, NPV=89%, RA%=21.25%. These statistical data reveal clearly that low LTCD4 levels influence the postoperative outcome, but the negative predictive value is more valuable than the positive predictive one. The value of LTCD4 as surgical risk factor remains controversial.

The average white blood cell count was 6409/mm3 on surgery day, SD=3120, CI 95% = 5802-7016, minimum= 1300/mm3, maximum= 1800/mm3, median= 5550/ mm3. Leukopenia was detected in 25 patients, explained by the immunodeficiency syndrome. We correlated leucopenia with postoperative evolution and obtained p=1, which is not statistically significant. In our group, low white blood cell count did not influence postoperative evolution, a result both concordant [15] and non-concordant with the results of other studies [12].

Preoperatively, patients had an average number of platelets of 222845/mm3, DS 196957, CI 95%=184541-261148, minimum=2000/mm3, maximum=194000/ mm3, median 200000/mm3. 26 thrombocytopenic patients were operated. We did not obtain a statistically significant result by correlating thrombocytopenia with postoperative evolution: p=0.26, so the low number of platelets did not influence the outcome of the disease.

The average value of serum hemoglobin within the first 24 hours before surgery was 11.42 g%, SD 1.92, CI 95%=11.05-11.8, minimum=7 g%, maximum=15 g%, median=11.85 g%. 54 patients with various degrees of anemia underwent surgery. We did not obtain a statistically significant result by correlating anemia with postoperative outcome – p=0.0853, which indicates that anemia did not have any effect on postoperative evolution.

Serum protein levels within the first 24 hours before surgery had an average value of 7.46 g%, with SD=1, CI 95%=7.26-7.6, minimum=5 g%, maximum 9.9 g%, median=7.45 g%. 6 patients had hypoproteinemia at the time of the intervention. We did not obtain a statistically significant result by correlating the presence of hypoproteinemia with postoperative outcome – p=0.08, which indicates that low serum protein levels did not influence the evolution.

Body mass index (BMI), separately calculated for each patient with help from the online BMI calculator [16], indicated the presence of wasting syndrome (BMI <16) in 36 patients, which is why we decided to analyze the obtained data statistically. By correlating the presence of wasting syndrome with postoperative evolution, we obtained a

very significant statistical result, p=0.0001, so wasting syndrome was associated with poor outcome in HIV-infected surgical patients, OR=12.4, PPV=44%, NPV 91%, RA%=91.93%, results which prove that wasting syndrome was a negative prognostic factor in our study group. This can be easily explained by the fact that patients with wasting syndrome are in an advanced stage of the infection, which involves multiple concurrent diseases and metabolic impairment. These results were concurrent with the observations of Schecter et al. [17].

Patients who underwent surgical interventions were categorized according to ASA, Altemeier, NNISS scores. Postoperative evolution was observed in correlation with these scores. Favorable outcome in patients with ASA 1 score compared to those with ASA 3 score was obvious, a result concordant with the observations of Schecter et al. [17].

A similar association was observed for Altemeier classification and NNISS score, which is why statistical analysis of data was performed. In order to differentiate the importance of score values, sets of categories were compared. By correlating ASA 1 and ASA 2+3+4 scores with postoperative evolution, we obtained a statistically significant result, p=0.0131, OR=4.19, PPV=28.07%, NPV= 91.48%, RA%=76.13%, which means that the patients' evolution is influenced by ASA score higher than 1. By correlating ASA 1+2 scores and ASA 3+4 scores with the evolution, we obtained a very significant statistical result, p=0.0001, OR=9.5, PPV=55.55%, NPV 88.37%, RA%=89.47%, which proves the negative effect of scores ASA 3 and 4 on the outcome and their value as prognostic factors. We did not obtain a statistically significant result by correlating ASA 1+2+3 compared to ASA 4 score with the outcome of the disease, p=0.1931, which indicates that there is no difference between the prognostic value of ASA 4 compared to ASA 3 score. This is how we reached to the conclusion that ASA score 2 may be considered a risk factor.

Altemeier classification was correlated with the patients' evolution, separated on categories as well. We did not obtain a statistically significant result by correlating Altemeier class I and Altemeier class II+IV with the evolution, p=0.628, so Altemeier class II/IV did not have a different impact on evolution compared to Altemeier class I. By correlating Altemeier class I+II and class IV with the evolution, we obtained a very significant statistical result, p=0.0001, OR=21, PPV=100%, NPV=84%, RA%=95%, according to which Altemeier class higher than II may be considered at risk.

We correlated NNISS score categories with the patients' evolution. When correlating NNISS 0 and NNISS 1+2 scores with the evolution, we obtained a statistically significant result, p=0.0001, OR=9.38, PPV=52.63%, NPV=91.56%, RA%=89%, which proves that NNISS 1 score may be used as prognostic factor. By correlating NNISS 0+1 and NNISS 2 scores with the evolution, we obtained a statistically significant result, p=0.0001, which proves that the outcome of surgical patients is influenced by a NNISS score > 1 in a progressive way.

According to these results, postoperative evolution in our group of study was influenced by the level of LTCD4 < 100/ µl, the presence of wasting syndrome, ASA score 1, Altemeier class II and NNISS score.

Conclusions

1. The incidence of surgical interventions in HIV-infected patiens is continuously increasing.
2. We registered a total of 15complications (14.42%), 66.66% of all postoperative complications were early superficial postoperative surgical site complications.
3. 5.74% of all surgical patients presented early death, 1.35% - late death.
4. Leukopenia (p=1), thrombocytopenia (p=0.26), anemia (p=0.08) hypoproteinemia (p= 0.08) did not influence postoperative evolution.
5. Poor postoperative outcome was statistically significantly related with LTCD4 count < 100/µl, p=0.031, with an OR=1.27, PPV=36%, NPV=89%, RA%=21.25%
6. Wasting syndrome was correlated with postoperative poor outcome in a very statistically significant way, p=0.0001, OR 12.4, PPV 44%, NPV91%, RA% 91.93%.
7. ASA score 2 represented a risk factor for postoperative evolution in HIV-positive patients, p=0.0001, OR=9.5, PPV=55.55%, NPV=88.37%, RA%=89.47.
8. Altemeier class II represented a risk factor for postoperative outcome in HIV-infected patients, p= 0.001, OR=21, PPV=100%, NPV=84%, RA%=95%.
9. NNISS score 1 represented a risk factor for postoperative outcome in HIV-infected patients, p= 0.0001, OR= 9.38, PPV= 52.63%, NPV= 91.56%, RA%= 89%.

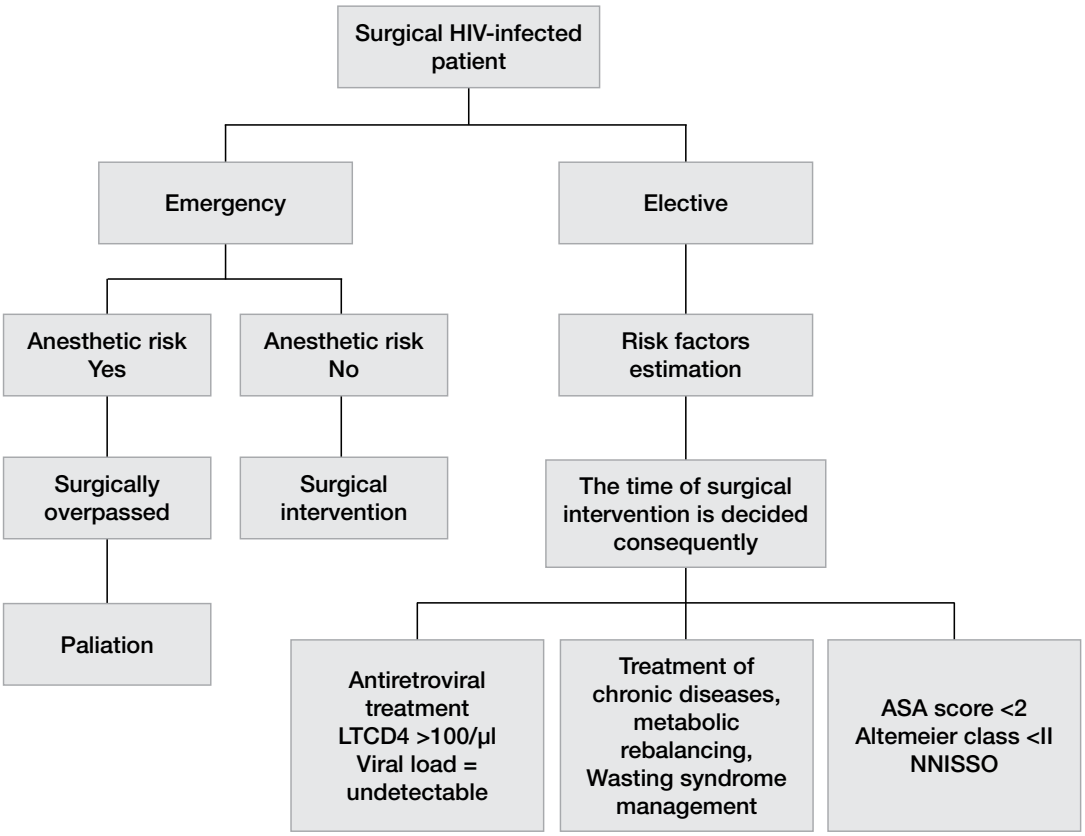
By corroborating these data, we established a management algorithm for surgical HIV-infected patients.

References

1. CNLAS. http://www.mateibals.ro/html/link.htm. [Online].; 2010 [cited 2010 12 12].
2. Dua R, Wajed S, Winslet M. Impact of HIV and AIDS on surgical practice. Ann R Coll Surg Engl. 2007; 89: 354-358.
3. Zaharia-Kézdi I, Boțianu A, Chiriac C, Boțianu P, Incze A, Dobrică A. The surgical pathology of human immunodeficiency virus infected patients in the experience of the surgical Clinic II Tîrgu Mure. Acta Medica Marisiensis. 2010; 56: 473-475.
4. Vijaykumar RN. The role of laparascopic surgery in the surgical treatment of HIV patients. World Journal of Laparascopic Surgery. 2008; 1(2): 9-14.
5. Savioz D, Chilcott M, Ludwig C, et a. Preoperative count of CD4 Lymphocites and early postoperative infective complications in HIV posotive patients. Eur J Surg. 1998; 164: 483-487.
6. Schecter WP, Stock P. http://hivinsite.ucsf.edu/InSite?page=kb-03-03-02. [Online] 2003 [cited 2010 12 12].
7. Karpelowsky SJ, Zar HJ, Bogerijen G, Graaf N, Millar AJW. Predictors of postoperative complications in HIV-infected children undergoing surgery. Journal of Pediatric Surgery. 2011; 46: 674-678.
8. Măruşteri M. Noţiuni fundamentale de biostatistică Tg.Mureş: University Press; 2006, 115-150
9. CDC. Revised classification systemfor HIV infection and expanded

surveillance case definition for AIDS among adolescents and adults. MMWR. 1992; 41:1-19.

10. Flum D, Wallack M. The surgeon s database for AIDS: collective review. JACS. 1997; 184: 403-412.
11. Cacala SR, Mafana E, Thpmson SR, Smith A. Prevalence of HIV status and CD4 counts in a surgical cohort: their relationship to clinical outcome. Ann R Coll Surg Engl. 2006; 88: 46-51.
12. Emparan C, Iturbu IM, Ortiz J, Mendez JJ. Infective complications after abdominal surgery in patients infected with human immunodeficiency virus: role of CD+ lymphocytes in prognosis. World J Surg. 1998; 22(Thus the surgical infection rates with HIV patients undergoing abdominal surgery are dramatically increased): 1788-1793.
13. Emparan C, Iturburu IM, Portugal V, Apecechea A, Bilbao JE, Mendez JJ. Infective complications after minor operations in patients infected with HIV: role of CD4 lymphocytes in prognosis. Eur J Surg. 1995; 161(10): 721-723.
14. Albaran RG, Webber J, Steffes CP. CD4 cell counts as a prognostic factor of major abdominal surgery in patients infected with the Human Immunodeficiency Virus. Arch Surg. 1998; 23: 626-631.
15. Robbs JV, Paruk N. Management of HIV vasculopathy- a South African Experience. Eur J Vasc Endovasc Surg. 2010; 39: 525-531.
16. http://www.nhlbisupport.com/bmi/. [Online]. [cited 2011 03 01].
17. Schecter JS, B SC, C S, D R. Is HIV infection a risk factor for complications of surgery? Mt Sinai J Med. 2002; 69: 329-333.



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