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Original Research Article

Surgical site infections in human immunodeficiency virus positive patients and their correlation with CD4 count

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ABSTRACT

Background: The CD4 count is like a snapshot of how well the immune system is functioning. The progressive failure of the immune system caused by the human immunodeficiency virus (HIV) can increase the possibility of developing surgical site infections (SSI) after surgery. Study about the incidence of SSI and their correlation with CD4 count in HIV positive patients has not been done in India. The present study was aimed to find the incidence and microbiological profile of SSI among HIV positive patients, and the correlation between SSI and CD4 count.
Methods: One hundred forty-six HIV positive patients >18 years of age scheduled for surgery were included. CD4 count of each patient was noted. The primary outcome measure was the incidence of SSI, whereas secondary outcome measures were the correlation of SSI with CD4 count and microbiological profile of infective material. Intergroup comparison of categorical, and continuous variables was done using the chi-square test/Fisher's exact test and unpaired 't' test respectively.
Results: The incidence of SSI in HIV positive patients was 14/146 (9.6%). The incidence of SSI was significantly higher among patients with CD4 count <200 (60.0%) as compared to patients with CD4 count >500 (0.9 %). Mean±SD of CD4 count in patients without SSI and with SSI was 712.5±238.9 and 330.1±118.1 (cells/mm^3) respectively (p<0.001). *Klebsiella pneumoniae* was the most common organism isolated in this study.
Conclusions: SSI is frequent in HIV positive patients whose CD4 count is <200 cells/mm^3.

Keywords: SSI, HIV, CD4 count

INTRODUCTION

Surgical site infections (SSI) are still a real risk in surgery, despite optimum care and represent a substantial burden of disease for both patients, and healthcare services in terms of morbidity, mortality and economic cost. The quality of life and survival expectancy of the human immunodeficiency virus (HIV) infected patients in developed countries have substantially improved. The clinical barriers towards the surgical treatment of HIV-infected patients, which were once associated with the poor surgical outcomes are gradually disappearing.[1-3] The number of HIV-infected patients undergoing ''high-risk'' surgical interventions is increasing although these patients do have a higher risk of mortality from infectious complications.[4-7]

In molecular biology, cluster of differentiation 4 (CD4) is a glycoprotein found on the surface of immune cells such as T helper cells, monocytes, macrophages, and dendritic cells. It was discovered in the late 1970s and was named CD4 in 1984.[8] In humans, the CD4 protein is encoded by the CD4 gene.[8,9]

The CD4 count is like a snapshot of how well the immune system is functioning. The progressive failure of the immune system caused by HIV can increase the possibility of developing SSI after surgery. SSI rate of

HIV-infected patients was reported twofold in Italian and European studies for the general population.[5] Study about the incidence of SSI and their correlation with CD4 count in HIV positive patients has not been done in India. The present study was aimed to find the incidence and microbiological profile of SSI and the correlation between SSI and CD4 count in HIV positive patients. The primary objective of the study was to find the incidence of SSI, whereas secondary objectives were to find the correlation of SSI with CD4 count, and microbiological profile of infective material from the surgical site.

METHODS

This prospective observational study was conducted between August 2018 and November 2019 in Poona hospital and research center, Pune, India. After approval from the scientific advisory committee (letter No. RECH/SAC/2018-19/262), and institutional ethics committee (letter No. RECH/EC/2018-19/339), written informed consent was obtained from all the patients prior to enrollment. Patients were explained about the risks and benefits of the procedure. HIV positive patients >18 years of age scheduled for surgery were included. Patients having HbA1C >7 gm% and had a wound infection 30 days after surgery were excluded from this study.

Each patient underwent preoperative evaluation by a surgeon, anesthesiologist, and physician. Preoperatively baseline data of patients such as demographics, co-morbidities, and surgical indications were recorded. Hemogram, blood sugar level (fasting and postprandial), HbA1c and CD4 count of each patient were noted. Standard care of asepsis was followed at time of surgery.

Postoperative data included the development of superficial SSI as per the standardized means of detecting, and diagnosing SSI. A microbiological profile was done if SSI was present.

Wounds were classified according to a type of SSI.[10] 1) Superficial incisional SSI: Infection must occur within 30 days after the operative procedure and should involve only skin and subcutaneous tissue of the incision. 2) Deep incisional SSI: Infection must occur within 30 days after the operative procedure if no implant is left in place or within 1 year if an implant is in place and the infection should be related to the operative procedure and should involve deep soft tissues (e.g., fascial and muscle layers). 3) An organ/space SSI: Involving any part of the anatomy (other than the incision) that was opened or manipulated during the operative procedure.

The primary outcome measure was the incidence of SSI, whereas secondary outcome measures were the correlation of SSI with CD4 count, and microbiological profile of infective material from the surgical site. Drapeau et al reported the incidence of SSI in 29/305 (9.5%) patients.[5] The sample size was calculated by formula $N=(Z_\alpha)^2 p(1-p)/d^2$.[11] We have taken Z_α a standard normal variate at 5% type 1 error as 1.96. A total sample size of 132 patients was calculated by above method. We included 146 patients to validate the results.

Statistical methods

Data collected were entered in excel 2007 and analysis of data was done using statistical package for social sciences for Windows, version 20.0 from IBM Corporation, Armonk, NY, USA. The data on categorical variables are shown as n (% of cases) and the data on continuous variables are presented as mean, and standard deviation (SD). The comparison of quantitative and qualitative variables was done using unpaired student's "t" test, and the Chi-square test or Fisher's exact test respectively. The confidence limit for significance was fixed at a 95% level with a $p<0.05$.

RESULTS

The present research was a prospective observational study planned to investigate the incidence of SSIs in HIV positive patients and their correlation with CD4 count. A total of 146 patients were recruited in the study. Of 146 patients, 3 (2.1%), 11 (7.5%), 17 (11.6%), 36 (24.7%), 33 (22.6%), and 46 (31.5%) were below 20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years and above 60 years respectively. Mean±SD of the age of patients was 52.1±14.7 years. Of 146 patients, 105 (71.9%) were males, and 41 (28.1%) were females. Of 146 patients, 73 (50.0%), 59 (40.4%), and 14 (9.6%) had retroviral disease duration (RDD) less than 10 years, 11-20 years and more than 20 years respectively. Of 146 patients, 142 (97.3%) were on antiretroviral therapy (ART), and 4 (2.7%) were not on ART. Of 146 patients, 5 (3.4%), 33 (22.6%), and 108 (74.0%) had CD4 count less than 200, between 200 and 500, and above 500 respectively.

Of 146 patients 132 (90.4%) did not develop SSI, whereas 14 (9.6%) developed SSI. Of 14 cases with SSI, 10 (71.4%), 3 (21.4%), and 1 (7.2%) had superficial SSI, deep SSI, and organ space deep SSI respectively. The distribution of incidence of SSI did not differ significantly according to RDD duration ($p>0.05$). Distribution of incidence of SSI did not differ significantly between the group of patients who were on ART, and a group of patients who were not on ART ($p>0.05$). The incidence of SSI differed significantly according to levels of CD4 count. The incidence of SSI was significantly higher among patients with CD4 count <200 as compared to patients with CD4 count >500 (Table 1). Mean ± SD of CD4 count in patients without SSI, and with SSI was 712.5±238.9 (cells/mm^3) and 330.1±118.1 (cells/mm^3) respectively ($p<0.001$). Of 14 patients with SSI, 6 (42.9%), 3 (21.4%), 3 (21.4%), 1 (7.1%), and 1 (7.1%) had *Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, Enterococcus faecium,* and *Staphylococcus aureus* infection respectively (Table 2).

Table 1: Distribution of incidence of surgical site infection according to CD4 count.

CD4 count (cells/mm^3)	Surgical site infection						P value
	Absent		Present		Total		
	N	%	N	%	N	%	
<200	2	40.0	3	60.0	5	100.0	0.001
200-500	23	69.7	10	30.3	33	100.0	
>500	107	99.1	1	0.9	108	100.0	
Total	132	90.4	14	9.6	146	100.0	
Fisher's exact test was used							

Table 2: Types of organism isolated among the surgical site infection cases.

Type of organisms	No. of cases	% of cases
Klebsiella pneumoniae	6	42.9
Pseudomonas aeruginosa	3	21.4
Escherichia coli	3	21.4
Enterococcus faecium	1	7.1
Staphylococcus aureus	1	7.1
Total	14	100.0

DISCUSSION

In the present study, the incidence of SSI was significantly higher among patients with CD4 count <200 as compared to patients with CD4 count >500. Of 14 cases with SSI, 10 (71.4%), 3 (21.4%), and 1 (7.2%) had superficial SSI, deep SSI, and organ space deep SSI respectively. Of 14 patients with SSI, 6 (42.9%), 3 (21.4%), 3 (21.4%), 1 (7.1%), and 1 (7.1%) had *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterococcus faecium*, and *Staphylococcus aureus* infection respectively.

Table 3: Incidence of surgical site infection in various studies.

Study	Year	No. of cases	Incidence (%)
Drapeau et al[5]	2009	305	9.5
Abalo et al[12]	2010	36	39.0
Zhang et al[13]	2012	242	47.5
Coleman et al[14]	2014	77	22.0
Ramesh et al[15]	2017	50	26.0
Present study	2019	146	9.6

Drapeau et al reported that of 29/305 (9.5%) HIV infected patients had SSI. Of 29 patients, 21 (72.4%), 4 (13.8%), 1 (3.4%), and 3 (10.3%) had superficial, deep, organ/space and sepsis respectively.[5] Abalo et al reported that of 36 patients, 14 (39.0%) developed SSI. Of 14 patients, 10 (71.4%) had superficial SSI, and 4 (28.6%) had deep SSI.[12] Zhang et al reported that the incidence of SSI was 115/242 (47.5%). The incidence of superficial incisional SSI, deep incisional SSI, and organ/space SSI was 38.4, 5.4, and 3.7% respectively.[13] The incidence of SSI was 9.5, 39.0, 47.5, 22.0 and 26.0% in studies conducted by Drapeau, Abalo, Zhang, Coleman and Ramesh et al, respectively (Table 3).[5,12-15] In the present study incidence of SSI was 9.6%.

Drapeau et al reported that of 305 patients, 210 (68.8%), and 95 (31.2%) were below 45 and ≥45 years respectively.[5] Abalo et al reported that of 36 patients, 8 (22%), 22 (61%), and 6 (17%) were below 20, 21-39, and 31-59 years respectively.[12] In the present study 2.1, 7.5, 11.6, 24.7, 22.6, and 31.5% were below 20, 21-30, 31-40, 41-50, 51-60, and above 60 years respectively.

Drapeau et al reported that of 305 patients, 132 (43.3%) were males and 173 (56.7%) were females.[5] Abalo et al reported that of 36 patients 29 (81%) were males and 7 (19%) were females.[12] In the present study, 105 (71.9%) were males and 41 (28.1%) were females.

Zhang et al reported that patients undergoing abdominal surgery with lower preoperative CD4 counts were more likely to develop SSIs.[13] Ramesh et al reported that of 13 patients infected, 7 (53.8%) patients had CD4 count less than 200, and 6 (46.2%) patients had CD4 count more than 200. Out of the 37 patients whose wounds were healthy 16 (43.2%) patients had CD4 counts less than 200, and 21 (56.8%) patients had more than 200. There was no statistically significant difference between the two groups.[15] In the present study, the incidence of SSI was significantly higher among patients with CD4 count <200. Chichom-Mefire et al reported that CD4 count remains a significant predictor of the outcome and patients with a low CD4 count require closer pre and postoperative monitoring.[16] Mauser et al reported low postoperative CD4 count was a predictor for anastomotic leaks irrespective of HIV serostatus.[17] Guild et al reported that HIV positive patients, who had CD4 count less than 300, were associated with the development of postoperative infection.[18]

Limitations

Limitations to the current analysis warrant consideration. This study was conducted over a limited period of time with a limited number of patients. The duration of follow up was also short.

CONCLUSION

The incidence of SSI in HIV positive patients was 9.6%. Of 14 cases with SSI, 10 (71.4%), 3 (21.4%), and 1 (7.2%) had superficial SSI, deep SSI, and organ space deep SSI respectively. The incidence of SSI was significantly higher among the group of cases with CD4 count <200 as compared to a group of cases with CD4 count >500. Mean CD4 count in patients with SSI was significantly low than in patients without SSI. *Klebsiella pneumoniae* was the most common organism isolated in this study.

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