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Mucocutaneous Manifestation of HIV and the Correlation with CD4 Count and Viral Load: A Prospective Study from Turkey

HIV'in Mukokutanöz Bulguları ve CD4 Sayısı ile Viral Yük Arasındaki Korelasyon: Türkiye'den Prospektif Bir Çalışma

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ABSTRACT Objective: From the first reported cases in the early 1980s, Human Immunodeficiency Virus (HIV) infection has been a major global health concern. Although currently the infection is considered to consolidate in areas of severe social and economic distress, recent data on the epidemiology of HIV reveals that more than 36 million people live with HIV globally. HIV has a wide range of mucocutaneous manifestations, some of which are hallmark presentations of the infection. The aim of the present study is investigate the mucocutaneous manifestations in HIV-positive patients and their relationship with CD4-cell count and viral load. **Material and Methods:** A total of 105 consecutive HIV-positive patients (94 men, 11 women) were prospectively enrolled. Detailed information about patients' demographic and clinical characteristics such as medical history, physical examination, laboratory evaluation, CD4- cell count and HIV RNA levels were recorded. Chi-square, Mann Whitney-U and Kruskal-Wallis tests were used for statistical analysis, with a significance threshold of $p<0.05$. **Results:** At least one mucocutanoues manifestation was detected in 82.9% of the patients. The most common mucocutanoues disorders were oral candidiasis (29%), xerosis cutis (23%), tinea pedis (18%), onychomycosis (14%) and seborrheic dermatitis (13%). Other sexually transmitted diseases were seen in 24.8% of the patients. There were not significant associations between the gender, CD4-cell count, HIV RNA copy count, treatment status and presence of mucocutaneous manifestations ($p=0.454$, $p=0.543$, $p=0.850$, $p=0.125$, respectively). On the other hand, the mean age and duration of HIV infection was significantly higher in patients with at least one mucocutaneous manifestation ($p<0.05$). **Conclusion:** This is the first prospective study from Turkey to address the mucocutaneous manifestations in HIV-infected patients. In our study, we found that the majority of patients with HIV infection had at least one mucocutaneous manifestation, the most common of which was oral candidiasis. Although further studies are needed to validate our assumption, our findings suggest that mucocutaneous manifestations might be indicators of HIV infection in our country.

Keywords: HIV; mucocutaneous manifestation; CD4- cell count; viral load

ÖZET Amaç: İlk vakalarının bildirildiği 1980'li yılların başından bugüne kadar geçen süre zarfında, İnsan İmmün Yetmezlik Virüsü [Human Immunodeficiency Virus (HIV)] majör bir global sağlık tehdidi olmuştur. Her ne kadar günümüzde enfeksiyon şiddetli sosyo-ekonomik sıkıntıların yaşandığı bölgelere konsolide olmuş olsa da, HIV epidemiyoloji ile ilgili güncel veriler global düzeyde 36 milyondan fazla insanın enfekte olduğunu ortaya koymaktadır. HIV enfeksiyonu oldukça geniş yelpazede ortaya çıkan mukokutanöz bulgulara sahiptir ve bunların bazıları hastalığa damga vuran prezentasyonlardır. Bu çalışmanın amacı HIV enfekte olguların mukokutanöz bulgularını ve bu bulguların CD4 hücre sayısı ve viral yükle olan ilişkisinin araştırmaktır. **Gereç ve Yöntemler:** Bu çalışmada ardışık 105 (94 erkek, 11 kadın) HIV pozitif olgu prospektif olarak değerlendirilmiştir. Hastaların tıbbi hikaye, fizik muayene, laboratuvar bulguları, CD4 sayıları ve HIV RNA düzeyleri gibi demografik ve klinik özelliklerini içeren ayrıntılı bilgileri kaydedildi. İstatiksel analizde Ki-kare, Mann Whitney-U ve Kruskal-Wallis testleri kullanıldı, 0,05'in altında olan p değerleri anlamlı olarak kabul edildi. **Bulgular:** Hastaların %82,9'unda en az bir mukokutanöz bulgu tespit edildi. En sık patolojiler oral kandidiyazis (%29), kserosis kutis (%23), tinea pedis (%18), onikomikoz (%14) ve seboreik dermatitti (%13). Hastaların %28,4'ünde diğer cinsel yolla bulaşan hastalıklar görüldü. Cinsiyet, CD4 sayıları, HIV RNA düzeyleri, tedavi durumu ve mukokutanöz bulgu mevcudiyeti arasında herhangi bir korelasyon saptanmadı ($p=0,454$, $p=0,543$, $p=0,850$, $p=0,125$, sırasıyla). Ancak, ortalama yaş ve HIV enfeksiyonu süresi, en az bir mukokutanöz bulgusu olan hastalarda belirgin olarak daha yüksekti ($p<0,05$). **Sonuç:** Bu çalışma Türkiye'de HIV enfeksiyonu tanısı olan olgularda mukokutanöz bulguları araştıran ilk prospektif çalışmadır. Bu çalışma ile HIV pozitif olguların büyük çoğunluğunda en sık olanın oral kandidiyazis olduğu, en az bir mukokutanöz bulgu geliştiğini ortaya koymuş olduk. Her ne kadar, hipotezimizin doğruluğunu kanıtlayacak ileri çalışmalara ihtiyaç olsa da, bu sonuç ülkemizde mukokutanöz bulguların HIV enfeksiyonunun göstergeleri olabileceği fikrini gündeme getirmektedir.

Anahtar Kelimeler: HIV; mukokutanöz bulgular; CD4 hücre sayısı; viral yük

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Human Immunodeficiency Virus (HIV) infection causes significant morbidity and mortality regardless of the country, region and race throughout the world.[1] Since the recognition of HIV infection in 1981, mucocutaneous manifestations have been important in the diagnosis, management and follow up of the infection.[2] Mucocutaneous manifestations are observed in up to 90% of the HIV-infected individuals.[1,3,4] Though some of these mucocutaneous diseases are observed in the general population and not specific for HIV infection, they may have atypical presentations and may be more resistant to treatment.[5,6] The impaired immune system of the skin creates a predisposition to a large variety of infectious and non-infectious skin diseases including opportunistic infections, inflammatory dermatoses, drug eruptions and cutaneous malignancies.[1,3]

The relation between mucocutaneous diseases and HIV infection may show some differences due to socioeconomic status, ethnicity and geographic region.[1-5] The mucocutaneous manifestations in HIV infection have been rarely studied in our country.[2] We aimed to investigate HIV-related mucocutaneous manifestations and their relation with CD4- cell count and viral burden [HIV ribonucleic acid (RNA) levels] in Turkey.

MATERIAL AND METHODS

A total of 105 consecutive patients [94 men and 11 women, mean age, 39,9±12,6 years (range: 19-69)] with HIV infection were prospectively enrolled in the present study between May 2015 and January 2017. The study was approved by the Ankara Numune Research and Training Hospital Medical Ethics Committee on 28.10.2015 with the number of E-15-623. The study was conducted in accordance with the principles of the Declaration of Helsinki. Hair, skin, mucosa and nail examinations were done and laboratory tests, microscopic, dermoscopic and histopathological examinations were performed to confirm the clinical diagnoses if needed. Demographical information including age, gender, marital status, sexual behavior was received from each patient. Treatment history, CD4-cell counts, the number of HIV RNA copies, Venereal Disease Research Laboratory (VDRL) and treponema pallidum hemagglutination (TPHA) test results were recorded. CD4-cell counts and the number of HIV RNA copies were classified into three and two groups respectively according to the recommendations of World Health Organization.[7] (CD4-cell counts <200 cells/ml, 200-500 cells/ml and >500 cells/ml, HIV RNA copy count ≤ 100.000 copy/ml and >100.000 copy/ml). Statistical analysis was performed using SPSS Windows 23.0. Chi-square, Mann Whitney-U and Kruskal-Wallis tests were used for statistical analysis and $p < 0.05$ was considered as statistically significant.

RESULTS

According to the results of our study, 42 of 105 patients (40%) were newly diagnosed and the duration of the infection ranged from 2 to 252 months (mean±SD: 36±59.6) in the rest of the patients. Of the patients, 24.8% (n=26) were homosexual. 75.2% (n=79) were married, of whom 15.2% (n=12) were homosexual. Among the patients who were already being followed up for HIV infection, 92% (n=58) were receiving highly active anti-retroviral therapy (HAART). The CD4 cell counts ranged between 10-1320 cells/ml (mean: 465.3±324.4 cells/ml). CD4 cell counts were < 200 cells/ml in 22 of 105 patients (21%), between 200-500 cells/ml in 45 (42.9%) and > 100.000 copy/ml in 38 (36.2%) of the patients. HIV RNA copy count was ≤ 100.000 copy/ml in 32 of 105 patients (30.5%) and >100.000 copy/ml in 73 (69.5%) patients.

In terms of the number of mucocutaneous manifestations, 87 of 105 patients (82.9%) had at least one, 32 (30.5%) had two and 40 (38%) had three or more mucocutaneous manifestations. The mean number of mucocutaneous manifestation was 2 per patient. Infectious mucocutaneous disorders other than sexually transmitted diseases (STD) were seen in 64 of 105 patients (61%) and non-infectious mucocutaneous disorders were observed in 64 (61%) of the patients. The most common mucocutaneous diseases were oral candidiasis in 28% (n=29), xerosis cutis in 23% (n=23), tinea pedis in 18% (n=19), onychomycosis in 14% (n=15) and seborrheic dermatitis in 13% (n=14) of the patients. Non-infectious skin diseases were observed as neoplastic pathologies in 9.5% (n=10), as nail pathologies in 26.7% (n=28), as in-

flammatory dermatoses in 28.6% (n=30) of the patients. Infectious disease group was fungal in 49.5% (n=52), viral 22.9% (n=24), bacterial 2.9% (n=3) and parasitic in 1.9% (n=2) of the patients. In 26 of 105 patients (24.8%), other STDs were detected. Twelve (11%) patients had syphilis, 11 (10%) had anogenital verruca, 5 (4.8%) had anogenital molluscum contagiosum and 2 (1.9%) had genital herpes simplex virus infection (Table 1).

There were not significant associations between the gender, CD4-cell count, HIV RNA copy count, treatment status and presence of mucocutaneous manifestations (p=0.454, p=0.543, p=0.850, p=0.125, respectively). On the other hand, the mean age and duration of HIV infection was significantly higher in patients with at least one mucocutaneous manifestation (p<0.05) (Table 2). The CD4-cell and HIV RNA copy counts did not significantly differ between patients with infectious and non-infectious mucocutaneous disorders (p=0.552, p=0.316). Also no significant difference was observed in those parameters between patients who had bacterial, fungal, parasitic or viral infections (p=0.954, p=0.388). When those parameters were compared with the presence of each skin disease there was not any significant relationship between groups (p>0.05).

TABLE 1: Mucocutaneous findings in HIV-infected patients.

Mucocutaneous findings	n (%)
Infections	64 (61%)
Bacterial infections	3 (2.9%)
Bacterial folliculitis	2 (1.9%)
Pyoderma	1 (1%)
Viral infections	24 (23%)
Viral verruca	4 (3.8%)
Herpes zoster	4 (3.8%)
Fungal infections	52 (50%)
Oral candidiasis	29 (28%)
Tinea pedis	19 (18%)
Onychomycosis	15 (14%)
Tinea cruris	8 (7.6%)
Pityriasis versicolor	2 (1.9%)
Parasitic infections	2 (1.9%)
Scabies	2 (1.9%)
Other STDs	26 (25%)
Syphilis	12 (11%)
Human papilloma virüs	11 (10%)
Molluscum contagiosum	5 (4.8%)
Genital herpes simplex	2 (1.9%)
Non-infections	64 (61%)
Neoplasm	10 (9.5%)
Angiokeratoma	4 (3.8%)
Seborrheic keratosis	3 (2.9%)
Squamous cell carcinoma	1 (1%)
Nail findings	28 (26.7%)
Longitidunal ridging	14 (13%)
Onycholisis	10 (9.5%)
Nail discoloration	1 (1%)
Nail pitting	1 (1%)
Inflammatory dermatoses	30 (29%)
Seborrheic dermatitis	14 (13%)
Lichen simplex chronikus	5 (4.8%)
Angular cheilitis	5 (4.8%)
Eosinophillic folliculitis	4 (3.8%)
Psoriasis	2 (1.9%)
Photocontact dermatitis	2 (1.9%)
Alopecia areata	2 (1.9%)
Rosacea	2 (1.9%)
Vitiligo	1 (1%)
Actinic dermatitis	1 (1%)
Other	37(35%)
Xerosis cutis	23 (21.9%)
Pruritus	7 (6.7%)
Acne vulgaris	5 (4.8%)
Nevus flammeus	2 (1.9%)
Drug eruption	2 (1.9%)
Oral aphtae	1 (1%)
Liveoid vasculopathy	1 (1%)
Venous lake	1 (1%)

DISCUSSION

Immunosuppressive conditions like HIV infection increase the incidence of infectious and neoplastic skin conditions also may cause changes in their course.[8,9] In addition, in advanced stages of HIV infection, mucocutaneous pathologies may have atypical clinical features and be more resistant to therapy.[8] Therefore, dermatological pathologies related to HIV infection are significant markers of HIV infection for clinicians and they are also important in the follow up of the patients.

The prevalance of mucocutaneous disorders have been reported to be 33-95% in patients with HIV infection.[2] In our study, 82.9% of the patients had at least one mucocutaneous disorder. In a similar study performed in China, the incidence was 81.6% and in a study from India it was found to be 85%.[4,9] In the only study in our country investigating the mucocu-

TABLE 2: The relation between the presence of at least one mucocutaneous disorder and age, gender, duration of the disease, CD4 cell count, HIV RNA count and treatment status.

		At least one mucocutaneous disorder		
		Present	**Absent**	**p**
Age		31.6±13.1	41.6±11.8	0.001
Gender	Male	17 (%18.1)	77 (%81.9)	0.454
	Female	1 (%9.1)	10 (90.9)	
Duration		10.4±21.2	41±57.9	0.028
CD4 cell count (cells/ml)		508.8±306.4	456.3±329	0.543
	<200	1 (%5.6)	21 (%24.1)	
	200-500	11 (%61.1)	34 (%39.1)	0.123
	>500	6 (%33.3)	32 (%36.8)	
HIV-RNA copy counts (copies/ml)		129753.2±371091.1	278716.6±842301.2	0.850
	<100	14 (%77.8)	59 (%67.8)	0.403
	>100	4 (%22.2)	28 (%32.2)	
Therapy (HAART)	(-)	11 (%61.1)	36 (%41.4)	0.125
	(+)	7 (%38.9)	51 (%58.6)	

taneous manifestations in HIV-infected patients which was performed by Aydın et al, the incidence was 36%.[2] It was the only study to compare, however we found a great difference between the incidence rates. In our opinion, the reason for the difference lies in the methodology of the studies, since Aydın et al's study was retrospective. Moreover, there is a geographic difference which may affect the incidence rates. In large studies from India and China, 60-70% of the patients with HIV infection were males, while in our study we found that nearly 90% of the patients were males.[4,6,10] Aydın et al. also reported a similar male predominance in their study (85%).[2] These studies reflect different populations live in different regions of the world, which have completely different social, economic, ethnic and religious background. Of our patients, 27% were homosexual which indicates that homosexual relationship is one of the major transmission ways of HIV.

CD4 count which is a marker of immunosuppression is one of the most important laboratory data in the follow up of HIV infection.[11] The mean C4 count was 465 cells/ml in our study. Some other studies investigating the mucocutaneous manifestations in HIV-infected patients reported the mean CD4 count in their patients between 250 and 772.[2,5,6,12,13] Of the patients, 21% had CD4 counts below 200 which shows serious immunosuppression, while in other studies studying dermatological manifestations, 33-71% patients had CD4 counts below 200. Of our patients, 92% had been treated with HAART when newly diagnosed patients were excluded in our study. The reason of the low number of patients with CD4 counts below 200 in our study may be that the number of patients who had been under treatment was high and the rest was newly diagnosed. In the study of Chandrakala et al., the relationship between the number of CD4 and mucocutaneous findings was examined. In this study, in addition to non-infectious diseases such as seborrheic dermatitis, drug reaction and lichen planus, infectious diseases such as genital wart, genital herpes, dermatophyte, herpes zoster ophthalmicus and pyoderma were found to be statistically significant with the CD4 count.[14] Though we found no relationship between the presence of at least one mucocutaneous manifestation and CD4 count, in most of the studies in the literature, the patients with mucocutaneous manifestations had lower CD4 counts and the number of mucocutaenous manifestations were correlated with CD4 counts.[3,6,12] The reason of this difference may be associated with the higher CD4 counts in our study.

HIV RNA copy counts are also a marker of immunosuppression in HIV positive patients. The incidence of mucocutaneous manifestations has also been

repoted to be related to HIV RNA copy counts.[13] There are few studies in the literature which investigate the relation between mucocutaneous manifestations and HIV RNA copy counts. In a study performed by Freytes et al. the mean HIV RNA copy counts were reported to be 143716 copies/ml, while it was 253180 in our study. The mean HIV RNA copy counts were similar to ours in that study and they also found no relation between HIV RNA copy counts and mucocutaneous manifestations. In our study, only maculopapular drug eruption was found to be related to HIV RNA copy counts and in Freytes et al.'s study only tinea pedis was found to be related with HIV RNA copy counts.[5] Both our study, results and Freytes et al.'s results show that mucocutaneous pathologies and HIV RNA copy counts are not correlated. But more studies are needed to confirm this assumption.

In our study while the most common infectious pathologies were oral candidiasis and tinea pedis; xerosis cutis and seborrheic dermatitis were the most common non-infectious pathologies. These findings were similar to Aydın et al.'s study from Turkey and Azfar et al.'s study from Pakistan.[2,3] But in some other studies pruritic papular eruption (PPE), onychomycosis, pyoderma, herpes zoster have been reported as the most common mucocutaneous pathologies.[1,4,11] We detected similar disorders except PPE in our study which was observed in only four patients. Geographical factors may play a role in the difference in the incidence of PPE between our study and studies performed in Indonesia and India.[1,12]

Fungal and viral infections were the most common infectious pathologies in our study. Oral candidasis and dermatophyte infections were the most common fungal infections and other STDs like anogenital verruca and genital molluscum contagiosum were the most common viral infections. Huang et al. reported similar incidence rate of fungal infections with our study but herpes zoster and oral hairy leukoplakia were the most common viral infections in their study.[10] Infectious pathologies largely consisted of STD in our study. It is known that the presence of one STD increases the incidence of another one.[15] In our study, 24% of the patients had other STDs as syphilis in 11.4%, anogenital verruca in 10.5%, anogenital molluscum contagiosum in 4.9%, genital herpes in 1.8% patients. Other STD's were not mostly grouped seperately in other studies which investigate mucocutaneous diseases in HIV-infected patients in the literatrure. Dwiyana et al. reported 3% and Vasudevan et al. reported that 13% of their patients had other STDs. While in our study syphilis was the most common STD, it was the second most common in Dwiyana and Vasudevan et al.'s studies.[11,12] This difference might be due to the fact that all HIV positive patients are also screened for syphilis in our hospital.

The most common non-infectious diseases were xerosis cutis (22%) and seborrheic dermatitis (13%) in our study. While Aydın et al. reported xerosis cutis incidence as 5% and seborrheic dermatitis incidence as 4% in their patients, in the literature the incidence of xerosis cutis have been reported between 16-52% and seborrheic dermatitis in 10-74%.[2,4,11] PPE, generalized hyperpigmentation, eczema and pruritus are among the other most common non-infectious skin disorders reported in the literature.[1,2,4,16] We found these disorders less common than the literature.

The most important feature of our study is that we investigated nail pathologies in detail: Of our patients, 26.7% had a nail pathology. The most common nail pathology was onychomycsis (14%), but we also observed longitidunal ridging (13%), onycholysis (9.5%), pitting (1%) and discoloration (1%) independently from onychomycosis. Kore et al. reported nail discoloration in 5.4%, Beau lines in 0.6% of the patients without mentioning onychomycosis.[13] We could not find any other study in the literature examining nail pathologies other than onychomycosis in HIV-infected patients.

Malignant diseases are one of the most important disease groups that increase the morbidity and mortality in HIV-infected patients. Besides systemic malignancies, cutaneous malignancies also show an increased incidence and worse prognosis in HIV-infected patients.[17] We detected squamous cell carcinoma and malignant melanoma only in one patient each. In the recent reports similar to ours the incidence of cutaneous malignancies have been reported as 0-7%. Kaposi sarcoma, squamous cell carcinoma and

basal cell carcinoma have been among the most common cutaneous malignancies reported.[1,2,4,10,18] The increase in the awareness of HIV infection in the society and the development of new diagnostic and therapeutic options might have caused the decrease in cutaneous malignancies in HIV positive patients.

CONCLUSION

Our study is the first prospective study on the mucocutaneous manifestations and their relation with CD4 count and HIV RNA copy count in Turkish patients with HIV infection. In the only retrospective study, which have been reported from Turkey, the relation between HIV RNA copy counts and mucocutaneous manifestations have not been investigated. In addition, our study is unique in that we have investigated nail pathologies in detail. Indeed, nail findings other than onychomycosis in HIV positive patients have not been extensively studied before. We think that further studies are needed on this subject. Our results indicate that oral candidiasis, seborrheic dermatitis and other STDs might be dermatological indicators of HIV infection. We suggest that patients with these disorders should be investigated for HIV infection.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Rıdvan Güneş, Seray Külcü Çakmak;* ***Design:*** *Rıdvan Güneş, Seray Külcü Çakmak;* ***Control/Supervision:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***Data Collection and/or Processing:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***Analysis and/or Interpretation:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***Literature Review:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***Writing the Article:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***Critical Review:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***References and Fundings:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz;* ***Materials:*** *Rıdvan Güneş, Seray Külcü Çakmak, Ahu Yorulmaz.*

REFERENCES

1. Rane SR, Agrawal PB, Kadgi NV, Jadhav MV, Puranik SC. Histopathological study of cutaneous manifestations in HIV and AIDS patients. Int J Dermatol. 2014;53(6): 746-51. [Crossref] [PubMed]
2. Altuntaş Aydın Ö, Kumbasar Karaosmanoğlu H, Korkusuz R, Özeren M, Nazlican Ö. Mucocutaneous manifestations and the relationship to CD4 lymphocyte counts among Turkish HIV/AIDS patients in İstanbul, Turkey. Turk J Med Sci. 2015;45(1):89-92.[Crossref] [PubMed]
3. Azfar NA, Khan AR, Zia MA, Humayun A, Malik LM, Jahangir M, et al. Frequency of mucocutaneous manifestations in HIV positive Pakistani patients. J Pak Assoc Dermatol. 2011;21:149-53.[Link]
4. Singh H, Singh P, Tiwari P, Dey V, Dulhani N, Singh A, et al. Dermatological manifestations in HIV-infected patients at a tertiary care hospital in a tribal (Bastar) region of Chhattisgarh, India. Indian J Dermatol. 2009;54(4):338-41.[Crossref] [PubMed] [PMC]
5. Freytes DM, Arroyo-Novoa CM, Figueroa-Ramos MI, Ruiz-Lebrón RB, Stotts NA, Busquets A, et al. Skin disease in HIV-positive persons living in Puerto Rico. Adv Skin Wound Care. 2007;20(3):149-50,152-6.[Crossref] [PubMed]
6. Chawhan SM, Bhat DM, Solanke SM. Dermatological manifestations in human immunodeficiency virus infected patients: Morphological spectrum with CD4 correlation. Indian J Sex Transm Dis AIDS. 2013;34(2):89-94.[Crossref] [PubMed] [PMC]
7. Organization WH. WHO case definitions of HIV for surveillance and revised clinical staging and immunological classification of HIV-related disease in adults and children Switzerland: Organization; 2007.[Link]
8. Osborne GE, Taylor C, Fuller LC. The management of HIV-related skin disease. Part I: infections. Int J STD AIDS. 2003;14(2):78-86.[Crossref] [PubMed]
9. Cedeno-Laurent F, Gómez-Flores M, Mendez N, Ancer-Rodríguez J, Bryant JL, Gaspari AA, Trujillo JR. New insights into HIV-1-primary skin disorders. J Int AIDS Soc. 2011;14:5. [Crossref] [PubMed] [PMC]
10. Huang XJ, Li HY, Chen DX, Wang XC, Li ZC, Wu YS, et al. Clinical analysis of skin lesions in 796 Chinese HIV- positive patients. Acta Derm Venereol. 2011;91(5):552-6.[Crossref] [PubMed]
11. Vasudevan B, Sagar A, Bahal A, Mohanty A. Cutaneous manifestations of HIV-a detailed study of morphological variants, markers of advanced disease, and the changing spectrum. Med J Armed Forces India. 2012;68(1):20-7.[Crossref] [PubMed] [PMC]
12. Dwiyana RF, Rowawi R, Lestari M, Alisjahbana B, van der Ven AJ, Djajakusumah TS, et al. Skin disorders in HIV-infected patients from West Java. Acta Med Indones. 2009;41 Suppl 1:18-22.[PubMed]

13. Kore SD, Kanwar AJ, Vinay K, Wanchu A. Pattern of mucocutaneous manifestations in human immunodeficiency virus-positive patients in North India. Indian J Sex Transm Dis AIDS. 2013;34(1):19-24.[Crossref] [PubMed] [PMC]
14. Chandrakala C, Parimalam K, Wahab AJ, Anand N. Correlating CD4 count with mucocutaneous manifestations in HIV-positive patients: A prospective study. Indian J Sex Transm Dis AIDS. 2017;38(2):128-35.[Crossref] [PubMed] [PMC]
15. de Vries HJ. Skin as an indicator for sexually transmitted infections. Clin Dermatol. 2014; 32(2):196-208.[Crossref] [PubMed]
16. Huang K, Chen A, Zhang X, Song Z, Xu H, Cao J, et al. Progranulin is preferentially expressed in patients with psoriasis vulgaris and protects mice from psoriasis-like skin inflammation. Immunology. 2015;145(2):279-87.[Crossref] [PubMed] [PMC]
17. Ertunc B, Kaya S, Koksal I. Clinico-epidemiological analysis of HIV/AIDS patients. Eurasian J Med. 2016;48(3):157-61.[Crossref] [PubMed] [PMC]
18. Nilesh Morar, FCDerm Mm, Ncoza C. Dlova, FCDerm Mm, Anisa Mosam Fcd, Jamila Aboobaker Fcd. Cutaneous manifestations of HIV in Kwa-Zulu Natal, South Africa. Int J Dermatol. 2006;45:1006-7.[Crossref] [PubMed]