

# Detection of human immunodeficiency virus (HIV) rna in sweat of hiv-infected patients

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## ABSTRACT

**OBJECTIVE:** Human immunodeficiency virus (HIV) infection is a significant health problem. It has been reported by several studies that HIV was mainly transmitted through parenteral exposure, sexual activity, and body secretions such as saliva and semen. Many people, including health-care providers and patient relatives may easily contact with sweat of HIV-infected patients. Although reference books assert that HIV does not transmit through sweat, there is no systemic study which this statement is based upon. This study aims to investigate the potential of sweat to transmit HIV infection.

**METHODS:** This study included 31 treatment-naive HIV RNA-positive patients who were in the acute phase of the infection and 26 subjects with a negative HIV RNA test who had received anti viral treatment. A total of 57 sweat samples collected from intact skin areas were prospectively evaluated by polymerase chain reaction (PCR) for the presence of HIV RNA. HIV RNA levels in the blood samples were also noted.

**RESULTS:** HIV RNA was not detected by PCR in any sweat sample taken from HIV-infected HIV RNA-negative and -positive subjects.

**CONCLUSION:** The results of this study suggest that sweat by itself has no potential for transmitting HIV infection.

*Keywords:* HIV; HIV transmission route; polymerase chain reaction; sweat.

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Human immunodeficiency virus (HIV) infection is a worldwide health problem [1]. Although the worldwide incidence of HIV infection decreased, the prevalence of HIV infection has increased with the increased life expectancy among patients receiving antiviral treatment (ART) [2].

It has been reported by several studies that HIV was mainly transmitted through parenteral exposure, sexual activity, and body secretions such as saliva and semen [1–3]. A high HIV RNA level in blood is the greatest risk factor for the transmission of HIV [4]. Risk of transmis-

sion can be reduced through early diagnosis, protection and decreasing HIV RNA levels by early treatment [5].

HIV-positive individuals get in contact with others in their daily lives. Health professionals are in daily contact with patients, their blood and fluids. Some of these patients may be infected or their fluids may be contaminated with HIV. Otorhinolaryngologists often get in contact with the face and scalp of patients during the physical examination. This fact gives rise to doubts about HIV transmission through exposure to sweat. Although reference books state that HIV is not transmitted via

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sweat, there is no systematic study which this statement is based upon.

In this study, we aimed to investigate the potential of contact with sweat of HIV-positive patients to cause HIV infection.

## MATERIALS AND METHODS

This study was approved by the local ethics committee. The patients were divided into two groups. Group 1 consisted of 31 treatment-naive HIV RNA-positive patients

who were in the acute phase of the infection and Group 2 included 26 subjects with a negative HIV RNA test who had received antiviral treatment. The participants were asked to walk until they sweat. Sweat samples were collected from the face by an otorhinolaryngologist and put in sterile Eppendorf tubes. 0.5 cc sterile saline was added to the tubes and the samples were placed in a deep freeze (-32°C). After collection of all the samples, the presence of HIV RNA was evaluated by the PCR method.

HIV RNA extraction followed by amplification and detection was performed according to the methodology

**TABLE 1.** Sweat HIV RNA concentrations and serological parameters in group 1

Patient no.	Gender	Age	ART	CD4	Serum HIV RNA (IU)	Sweat HIV RNA
1	M	26	Naive	362	476973	Non detected
2	M	26	Naive	803	329	Non detected
3	M	59	Naive	8	775,774	Non detected
4	M	26	Naive	1046	114	Non detected
5	M	45	Naive	481	3290	Non detected
6	M	26	Naive	675	19200	Non detected
7	F	23	Naive	398	183303	Non detected
8	M	40	Naive	255	626246	Non detected
9	M	27	Naive	262	16410	Non detected
70	M	29	Naive	244	2187265	Non detected
11	M	21	Naive	287	482929	Non detected
12	M	24	Naive	807	1068449	Non detected
13	M	37	Naive	906	102156	Non detected
14	M	32	Naive	410	87748	Non detected
15	M	31	Naive	254	14854	Non detected
16	M	30	Naive	301	322190	Non detected
17	M	33	Naive	382	928394	Non detected
18	M	22	Naive	170	610494	Non detected
19	M	42	Naive	209	583	Non detected
20	M	44	Naive	372	248,726	Non detected
21	M	36	Naive	312	5169	Non detected
22	M	34	Naive	230	435523	Non detected
23	M	26	Naive	397	5778788	Non detected
24	M	38	Naive	279	395533	Non detected
25	M	21	Naive	616	436	Non detected
26	M	28	Naive	237	49902	Non detected
27	M	24	Naive	413	52912	Non detected
28	M	30	Naive	320	437461	Non detected
29	M	47	Naive	410	214	Non detected
30	M	29	Naive	646	303,856	Non detected
31	M	45	Naive	226	348,851	Non detected

HIV: Human immunodeficiency virus; M: Male; F: Female; ART: Antiretroviral therapy.

**TABLE 2.** Sweat HIV RNA concentrations, transmission routes, and serological parameters in group 2

Patient no.	Gender	Age	ART	CD4	Serum HIV RNA (IU)	Sweat HIV RNA
1	M	44	+	617	negatif	Non detected
2	M	34	+	313	negatif	Non detected
3	M	42	+	346	negatif	Non detected
4	M	49	+	173	negatif	Non detected
5	M	27	+	736	negatif	Non detected
6	M	34	+	966	negatif	Non detected
7	M	39	+	560	negatif	Non detected
8	F	40	+	988	negatif	Non detected
9	M	29	+	999	negatif	Non detected
10	F	33	+	424	negatif	Non detected
11	M	54	+	482	negatif	Non detected
12	M	35	+	691	negatif	Non detected
13	M	28	+	519	negatif	Non detected
14	M	31	+	822	negatif	Non detected
15	M	60	+	594	negatif	Non detected
16	M	51	+	527	negatif	Non detected
17	M	26	+	571	negatif	Non detected
18	M	33	+	680	negatif	Non detected
19	M	22	+	512	negatif	Non detected
20	M	32	+	542	negatif	Non detected
21	M	24	+	791	negatif	Non detected
22	M	25	+	708	negatif	Non detected
23	M	56	+	406	negatif	Non detected
24	M	28	+	1113	negatif	Non detected
25	M	37	+	350	negatif	Non detected
26	M	71	+	1223	negatif	Non detected

HIV: Human immunodeficiency virus; M: Male; F: Female; ART: Antiretroviral therapy.

mentioned elsewhere [6]. Briefly, RNA was extracted using the ready-to-use RNA extraction kit (QIAampUltraSens, QIAGEN, Hilden, Germany), according to manufacturer's instructions. A 240 bp region of HIV RNA was reverse transcribed and amplified. Amplification and detection were performed in Rotor-Gene 2000/3000 (Corbett Research, Hamburg-Germany). Amplification protocol was as follows: one cycle of 50°C for 10 min, 45 cycles of 95°C for 8 s, 55°C for 20 s, and 72°C for 20 s.

## RESULTS

A total of 57 patients were included in the study. The study group consisted of 3 (5.2%) females and 54 (94.7%) males. The mean age of the patients was  $34.8 \pm 10.9$  years

(range: 21–71). PCR assay showed no detectable HIV RNA in sweat samples of the two groups (Table 1, 2). HIV RNA levels in serum and sweat samples are shown in Table 1 and 2.

## DISCUSSION

It has been shown that various body fluids, such as genital secretions, semen feces and saliva, may be HIV RNA positive in HIV-positive patients [7–18]. In their study, Kantor et al. reported that HIV RNA was detected in genital secretions in 82 out of 143 HIV-positive patients [7]. Cotten et al. found HIV RNA in 12 out of 20 feces samples [9]. In their cross-sectional study, Liuzzi et al. detected HIV1 RNA in 25 semen samples out of 26 [10]. Balamane et al. reported measurable saliva HIV-1

**TABLE 3.** Studies on the prevalence of HIV RNA in different body fluids or secretions of HIV positive patients

Study	HIV positive body fluid/secretion	Body fluid/secretion	Positive HIV RNA in body fluid/secretion	
			n	%
Kantor et al., 2014 [9]	143	Genital secretion	82	57
Cotten et al., 2014 [11]	20	Feces	12	60
Liuzzi et al., 1996 [12]	26	Semen	25	96
Balamane et al. 2010 [15]	47	Saliva	36	76
Lourenco et al., 2014 [16]	57	Saliva	34	59
Mohlala et al., 2005 [14]	23	Amniotic fluid	0	0
Mohlala et al., 2005 [14]	23	Fetal cord blood	0	0
Hanege et al., 2015 [21]	78	Cerumen	0	0
<i>Current study</i>	57	Sweat	0	0

HIV: Human immunodeficiency virus.

RNA in 36 of 47 (77%) patients with plasma viremia [13]. Lourenco et al. [14] detected HIV RNA in 34 saliva samples out of 57 and suggested that saliva may facilitate HIV entry and possibly other pathogens via the genital mucosa during heterosexual intercourse (Table 3). Detection of HIV RNA in samples collected even from patients receiving treatment demonstrates that the most efficient way to halt the disease progression is to know the ways of transmission and protection against transmission.

In addition to these studies showing the ways of transmission, there have been various studies reporting no HIV RNA in some body fluids. In a previous study, HIV RNA was not detected by PCR in ear cerumen of patients with a positive test for serum HIV RNA [6]. Likewise, in a study including 23 patients infected with HIV, Mohlala et al. [12] reported that no HIV RNA was found in amniotic fluids and umbilical cord blood of 23 HIV-infected pregnant women who received single-dose nevirapine or short-term zidovudine treatment before elective cesarean section (Table 3).

Although some statements are suggesting that HIV is not transmitted through sweat, in the literature, there are only limited studies performed on patients with a positive test for serum HIV RNA supporting those statements. Wormser et al. could not demonstrate HIV-RNA in eccrine sweat samples of 50 HIV-infected patients [19]. Reliable information and comment on this matter require more scientific research on patient sam-

ples. For this purpose, to base the subject upon a scientific foundation, we evaluated 31 treatment-naive HIV RNA-positive patients who were in the acute phase of the infection and 26 subjects with a negative HIV RNA test who had received ART. All sweat samples analyzed by PCR were found to be negative for HIV RNA. This finding was a scientific result supporting the statements having no scientific basis in the literature.

## Conclusion

The results of this study suggest that sweat from an HIV-infected individual that is not contaminated with blood or other body fluids has no potential for transmitting HIV infection even if serum HIV RNA level of the patient is considerably high. This result certainly does not ignore the necessity of precautions to prevent transmission of HIV during medical interventions or other approaches. General infection prevention should be precisely implemented.

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