Influence of Tattoo Ink on Hepatitis C Virus Infectiousness

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Hepatitis C virus (HCV) is a blood-borne virus and is most frequently transmitted through large or repeated direct percutaneous exposures to infected blood. The 2 most common exposures associated with transmission of HCV are blood transfusion and intravenous drug abuse. The association between HCV transmission and other suspected risk factors such as tattooing is more controversial. Although HCV can survive for days to weeks in suspension or on inanimate surfaces, its stability in tattooing supplies remains elusive. Here, we analyzed the influence of tattoo ink on HCV infectiousness.

Keywords. hepatitis C virus; transmission; prevention; viral stability.

RESULTS

HCV chimeric Jc1 virus was generated in the human hepatoma cell line Huh-7.5, as previously described [7].

Huh-7.5 cells were cultured in Dulbecco’s modified Eagle medium (Invitrogen) with 10% fetal bovine serum, 1× non-essential amino acids (Invitrogen), 100 µg/mL streptomycin (Invitrogen), and 100 IU/mL penicillin (Invitrogen).

For the suspension test, 9 parts by volume of the test virus suspension were mixed with 1 part by volume of different tattoo inks. Titers of infectious virus were determined using a limiting dilution assay on Huh-7.5 cells, and tissue culture infectious dose 50 (TCID50) was determined as described elsewhere [8].

Stainless steel discs for carrier assay were prepared as previously described [9]. One part of the respective tattoo ink was mixed with 1 part of the virus suspension, pipetted in the center of each pretreated carrier, and dried under a laminar flow for about 1–3 hours at room temperature. The virus was recovered as previously described [9], and TCID50 was determined as mentioned above.

METHODS

To estimate the risk of HCV transmission via contaminated tattoo ink, we incubated cell culture–derived infectious HCV with 4 different commercially available tattoo inks (Sailor Jerry, Diabolo, Tribal Black, Lining Black) and a reference hand disinfectant (Sterilium virugard) for 5 minutes in a suspension assay.
As depicted in Figure 1A, different tattoo inks did not stimulate, but rather reduced HCV infectiousness by 2 orders of magnitude, although 1 brand exerted a lower but still detectable inactivation effect (Figure 1A). Next, we tested the degree of cross-contamination of inanimate surfaces (e.g., needles) from contaminated tattoo ink as a measure of the risk for virus cross-transmission by tattooing procedures. To this end, we dried a mixture of HCV and tattoo inks on small steel discs and determined viral infectivity adherent to these disks as described previously [9]. As expected, a commercial disinfectant (Pliwa) displayed the strongest virucidal effect. Moreover, the tattoo inks reduced HCV titers by 50- to 1000-fold depending on the brand (Figure 1B).

DISCUSSION

To date, there is no definitive evidence that HCV infection occurs through tattooing when sterile material is used. Although no outbreaks of HCV infection have been observed that originate from professional tattoo parlors, case reports of acute HCV infection from tattooing in prison suggest that tattooing could be a mode of transmission [10, 11]. The data obtained in our study indicate that components of tattoo ink partially inactivate HCV and that different ink brands substantially differ in their virucidal activity. Thus, unlike some anesthetic agents, an increase of HCV stability in the presence of tattoo ink could not be observed and therefore does not facilitate infection [12, 13]. However, because of the increasing prevalence of tattooing, particularly among youths, awareness campaigns should still highlight the danger of transmitting blood-borne infections such as HCV, regardless of the venue of placement.

In summary, incubation of HCV in tattoo ink reduces HCV infectiousness, while residual virus is still detectable, indicating that HCV transmission is not facilitated through virus–ink mixtures. Notably, ink brands differ in virucidal activity. Thus, selection of ink brands with high antiviral activity may reduce the risk of HCV transmission via this route.
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