

Reference study for hcspFACTsheet: How Long Does HCV Live on Surfaces?

Environmental Stability of Hepatitis C Virus (HCV): Viability of Dried/Stored HCV in Chimpanzee Infectivity Studies.

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Background:

Epidemiologic studies of HCV have indicated that transmission among patients in health care settings is associated with contaminated vehicles such as multi-dose medication vials and re-used needles and syringes and among injecting drug users is associated with contaminated drug paraphernalia such as cookers and cotton. Determining the viability of HCV and extent to which the infectious virus can survive on environmental surfaces is critical for developing effective recommendations for prevention and control.

Material and Methods:

Aliquots of HCV inoculum (CH910 second passage chimpanzee plasma, genotype 1a) containing 10⁵ chimpanzee infectious doses (CID) were dried in siliconized microfuge tubes under vacuum in the presence of Drierite® (W.A. Hammond Drierite Co.) at 250C. After overnight drying (~16 hrs) samples were either rehydrated with 300 µL sterile water and stored at -700C or transferred to a controlled environmental chamber (42% humidity, over saturated salt solution) for a 4 or 7 day storage at 250C and subsequently rehydrated with 300 µL sterile water and kept at -700C. Samples dried/stored 7 days and dried overnight were used for reverse transcriptase polymerase chain reaction (RT-PCR) titration. To determine infectivity, aliquots of dried/stored plasma for 7 days, 4 days and overnight, were reconstituted in sterile water, suspended in 1 mL of PBS and administered intravenously to a chimpanzee (CH247). Size of the infectious dose in each inoculum was calculated at 3.3 x 10⁴ CID. Plasma samples from CH247 were tested for HCV RNA (Amplicor, Roche) and anti-HCV (Ortho HCV 3.0), and alanine aminotransferase (ALT) twice weekly. Liver specimens were obtained weekly or biweekly and tested for hepatitis C virus antigen (HCVAg) and histopathology. The animal was first inoculated with HCV inoculum dried/stored for 7 days and followed during 129 days. Subsequently, the animal was inoculated with the HCV inoculum dried/stored for 4 days and followed for 134 days, and finally inoculated with the aliquot dried overnight and followed for 201 days. Virologic, serologic, and clinical data from three control chimpanzees (CH1555, CH1487, CH1493) inoculated with 3 x 10⁴ CID of untreated HCV inoculum (CH910 second passage chimpanzee plasma, genotype 1a) were included in the study.

Results:

HCV RNA was detectable in plasma dried overnight and 7 days, but a ten fold decrease of detectable HCV RNA was found in both of these samples compared with the HCV RNA titer of the original, untreated HCV positive plasma sample. No evidence of HCV infections was detected in CH247 after inoculation with either the 7-day or 4-day dried/stored samples. All serum samples tested were negative for HCV RNA and anti-HCV; ALT activity level remained in the normal range. However, after inoculation with the overnight dried sample, HCV RNA was detected in serum of CH247 from day 7 post inoculation and the viral load reached 6.0 to 7.3 logs IU/mL. HCVAg positive hepatocytes were observed from day 11 post inoculation, seroconversion to anti-HCV was observed on day 127, and the animal was still positive for HCV RNA (4.8 logs IU/mL) at day 201 post infection. ALT activity level was elevated over the normal range from day 11 post inoculation and remained elevated until the end of the observation. Virologic, serologic, and clinical evidence of HCV infection and acute hepatitis was found in all three control animals.

Conclusions:

Infectivity studies in a chimpanzee suggest that HCV may survive on environmental surfaces at room temperature **at least 16 hours but not longer than 4 days**. The potential for HCV to survive in the environment re-emphasizes the importance of cleaning and disinfection procedures, safe therapeutic injection practices, and harm reduction counseling and services for injection drug users.