Community-based survey of HCV and HIV coinfection in injection drug abusers in Sichuan Province of China

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AIM: To investigate the prevalence and risk factors of HCV/HIV coinfection in injection drug abusers (IDAs) in Lianshan Yi Autonomous Prefecture of Sichuan province, China.

METHODS: From November 8, 2002 to November 29, 2002, a community-based survey was conducted to investigate the demographic characteristics, patterns of shared injectors devices and sexual behaviors in IDAs. Blood samples were also collected to test HCV and HIV infection. A total of 379 subjects were recruited in the study through community outreach and peer recruiting methods.

RESULTS: Of the 379 IDAs, the HCV prevalence and HIV prevalence were 71.0% and 11.3%, respectively, and HCV/HIV coinfection was 11.3%. HCV infection was found in 100% and 67.3% of HIV-positive and HIV-negative IDAs, respectively. HIV prevalence was 16.0% in HCV positive IDAs while none of the HCV negative IDAs was positive for HIV. Ethnicity, shared needles or syringes and cotton in the past 3 mo and syphilis infection were associated with HCV/HIV coinfection shown by univariate analysis using chi-square test. Multivariate logistic regression analysis showed that shared needles or syringes in the past 3 mo (Odds ratio=3.121, 95% CI: 1.278-7.617, P<0.05) and syphilis infection (Odds ratio=2.914, 95% CI: 1.327-6.398, P<0.01) were significantly associated with HCV infection.

CONCLUSION: Shared needles and syringes in the past 3 mo and syphilis infection were significantly associated with HCV infection. Further sero-epidemiological prospective cohort studies should be conducted to clarify the impact of syphilis and high risk sexual behaviors on HCV transmission through unprotected sexual intercourse.

MATERIALS AND METHODS

Materials
Study participants were recruited through a community-based outreach method that involved the distribution of information materials regarding the study to the community. The outreach campaign was especially targeted to the known IDA groups. During the informed consent process, potential participants in our study were invited to be peer recruiters with the offer of financial incentives for recruiting other IDAs in the community.
After providing written informed consent, potential study participants underwent a screening interview designed to identify IDAs eligible for the study. All participants were at least 18 years of age, and injected drugs at least one time in the past 3 mo. Those who met the inclusion criteria then completed an HCV and HIV risk assessment interview, received HIV pretest and risk reduction, underwent phlebotomy for HCV and HIV antibody testing, and received HIV post-testing counseling.

Sichuan Province is located in southwest China and the main drug transportation route from Yunnan and Guaxi to Xinjiang. Xichang County is located in Lianshan Yi Autonomous Prefecture of southwest Sichuan. The total population of Xichang County is 617,000. From November 8, 2002 to November 29, 2002, 379 IDAs based in the community of Xichang County were enrolled by the Xichang Center for STD and Leprosy Control to estimate the prevalence of HCV/HIV coinfection and to investigate the risk factors associated with HCV and HIV infection. The study protocol and informed consent were approved by the Institutional Review Board (IRB) of the Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention. Informed consent was obtained from all study participants before being interviewed.

Methods
Each study participant was assigned a unique and confidential identification number that was subsequently used to label questionnaire responses and serum specimens. An interviewer-administered questionnaire was used to collect data on risk factors for HCV and HIV infection. Questions were concerned with demographic characteristics, drug use and drug injection behaviors, condom use and sexual behaviors. Demographic variables included age, gender, ethnicity, education, employment, marital status, and home ownership. Questions pertaining to drug use investigated the frequency of drug use and drug injection in the past 3 mo and the frequency of shared injection devices in the past 3 mo, including shared needles or syringes, cookers, cotton, rinse water, and use of front- or back-loading. Assessment of sexual behaviors included questions regarding sex behaviors with a steady partner or other partner(s) in the past 6 mo, condom use in the past month, exchange of money for sex partner in the past 6 mo, and the addition of any new sex partners in the past 6 mo. The interview, counseling and blood collection were performed at the site clinic of the Xichang Center for STD and Leprosy Control.

Each serum or plasma sample was collected from IDAs by venipuncture and tested for antibodies to HIV by enzyme-linked immunosorbent assay (ELISA; Beijing Wantai Biological Medicine Company, China). Positive results were confirmed by an HIV-1/HIV-2 Western immunoblot assay (HIV BLOT 2.2 WB; Genelabs, Singapore). Samples were considered as HIV-positive when both ELISA and Western immunoblot results were positive. Samples were tested for antibodies to HCV by ELISA (Beijing Jinhao Biological Production Company, China). The presence of antibodies to syphilis was tested by ELISA (Beijing Jinhao Biological Production Company, China), positivity was confirmed by passive particle agglutination test for detection of antibodies to Treponema pallidum (TPPA; Fujirebio, Inc., Japan).

EpiData software (EpiData 2.1 for Windows; The EpiData Association, Odense, Denmark) was used for data double entry and validation. Statistical analysis of chi-square test or Fisher’s exact test was performed to screen behaviors and demographic characteristics associated with high risk for HCV and HIV infection. A multivariate logistic regression model was constructed to select independent risk factors of HCV infection and to control confoundings among various risk factors which provided both P-values and 95% confidence intervals for the Odds ratio (OR) point estimates. Data analyses were carried out using the statistical analysis system (SAS 8.2 for Windows; SAS Institute Inc., North Carolina, USA).

RESULTS
Prevalence of HCV and HIV coinfection in IDAs
A total of 379 IDAs were investigated in this study. As shown in Table 1, HCV prevalence and HIV prevalence were 71.0% and 11.3%, respectively. HCV/HIV coinfection was 11.3%. HCV infection was found in 100% and 67.3% of HIV-positive and HIV-negative IDAs, respectively. HIV prevalence was 16.0% among HCV-positive IDAs and none of the HCV-negative IDAs was found to be HIV-positive.

Table 1  Prevalence of HCV/ HIV coinfection in IDAs in Xichang County, Sichuan Province, China

|            | HCV Positive | HCV Negative | Total |
|------------|--------------|--------------|-------|
| HIV Positive| 43           | 226          | 269   |
| HIV Negative| 0            | 110          | 110   |
| Total      | 43           | 336          | 379   |

Risk factors for HCV and HIV infection in IDAs
Table 2 presents the results of univariate analysis of demographics, risk variables of injection drug abusers in the past 3 mo, sexual behaviors in the past 6 mo, and syphilis infection. HCV/HIV coinfection showed a statistically significant association with ethnicity (P<0.01), frequency of shared needles or syringes (P<0.05) and cotton in the past 3 mo (P<0.05) and syphilis infection (P<0.01). The frequency of drug injection, shared rinse water and cooker in the past 3 mo all showed a strong but not statistically significant correlation with HCV/HIV coinfection, with P values near 0.05.

Stepwise multivariate logistic regression analyses were performed using risk factors of ethnicity; Frequency of drug injection, shared needles or syringes, rinse water, cooker and cotton in the past 3 mo and syphilis infection were included in the initial model to investigate the association with HCV infection. As shown in Table 3, shared needles or syringes in the past 3 mo (P<0.05) and syphilis infection (P<0.01) were independently associated with HCV infection.

DISCUSSION
Among male IDAs in preparatory cohorts for HIV vaccine trials in Thailand, the prevalence of HCV and HCV/HIV coinfection was 96.4% and 50.7%[29]. In a study on IDAs from drug detoxification centers in Yunnan Province of China in 2000, the prevalence of HCV was 99.3% in HIV-positive IDAs[20]. Lai et al[27] reported 15.4% HIV infection and 63.5% HCV infection in IDAs in Guangxi Zhuang Autonomous Region of China; HCV incidence was about 10 times more than HIV incidence. These studies showed that the prevalence of HCV and HIV was high in IDAs, and that HCV transmission was more rapid than HIV transmission.

In previous studies of HIV-positive populations in Xichang County in Sichuan Province, the prevalence of HCV was found to be approximately 60% in HIV-positive individuals[28,29]. In this study, we found a relatively high prevalence (11.3%) of HCV/HIV coinfection in IDAs in Xichang County. Shared needles or syringes in the past 3 mo (P<0.05) was significantly associated with HCV infection after demographic characteristics and other risk factors were controlled. However, multivariate analysis showed that shared devices were indirectly related to drug injection, such as cotton, rinse water, cookers, and front- or back-loading, while not significantly associated with HCV/HIV coinfection or with HCV infection. Univariate analysis showed...
Table 2 Risk factors associated with HCV/HIV coinfection in IDAs in Xichang County, Sichuan Province, China

| Factor                                      | Total n | HCV/HIV coinfection | HCV infection | \(\chi^2\) | P    |
|---------------------------------------------|---------|----------------------|---------------|-------------|------|
| **Gender**                                  |         |                      |               |             |      |
| Male                                        | 313     | 38                   | 12.1          | 180         | 57.5 |
| Female                                      | 66      | 5                    | 7.6           | 46          | 69.7 |
| **Age (yr)**                                |         |                      |               |             |      |
| <29                                         | 208     | 25                   | 12.0          | 123         | 59.1 |
| >=29                                        | 171     | 18                   | 10.5          | 103         | 60.2 |
| **Ethnicity**                               |         |                      |               |             |      |
| Han                                         | 243     | 20                   | 8.2           | 142         | 58.4 |
| Other                                       | 136     | 23                   | 16.9          | 84          | 61.8 |
| **Years of education**                      |         |                      |               |             |      |
| <=6                                         | 158     | 22                   | 13.9          | 94          | 59.5 |
| >6                                          | 221     | 21                   | 9.5           | 130         | 58.8 |
| **Marriage**                                |         |                      |               |             |      |
| Yes                                         | 113     | 16                   | 14.2          | 66          | 58.4 |
| No                                          | 266     | 27                   | 10.2          | 160         | 60.2 |
| **Employed**                                |         |                      |               |             |      |
| Yes                                         | 167     | 20                   | 12.0          | 91          | 54.5 |
| No                                          | 212     | 23                   | 10.8          | 135         | 63.7 |
| **Own home**                                |         |                      |               |             |      |
| Yes                                         | 132     | 20                   | 15.2          | 76          | 57.6 |
| No                                          | 247     | 23                   | 9.3           | 150         | 60.7 |
| **Drug abuse and drug injection behaviors (past 3 mo)** |         |                      |               |             |      |
| Frequency of <1 time/d                      | 79      | 6                    | 7.6           | 42          | 53.2 |
| Drug injection                              | 300     | 37                   | 12.3          | 184         | 61.3 |
| Frequency of <2 times/wk                    | 332     | 35                   | 10.5          | 193         | 58.1 |
| Needles or syringes                         | 47      | 8                    | 17.0          | 33          | 70.2 |
| Frequency of <2 times/wk                    | 336     | 36                   | 10.7          | 196         | 58.3 |
| Shared rinse water                          | 43      | 7                    | 16.3          | 30          | 69.8 |
| Frequency of <2 times/wk                    | 335     | 36                   | 10.7          | 195         | 58.2 |
| Shared cooker                              | 44      | 7                    | 15.9          | 31          | 70.5 |
| Frequency of shared cotton                  | 352     | 36                   | 10.2          | 213         | 60.5 |
| Front- or back-loading                      | 364     | 40                   | 11.0          | 220         | 60.4 |
| Sexual behaviors (past 6 mo)                |         |                      |               |             |      |
| Steady sex partner                         | 209     | 25                   | 12.0          | 124         | 59.3 |
| Yes                                         | 170     | 18                   | 10.6          | 102         | 60.0 |
| Sex behavior with non-steady sex partner    | 241     | 25                   | 10.4          | 144         | 59.8 |
| Yes                                         | 138     | 18                   | 13.0          | 82          | 59.4 |
| Steady sex partner of IDU                   | 308     | 35                   | 11.4          | 182         | 59.1 |
| Yes                                         | 71      | 8                    | 11.3          | 44          | 62.0 |
| Gave money for sex behavior                 | 303     | 32                   | 10.6          | 186         | 61.4 |
| Yes                                         | 76      | 11                   | 14.5          | 40          | 52.6 |
| Received money for sex                      | 334     | 39                   | 11.7          | 195         | 58.4 |
| Behavior                                    | 45      | 4                    | 8.9           | 31          | 68.9 |
| Addition of new sex partner(s)              | 264     | 25                   | 9.5           | 160         | 60.6 |
| Yes                                         | 115     | 18                   | 15.7          | 66          | 57.4 |
| Presence of syphilis infection              | 321     | 30                   | 9.3           | 189         | 58.9 |
| Yes                                         | 58      | 13                   | 22.4          | 37          | 63.8 |

Note: \(\chi^2\) Fisher’s exact test.

Table 3 Multivariate logistic regression analyses of risk factors associated with HCV prevalence in IDAs in Xichang County, Sichuan Province, China

| Factor                                    | \(\beta\) | SEM   | P-value | Odds ratio | 95% CI     |
|-------------------------------------------|-----------|-------|---------|------------|------------|
| Shared needle or syringe in the past 3 mo | 1.1380    | 0.4553| 0.0124  | 3.121      | 1.278-7.617|
| Syphilis infection                        | 1.0695    | 0.4013| 0.0077  | 2.914      | 1.327-6.398|

that shared cotton in the past 3 mo was associated with HCV/HIV coinfection. Some studies reported that factors of indirectly shared injection devices, including cotton, rinse water, and cookers, posed significant risks for HIV infection in IDAs.[30-32]

The modes of HCV transmission have been a matter of important controversy in literature.[10-15] Although a high prevalence of HCV was found in STD patients, female workers and homosexual partners might be suggestive of sexual transmission. Drug injection might also play a significant role in HCV transmission.[14]. Furthermore, drug injection was the main risk factor associated with HCV infection in homosexual and bisexual men, while the other risk factors after adjusting injection drug abuse included the number of sexual partners in the past year, anal sex and oral sex behaviors.[33] Moreover, Alter et al.[15] reported that unsafe heterosexual behavior, anal sex and oral sex behavior were associated with HCV infection, suggesting that both sex behavior and injection drug abuse may play significant roles in HCV transmission. Univariate and multivariate analysis showed that syphilis infection was associated with HCV/HIV coinfection and HCV infection.
However, univariate analysis showed that high risk sexual behaviors were not associated with HCV/HIV coinfection. Lai et al.\textsuperscript{[22]} reported that history of sexually transmitted diseases was independently associated with HIV infection in Guangxi Zhuang Autonomous Region. A study showed that the total number of past sexual partners was associated with HCV infection, but there was no relationship between HCV infection and the total number of sexual partners or sexual behaviors in the past several months\textsuperscript{[14]}. Two studies of STD individuals confirmed the important role that IDA played a role in HCV infection and sexual transmission played a minor role in HCV epidemiologies, such as homosexuality/bisexuality, syphilis seropositivity, and a history of syphilis\textsuperscript{[33,36]}. In our study, persistent use of condom (vaginal sex only) and non-use of condom in IDAs with steady sex partners, and non steady sex partners accounted for 7.6% (911/119) and 88.2% (105/119), 14.6% (13/89) and 68.5% (61/89) in the past month, respectively. This was the first evidence in our study that syphilis infection might contribute to HCV infection in IDAs in Sichuan Province, and syphilis infection is a significant indicator of past high risk sexual behaviors, which increase risk for HCV sexual transmission.

Further sero-epidemiological prospective cohort studies should be conducted to clarify the impact of syphilis and high risk sexual behaviors on HCV transmission through unprotected sexual intercourse.

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