Seroprevalence of acute hepatitis C virus infection among mortuary workers and ambulance drivers in Plateau State, Nigeria

Jeremiah M. Urukua, Amos Dangana, Idris-Abdullahi Nasir, Bibiana N. Egenti, Nimzing Lohya, Enenche S. Iyalla, Kadiri Ezra, Emmanuel O. Falade

Nigeria is one of the countries highly endemic for viral hepatitis. However, data on the prevalence of hepatitis C virus (HCV) infection among mortuary workers and ambulance drivers has not been documented. Hence, this study sought to determine the seroprevalence of HCV among mortuary workers and ambulance drivers in Plateau State, North Central Nigeria. Between December 2015 and February 2016, a total of 80 blood samples were collected from mortuary workers and ambulance drivers with the view to test for HCV antibody using rapid immunochromatographic test (ICT) and enzyme-linked immunosorbent assay for anti-HCV immunoglobulin M. Three milliliter of blood was collected from each patient and the serum was separated out and used for the screening. A self-administered questionnaire was used to access the patients’ sociodemographic variables. Of the 80 samples analyzed, five (6.3%) were positive for HCV using the rapid immunochromatographic assay, while two (2.5%) were positive for anti-HCV immunoglobulin M. There was no statistical association between seroprevalence of HCV with age and sex of patients. However, the seroprevalence of HCV was significantly associated with contact with blood, number of sexual partners, use of gloves, and history of sexually transmitted infections (P<0.05). The HCV seroprevalence of 2.5% among mortuary workers and ambulance drivers was relatively low; however, this suggests that the patients are at-risk group for occupational infection due to HCV.

Keywords: hepatitis C, mortuary staff, risk factors, serosurvey

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work noncommercially, as long as the author is credited and the new creations are licensed under the identical terms.
syringes and needles, needle-stick injuries in healthcare settings, intravenous injection drug of abuse, and being born to an HCV infected mother [9].

Mortuary workers and ambulance drivers are at risk of HCV due to their involvement with corpse or death bodies which may pose infectious disease hazards. The postmortem room is a source of potential hazard and risk to workers handling the body after necropsy. Nigeria is one of the countries highly endemic for viral hepatitis. However, data on the prevalence of HCV infection among mortuary workers and ambulance drivers has not been documented. Hence, this study sought to determine the seroprevalence of HCV among mortuary workers and ambulance drivers in Plateau State, North Central Nigeria.

Materials and methods

Study design
This cross-sectional prospective study was carried out from December 2015 to February 2016 in mortuaries within the Plateau State, North Central Nigeria.

Study area/location
Plateau State which is the home of peace and tourism is the 12th largest state in Nigeria (2006 population census result) with a population of 3,178,712 people. It has an area of 30,913 km², with 17 local government council areas. It is bounded by Bauchi State in the north, Nasarawa State in the south, Kaduna State in the northwest, and Taraba State in the southeast. It is situated along latitude 8° 24N, longitude 8° 32, and 100° 32E of the equator. Its average temperature is in the range 19–22 °C and the annual rainfall is about 146 cm (57 inch). The altitude ranges from around 1200 m (about 4000 feet) to a peak of 1829 m above sea level.

Study participants
A total of 80 samples were collected from mortuary workers and ambulance drivers between the age of 19 and 50 years in the three regions (North, South, and Central) of the Plateau State. Mortuary workers in this study include porters, attendants, and others working in mortuary, but excluding doctors (pathologists). These patients were sourced from Jos University Teaching Hospital in Jos, MRS Hospital in Bassa Local Government, Air-Force Base Hospital in Jos, Plateau State Hospital in Jos, Our Lady of Apostle Hospital in Jos, and Mangu General Hospital in Mangu Local Government in Plateau State.

Specimen collection, processing, and storage
A sample of 3 ml of blood was collected from each participant using the standard venipuncture procedure. The blood was carefully and gently dispensed into sterile, plain, sample containers. The tubes were labeled appropriately with the participants’ identification numbers. Sera from these blood samples were separated by allowing the blood to clot at room temperature before centrifuging at 2500 rpm for 10 min. Thereafter, the retracted sera were dispensed into serum aliquot containers and stored at −10°C pending laboratory analyses.

Laboratory analysis
HCV was tested with serum sample collected using HCV One Step Rapid Strip (rapid immunochromatographic assay) and second-generation enzyme-linked immunosorbent assay (ELISA) method (AccuDiag HCV IgM ELISA kit; Diagnostic Automation, Inc., California, USA). These tests were done based on manufacturers’ instructions.

Statistical analysis
Frequency distribution and prevalence of HCV status were determined. Differences in proportions were determined by χ²-tests using the statistical package for the social sciences (SPSS), version 21.0 software, IBM Corp., New York, USA. Findings from these analyses were statistically analyzed using the χ²-test to determine the association between HCV seroprevalence with patients’ sociodemographic variable. P values less than 0.05 were considered statistically significant.

Ethical approval and informed consent
Ethical clearance was obtained from the research and ethics committee from various hospitals where the samples were collected after being scrutinized by the ethics committee of the various hospitals within the Plateau State, Nigeria. All participants gave their written informed consent for inclusion before they voluntarily participated in the study. The purpose of this work was explained to patients before they voluntarily consented to participate in the research. All data were analyzed anonymously throughout the study.

Results
Of the total samples, five (6.3%) were positive for HCV Antibody using the RDT, while two (2.5%) were positive for the HCV antibody using AccuDiag HCV immunoglobulin M (IgM) ELISA Kit. A total of 54 male samples were tested with one (1.9%) tested positive for HCV using HCV IgM ELISA kit. From among the total number of 26 female samples
collected, one (3.8%) tested positive for HCV using HCV IgM ELISA kit. There was no statistical association between HCV seroprevalence and the sex of patients \((P>0.05)\). In the age range of 31–36, one (3.6%) was positive out of the total of 28. In the age range of 37–42, one (3.0%) was positive out of the total of 33 \((P>0.05)\) which shows that the distribution is statistically insignificant. Of the total number of 80 respondents, 63 were mortuary workers in which two (2.5%) were positive, 17 were ambulance drivers in which none was positive. There was statistical association between HCV seroprevalence and the numbers of sexual partners, having casual sex, and being involved in social vices \([16]\). Statistic on the prevalence of HCV in young adults between 25 and 40 years \([16]\). People between these ages are more involved in several risk factors of hepatitis virus infection such as having more than one sexual partners, having casual sex, and being involved in social vices \([16]\). Statistic on the prevalence of HCV in Nigeria showed a high prevalence in youths between 25 and 40 years \([16]\). This study was carried out to determine the health and safety of mortuary workers and ambulance drivers to risk of contracting HCV due to their occupation. Unfortunately, they are often an underestimated category of workers. In this study, 5 (6.3%) respondents screened for HCV antibody using ICT were seropositive. The five (6.3%) respondents tested positive for the ICT to confirm to be two (2.5%) anti-HCV IgM using ELISA.

Out of the five (6.3%) tested positive with strip, four (7.2%) were men while one (1.9%) was a woman. Two (2.5%) were positive for the HCV antibody (IgM), one (1.9%) out of the 54 men was positive, while one (3.9%) out of 26 women was positive. The difference in these results could be as a result of false-positive results from the test strip \([10]\). Antibody positivity by ICT may have been due to cross-reactivity with similar plasma protein or infectious agents or it may be due to previous HCV (chronic hepatitis) \([11]\).

The anti-HCV IgM prevalence rate of 2.5% recorded among mortuary workers and ambulance drivers is lower than that found in Jos, Nigeria, which has a prevalence rate of 5.56\% 12 but in a different location and lower than the range reported in Nigeria \([13]\). This prevalence is lower than the prevalence recorded in other regions such as Makurdi and Benin City with a seroprevalence of 5.4 and 12.3\% \([12,14]\). This suggests that Benin City is an area of higher prevalence, compared with Makurdi and Jos. The relatively lower seroprevalence from our study may be attributed to the sample size and differences in endemicity of HCV from previous studies and possibly to good personal protective measures undertaken by the patients in our study \([15]\).

The anti-HCV IgM positivity was more among the young adults between 25 and 40 years. A similar report was provided by McQuillan \textit{et al.} \([16]\) People between these ages are more involved in several risk factors of hepatitis virus infection such as having more than one sexual partners, having casual sex, and being involved in social vices \([16]\). Statistic on the prevalence of HCV in Nigeria showed a high prevalence in youths between 25 and 40 years \([16]\). This is related to the age group with the highest cases of anti–HCV IgM study among mortuary workers and ambulance drivers. None of the patients between 19–24 and 49–54 years had HCV IgM positive result. This could be because of the relatively few patients recruited from this group. The findings from this study have shown that men had a prevalence of 1.9\% and women with 3.8\% which showed that women have a higher prevalence than men. But there were more of men in this work group than women. High prevalence among the women may be as a result of increase in sexual activities which predispose them to HCV infection. It could also be that they had contact with blood and due to irregular use of gloves.

The study also showed a high prevalence of HCV of 3.2\% among the mortuary workers and 0\% among ambulance drivers. Mortuary workers like other health workers are
exposed to the hazards of blood-borne pathogens in their workplace due to their involvement in activities such as embalming, and corpse bathing and preparation [10,17]. This practice routinely carried out in mortuaries predisposed them to the risk of acquiring infections such as HCV.

**Conclusion**
The HCV seroprevalence of 2.5% among mortuary workers and ambulance drivers was relatively low; however, this suggests that the patients are at-risk group for occupational infection due to HCV.

**Acknowledgements**
The authors greatly appreciate the technical input of the staff of the Medical Microbiology Laboratory, University of Jos Teaching Hospital, Nigeria.

**Table 1** Distribution of hepatitis C virus seroprevalence by sociodemographic variable of patients

| Sociodemographic          | Number of participants tested | Number of positive (%) | $\chi^2$ | P-value |
|---------------------------|-------------------------------|------------------------|---------|---------|
| Age (years)               |                               |                        |         |         |
| 19–24                     | 1                             | 0 (0.0)                | 3.419   | 0.331   |
| 25–30                     | 10                            | 0 (0.0)                |         |         |
| 31–36                     | 28                            | 1 (3.6)                |         |         |
| 37–42                     | 33                            | 1 (3.0)                |         |         |
| 43–48                     | 5                             | 0 (0.0)                |         |         |
| 49–54                     | 3                             | 0 (0.0)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Sex                       |                               |                        |         |         |
| Male                      | 54                            | 1 (1.9)                | 0.286   | 0.593   |
| Female                    | 26                            | 1 (3.8)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Nature of work            |                               |                        |         |         |
| Mortuary workers          | 63                            | 2 (3.2)                | 0.684   | 0.408   |
| Ambulance drivers         | 17                            | 0 (0.0)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Sexually transmitted disease |                         |                        |         |         |
| No                        | 80                            | 2 (2.5)                | 55.55   | 0.000   |
| Yes                       | 0                             | 0 (0.0)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Use of gloves             |                               |                        |         |         |
| No                        | 0                             | 0 (0.0)                | 55.55   | 0.000   |
| Yes                       | 80                            | 2 (2.5)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Number of sex partner(s)  |                               |                        |         |         |
| 1                         | 68                            | 0 (0.0)                | 38.974  | 0.000   |
| 2                         | 8                             | 0 (0.0)                |         |         |
| ≥3                        | 4                             | 2 (50.0)               |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Contact with blood        |                               |                        |         |         |
| Often                     | 10                            | 2 (25.0)               | 14.359  | 0.000   |
| Rarely                    | 70                            | 0 (0.0)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |
| Marital status            |                               |                        |         |         |
| Single                    | 8                             | 0 (0.0)                | 0.228   | 0.633   |
| Married                   | 72                            | 2 (2.8)                |         |         |
| Total                     | 80                            | 2 (2.5)                |         |         |

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest.

**References**
1 Nasir IA, Yakubu S, Mustapha JO. Epidemiology and synergistic hepatopathology of malaria and hepatitis C virus coinfection. Virology (Auck) 2017; 8:1–4.
2 Center for Disease Control. National hepatitis C prevention strategy. Hepatitis C infection in the United States viral hepatitis C. Atlanta, USA: National Center for Infectious Disease, Center for Disease Control; 2001. pp. 1–5.
3 Sharma SD. Hepatitis C virus: molecular biology and current therapeutic options. Indian J Med Res 2010; 131:17–34.
4 World Health Organization. Hepatitis C fact sheet no. 164. 2017. Available at: http://www.who.int/mediacentre/Fact Sheets/fs164/en/. [Accessed 26 June 2017].
5 CDC. Viral hepatitis. Hepatitis C FAQs for the public. 2016. Available at: http://www.cdc.gov/hepatitis/hcv/cfaq.htm. [Accessed 26 June 2017].
Acute HCV infection among mortuary staff  Uruku et al.  39

6 Cacoub P, Comarmond C, Domont F, Savey L, Desbois AC, Saadoun D. Extrahepatic manifestations of chronic hepatitis C virus infection. Ther Adv Infect Dis 2016; 3:3–14.
7 Chen J, Zhao Y, Zhang C, Chen H, Feng J, Chi X, et al. Persistent hepatitis C virus infections and hepatopathological manifestations in immune-competent humanized mice. Cell Res 2014; 24:1050–1066.
8 Lavanchy D, Gavinio P. Hepatitis C. Can J Gastroenterol 2000; 14 (Suppl B):67B–76B.
9 Ohto H, Terazawa S, Sasaki N, Hino K, Ishiwata C, Kako M, et al. Transmission of hepatitis C virus from mothers to infants. N Engl J Med 1994; 330:744–750.
10 Scott JD, Gretch DR. Molecular diagnostics of hepatitis C virus infection: a systematic review. JAMA 1997; 297:724–732.
11 Pawlotsky JM. Use and interpretation of hepatitis C virus diagnostic assays. Clin Liver Dis 2013; 7:127–137.
12 Alao O, Okwori E, Araoye M. The sero-prevalence of hepatitis C virus (HCV) infection among prospective blood donors in a Nigerian Tertiary Health Institution. Int J Epidemiol 2008; 7:1–6.
13 Halim NK, Ajayi OI. Risk Factors and sero- prevalence of hepatitis C antibody in blood donors in Nigeria. East Afr Med J 2000; 77:410–412.
14 Koate BB, Buseri FI, Jeremiah ZA. Seroprevalence of hepatitis C virus among blood donors in Rivers State, Nigeria. Transfus Med 2005; 15:449–451.
15 Shepard CW, Finelli L, Alter MJ. Global epidemiology of hepatitis C virus infection. Lancet Infect Dis 2005; 5:558–567.
16 McQuillan GM, Alter MJ, Moyer LA, Lambert SB, Morgrohs HS. Prevalence based serology study of hepatitis C virus infection in the United State. J Hepatol 1997; 204:267–270.
17 Layden JE, Phillips R, Opare-Sem O, Akere A, Salako BL, Nelson K, et al. Hepatitis C in sub-Saharan Africa: urgent need for attention. Open Forum Infect Dis 2014; 1:1–3.