

Prevalence and epidemiology of blood borne pathogens in health care workers of Rawalpindi/Islamabad

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Abstract

Objective: To attempt to trace the molecular epidemiology of blood-borne diseases in the hospital community of Pakistan.

Methods: The cross-sectional study was conducted at three major hospitals of Rawalpindi and Islamabad from January to May, 2014. The prevalence of three blood-borne pathogens hepatitis B and C as well as human immunodeficiency virus was investigated in hospital workers of different occupations.

Initial screening was performed with immuno-chromatographic technique followed by enzyme-linked immune-sorbent assay. Positive samples were subjected to real time polymerase chain reaction amplification of specific viral sequences for amplification with universal as well as genotype-specific primers.

Results: Out of total 500 subjects, there were 42(8.4%) doctors, 101(20.2%) nurses, 92(18.4%) technicians, 67(13.4%) ward boys, 41(8.2%) sweepers, 36(7.2%) security guards and 122(24.4%) administrative workers. None was positive for the presence of human immunodeficiency virus after initial screening with immuno-chromatographic technique. In case of hepatitis viruses, 9(0.18%) samples were positive for anti-hepatitis C virus and 3(0.6%) for hepatitis B surface antigen. Three (2.97%) nurses and 3(3.29%) lab technicians were at the highest risk of exposure.

Conclusion: Human immunodeficiency virus was not present among the healthcare workers, while the prevalence of hepatitis B and C viruses was far less compared to the general population.

Keywords: Healthcare workers, HCWs, Risk factors, ICT, ELISA, Real time PCR. (JPMA 66: 170; 2016)

Introduction

Blood-borne pathogens cause various notorious diseases in humans. The two major blood-borne pathogens prevalent in Pakistani population are hepatitis C virus (HCV) and hepatitis B virus (HBV), whereas human immunodeficiency virus (HIV) is present at a much smaller scale. All these three viruses share almost the same route of transmission.¹ Healthcare workers (HCWs) are more prone to needle stick and sharp injuries and thus have higher risk of exposure to blood-borne pathogens. It has previously been reported that transmission of about 20 types of pathogens occurs by needle stick and sharp injuries.² Many improved methods are being adopted to prevent exposure but still some occupational exposures can occur. Intra-vascular access of needles or percutaneous injury (PI) constitute the highest proportion of occupational transmission among the HCWs. According to an estimate, about 66,000 infections of HBV, 16,000 infections of HCV and 1,000 infections of HIV may have taken place throughout the world only in the year 2000 due to occupational exposure to PIs.³ Work practices of medical personnel in hospitals greatly affect the risk of

transmission. Higher risk of transmission has been recorded in surgeons and laboratory assistants.⁴⁻⁶ Risk of transmission for HBV from PI was reported to be approximately 30% in HCWs without post-exposure prophylaxis (PEP) or adequate HBV vaccination.^{7,8} HCV transmission risk from PI is reported at about 0.5%, and in case of exposure to non-viraemic patients, it is considered null.^{8,9} HIV has a risk of transmission estimated at <0.3%.¹⁰

The current study was planned to provide an initial idea about the molecular epidemiology of blood-borne diseases in the hospital community of Pakistan.

Materials and Methods

The cross-sectional study was conducted at three major hospitals of Rawalpindi and Islamabad from January to May, 2014. HCWs working Holy Family Hospital (HFH), Benazir Bhutto Hospital (BBH) and Nuclear Medicine, Oncology and Radiotherapy Institute (NORI) (Figure) were approached. The sampling was done randomly with proper approval of authorities and informed consent of the subjects. The HCWs included doctors, nurses, lab technicians, security guards, sanitary workers and administrative staff.

Information regarding subjects' demographics, work practices, disease history, job history, occasional exposures and risk behaviours was collected after

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detailed interview with the subjects. All subjects included in this study denied any previous history of any of these infections prior to their joining the hospitals as HCWs.

Blood (3 ml) was collected from the subjects using standard procedures and serum was separated and stored at -20°C. All samples were initially screened for HBV, HCV and HIV through immuno-chromatographic technique (ICT) as per the manufacturer's protocol (Standard Diagnostics, Germany). ICT for HBV checked the presence of hepatitis b surface antigen (HBsAg) in sample serums. HBsAg is the surface protein of HBV and this assay checked for the presence of virus in the sample. In case of HCV, ICT devices checked for antibodies produced as an immune response against the virus (anti-HCV). Samples which were positive for HCV and HBV using ICT assay were further confirmed through enzyme-linked immunosorbent assay (ELISA) using standard procedure described by the manufacturer (Antec Diagnostics, UK).

From ELISA-positive samples, isolation of viral nucleic acids was carried out by using extraction kit GF-RD-300 (Vivantis, USA). Confirmatory polymerase chain reaction (PCR) and genotyping of the samples was performed using Real Time PCR (RT-PCR) (Mini Opticon™ BioRad using Quantifast/sybr green). An already published protocol for genotyping was adopted with slight modification of annealing temperatures.¹¹

Results

Of the 500 samples in the study, 160(32%) each were collected from HFH and BBH, while 180(36%) were taken from NORI. Overall, there were 42(8.4%) doctors, 101(20.2%) nurses, 92(18.4%) technicians, 67(13.4%) ward boys, 41(8.2%) sweepers, 36(7.2%) security guards and 122(24.4%) administrative workers. None was positive for the presence of HIV after initial screening with ICT. In case of hepatitis viruses, 9(0.18%) samples were positive for anti-HCV and 3(0.6%) for HBsAg.

When the ICT-screened anti-HCV positive samples were

Table-1: Job categories.

Profession	Anti-HCV	HBs Ag	Total
Doctors	0/42	0/42	0/42
Nurses	2/101	1/101	3/101 (2.97 %)
Technicians	1/91	2/91	3/91 (3.29 %)
Ward boys	1/67	0/67	1/67 (1.49 %)
Sweepers	1/41	0/41	1/41 (2.4 %)
Security Guards	1/36	0/36	1/36 (2.7 %)
Administrative workers	2/122	0/122	2/122 (1.63 %)

HCV: Hepatitis C virus

HBsAg: Hepatitis B surface antigen.

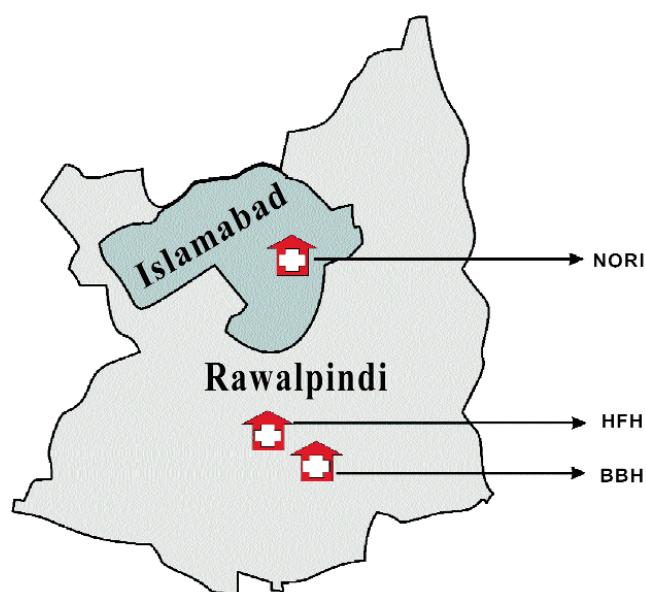


Figure: Map of Rawalpindi-Islamabad showing three hospitals selected for sampling.

This image was created using software CorelDRAW X6. Google maps were used to indicate the locations of the hospitals, as close to their original locations as possible.

NORI: Nuclear Medicine, Oncology and Radiotherapy Institute, Islamabad

HFH: Holy Family Hospital, Rawalpindi

BBH: Benazir Bhutto Hospital, Rawalpindi.

Table-2: Age-wise distribution.

Age (years)	Total number of samples	Anti-HCV positive samples	HBs-Ag positive samples
19-30	174	0	0
31-40	157	3	2
41-50	106	3	0
51 and above	63	2	1

HCV: Hepatitis C virus

HBsAg: Hepatitis B surface antigen.

further confirmed with ELISA, 8(89%) were found positive. In case of HBV, all 3 (100%) ICT-positive samples were also positive through ELISA. The ELISA-positive samples for both HCV and HBV were subjected to RT-PCR with universal primers. All 3(100%) samples in case of HBV were PCR-positive for the presence of viral deoxyribonucleic acid (DNA) in the blood. However, in case of HCV, only 3(37.5%) of the 8 samples were PCR-positive for the presence of viral ribonucleic acid (RNA) in the blood. No case of co-infection was found.

All the HCV-hit HCWs were infected with 3a genotype, while the HBV-hit HCWs were infected with genotype D.

Table-3: Relevant risk factors.

Serological status	ELISA positive samples	Exposure to blood	Needle stick injuries	Hepatitis patient in family	Status of blood transfusion
Anti-HVC	8/500	7/8	4/8	3/8	1/8
HBs-Ag	3/500	3/3	2/3	0/3	0/3

ELISA: Enzyme-linked immunosorbent assay

HCV: Hepatitis C virus

HBsAg: Hepatitis B surface antigen.

In terms of category, the highest prevalence was found in lab technicians (n=3; 3.29%) and nurses (n=3; 2.97%). None of doctors was sero-positive for either HBV or HCV (Table-1).

Of the 11 infected HCWs, 8(72.7%) belonged to the middle age (31 to 50 years) (Table-2).

Exposure to the blood and needle stick was the major risk factors involved in the transfer of hepatitis (Table-3).

Discussion

Prevalence of hepatitis viruses in HCWs was far less compared to the general population in the country. The same dominant genotypes of the viruses were represented in this population as in the general public. Needle stick injury was found to be the major risk factor at work. Majority of HCWs were well aware of the risk factors involved in transmission of these viruses and preventive measures were routinely in practice.

The current study focussed on the prevalence and molecular epidemiology of HBV, HCV and HIV in HCWs of three hospitals of Rawalpindi and Islamabad. Out of 500 samples analysed none was positive for HIV. HCV and HBV were found to be infecting lab technicians, nurses, security guards, sweepers and ward boys. Technicians and nurses had the highest prevalence of hepatitis. This prevalence is supported by the fact that technicians and nurses are highly exposed to blood products and needles on a daily basis. Rate of prevalence and an estimate of the currently infected individuals are very high among Pakistani population.^{12,13}

Techniques that are widely used these days for the detection of HBV and HCV are ICT, ELISA and RT-PCR. For HCV we obtained 9 positive results by ICT against anti-HCV antibody,⁸ with ELISA and only 3 were positive using RT-PCR. In case of HBV, 3 infected subjects were positive using all the three techniques. A possible explanation for high sero-positivity of HCV compared to low PCR confirmation rate for the presence of the virus in the body was the presence of antibodies due to prior infection which was later on cleared out by the body's immune

system. However, in case of HBV, ELISA was performed against surface antigen of the virus itself and PCR provided further confirmation of the presence of viral DNA in the blood for all ELISA-positive samples.

Genotype-specific PCR revealed the presence of 3a in case of HCV and genotype D was the only genotype present in case of HBV. This data is in accordance with already published reports on the prevailing dominant genotypes in the country.^{11,14,15}

The major risk factors for acquiring hepatitis infections were assessed during this study. HCWs usually deal with blood, blood-products and sharp instruments which can transmit various pathogens.¹⁶ In this study, needle stick injury was reported as a major risk factor in HCWs. A study reported that the main factor for receiving needle stick injuries in HCWs was recapping of syringes. Transmission of HCV by needle stick injury is reported to be in the range of 2% to 10%.¹⁷ Similar results have also been reported by a 2010 study.¹⁸

In the general population, about 43% of HCV-positive patients belong to the middle age group, 25 to 45 years, and in case of HBV about 42% were higher than 45 years. Our study supports that data as well and, according to this study, about 34% HCWs reported positive for HBV were over 45 years of age. Vaccination against HBV in recent years is credited for its low prevalence in younger population.

Due to small sample size and prevalence of hepatitis in the general population at very high rate, work-related risk factors other than needle stick injury could not be significantly associated for acquiring hepatitis at work. However, it is an initial indication that prevalence of hepatitis in HCWs, who are in the high-risk category, is far less than expected in a country with such high rates of infection. An important point to be considered is that HCV-positive HCWs also had a close relative infected with HCV. Among the 8sero-positive HCWs, 3 had close relatives infected. This shows that not only risk factors at job, but high prevalence in the general population also cannot be ignored in this case.

Conclusion

HIV was not found in the HCWs of Rawalpindi and Islamabad. The percentage of HCV and HBV infection was far less in HCWs compared to the general population. Major risk factor was needle stick injury. Technicians and nurses were found to be at the highest risk compared to other job categories.

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