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Prevalence of Viral Hepatitis C among Healthcare Professionals in Intensive Care Units in 2015: a Cross-Sectional Study from Latvia

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Abstract

Background: Latvia is considered as one of the countries with highest prevalence of hepatitis C virus (HCV) infection in Europe. The prevalence of anti-HCV and HCV-RNA in Latvia was found to be 2.4% and 1.7%, respectively. The prevalence of anti-HCV and HCV-RNA among healthcare professionals in Latvia has never been studied before.

Aim: The main objective of the study was to detect HCV infection prevalence in healthcare professionals at Intensive Care Units in Latvia and compare results with population data. The second objective was to analyze healthcare's professional's behavior in case of accident at workplace with potential exposure to HCV infection.

Methods: Healthcare professionals from 35 intensive care units of 26 Latvian hospitals participated in the study. Antibodies against HCV (anti-HCV) were identified in the venous blood sample of the study participants. Data were collected from April 2014 to April 2015. Study participants with positive anti-HCV had provided repeated blood samples in order to identify the presence of HCV-RNA using real time PCR. Immunoblot antibody test was performed to verify the presence of HCV antibodies in study participants with positive anti-HCV and negative HCV-RNA results.

Study participants completed a questionnaire including questions regarding accidents at work, post-exposure preventive actions, and previous HCV testing. The results were summarized and subjected to statistical analysis.

Results: One thousand two hundred twenty two medical professionals are employed in the intensive care units in Latvia. All were invited to participate in the study. Of those, 777 healthcare professionals voluntarily participated in the cross-sectional study, with a response rate (RR) of 63.6%. Others – refused. Four hundred and sixty four of 777 (59.7%) study participants indicated accidents at work with potential exposure to HCV. To prevent HCV infection 313 of 464 (67.5%) participants applied local preventive techniques. Seventy six (16.4%) of those who indicated accidents at work with potential exposure to HCV performed such local preventive techniques as wound washing. One hundred and thirty nine injured employees and 98 patients (source of exposure) were screened for presence of HCV. Out of all study subjects 471 (60.6%) had previously been tested for anti-HCV, while 254 (32.7%) had not been tested never before and 52 (6.7%) did not provide answer regarding previous HCV testing.

Main findings: From the 777 subjects tested, 18 were positive for anti-HCV and HCV-RNA test was positive in 9 subjects so prevalence of anti-HCV in healthcare professionals included in this study is 2.3% (95% CI 1.3 to 3.4) and HCV-RNA prevalence is 1.2% (95% CI 0.4 to 1.9).

Conclusions: The anti-HCV prevalence among healthcare professionals at intensive care units in Latvia is high and is similar to that in the general population. The prevalence of HCV-RNA among healthcare workers is slightly lower than observed in the population. Post-exposure interventions are limited mainly with local preventive techniques for the majority of participants and only small portion carry out all necessary post-exposure actions. Approximately one third of healthcare professionals included in study have never been tested for hepatitis C before, despite high risk for exposure at work.

Keywords: Hepatitis C; Prevalence; Latvia; Healthcare professionals

Abbreviations: Anti-HCV: Antibodies against Hepatitis C Virus; CDPC: The Latvian Centre for Disease Prevention and Control; ECDC: European Centre for Disease Prevention and Control; ELISA: Enzyme-Linked Immunosorbent Assay; HCV: Hepatitis C Virus; HCV-RNA: Hepatitis C Virus Ribonucleic Acid; ICU: Intensive Care Unit; PCR: Polymerase Chain Reaction; WHO: World Health Organization

Background

Approximately 15–30% of chronic hepatitis C patients develop liver cirrhosis, from those 20% may develop hepatocellular carcinoma [1]. More than seventy one million people suffer from viremic HCV infections worldwide [2] and 350,000–500,000 patients die from liver diseases associated with HCV infection each year [3,4]. The prevalence of HCV-specific immunoglobulin G (anti-HCV) in the general population in various European countries ranges from 0.4% in Sweden to 22.4% in the particular region of Central Italy (report from population study) [4,5]. According to prevalence of anti-HCV, European countries are divided into low, moderate or high prevalence groups [3,5]:

- Low (≤0.5%) - Belgium, Switzerland, Germany, Netherlands, Slovakia, Sweden, and the United Kingdom;
- Moderate (0.5-2%) - France, Spain, and Greece;
- High (≥2%) - Romania, and Italy.

HCV-RNA test is essential for detection of viremic patients. Prevalence of HCV-RNA in different European countries ranges from 0.1% to 4.5% [3-5]. Based on results of the study conducted in Latvia in 2008, the prevalence of anti-HCV in general population was 2.4% (high), while HCV-RNA was found in 1.7% of enrolled participants [6].

A total of 1348 hepatitis C cases were reported to European Centre for Disease Prevention and Control (ECDC) from Latvia in 2012 (48 acute and 1300 chronic). The overall number of hepatitis C cases reported from Latvia has remained fairly stable since 2006. Latvia had the highest overall rate of newly diagnosed reported hepatitis C cases in Europe in year 2012 (62.2 cases per 100 000) [7]. According to Latvian Centre for Disease Prevention and Control (CDPC) - in 2016, there were 1,971 newly diagnosed cases of HCV infection in Latvia. From those 64 were acute and 1,907– chronic hepatitis C [8,9].

In Latvia the most common transmission routes of HCV were intravenous drug use (29.2%), nosocomial (22.9%), and unspecified or sexual transmission (25%) [4,7]. It is hard to analyze transmission routes in chronic hepatitis C, as the transmission time in most cases is not known.

The World Health Organization (WHO) recommends HCV testing for individuals from populations with high HCV prevalence or those at risk of HCV exposure [10]. Intravenous drug users, as well as recipients of infected blood components (received until 1992), patients undergoing invasive procedures in healthcare facilities with inadequate infection control, infants born to HCV infected mothers, sex partners of HCV-infected individuals, HIV positive individuals, intranasal drug users, individuals with tattoos and piercings, and healthcare personnel are at increased risk for HCV infection [10].

Healthcare professionals constitute a major risk group for HCV infection [2,10,11]. Studies of healthcare personnel exposed to HCV after needle stick injury from anti-HCV-positive patients showed a sero-conversion rate varying from 0% to 7% reaching 10% following an exposure to HCV-RNA-positive blood [11,12]. The risk is higher in cases of deep injuries, venous and arterial catheter placement, and lasting contact with the blood of patients with high viremia [11,12]. Personnel of intensive care units, surgery departments, renal replacement therapy clinics and laboratories are at a particularly high risk of exposure [1]. In Europe, the prevalence of anti-HCV among medical professionals is between 0.1% and 3.8% [11-28]. The prevalence of HCV-RNA is significantly lower and varies from 0.1% to 1.3% [18,29].

Prevalence of anti-HCV and HCV-RNA among healthcare professionals in Latvia has not been previously assessed.

Material and Methods

Healthcare professionals from 35 intensive care units of 26 Latvian hospitals participated in the study.

Study was designed according to Declaration of Helsinki, approved by Riga East University Hospital Ethics board and all participants provided written informed consent.

Antibodies against HCV (anti-HCV) were identified in the venous blood sample of the study participants using the 4th generation ELISA method (Innotest HCV Ab IV; Fujirebio, Gent, Belgium). Data were collected from April 2014 to April 2015. Study participants with positive anti-HCV had provided repeated blood samples in order to identify the presence of HCV-RNA using real time PCR (Abbott Real Time HCV; Abbott Molecular Inc., Lake Bluff, IL, USA). Immunoblot antibody test (Inno-Lia HCV Score; Fujirebio, Gent, Belgium) was performed to verify the presence of HCV antibodies in study participants with positive anti-HCV and negative HCV-RNA results. In healthcare professionals who had anti-HCV tests within one-year from the start of the study, the test results were verified.

The study participants completed a questionnaire prepared by study authors. Inquiry form included data about profession, seniority, questions regarding accidents at work (did the participant experienced an accident at work-needle stick injury or other, with potential contact with patients material?), post-exposure preventive actions (did the participant performed local preventive actions-forcing blood from the wound, washing the wound, and applying aseptic wound dressing?; was there performed testing for HCV in the blood of potential source of infection?; was the participant checked for HCV-RNA after an accident to detect an acute hepatitis C?), and previous HCV testing. The results were summarized and subjected to statistical analysis.

Statistical analysis of the study was performed using descriptive statistical parameters and comparative statistic methods. There were also applied Chi-Square tests to determinate whether there are any significant statistical differences between anti-HCV positive or negative results but no such differences were found, thus those results were excluded as non-informative.

Results

One thousand two hundred twenty two medical professionals are employed in the intensive care units in Latvia. All were invited to participate in the study. Of those, 777 healthcare professionals voluntarily participated in the cross-sectional study, with a response rate (RR) of 63.6%. Others-refused. 775 blood samples were collected. Two participants provided result of anti-HCV test performed during previous year. All 777 participants completed the research questionnaires at least partially.

Out of 777 participants, 77 (9.9%) were men and 700 (90.1%) were women. The average age was 46 years (range from 20 to 76 years). The participants were grouped based on their occupation (Table 1), and the length of their work experience in medicine (Table 2).

The response rates of different occupational groups were: physicians-43.9%, nurses and doctor's assistants-72.9%, nurse assistants and others-65.1%.

As illustrated in Figure 1, anti-HCV antibodies were detected in 18 out of 777 study participants (2.3%; 95% CI: 1.3-3.4). HCV-RNA was found in 9 out of 777 participants (1.2%; 95% CI: 0.4-2.0). From the 18 participants with a positive anti-HCV finding - nine (50.0%) had

Table 1: Grouping of the study participants by occupation (n=777).

Occupation	Number (%)
Physicians	137 (17.6)
Doctor's assistants	25 (3.2)
Nurses	406 (52.3)
Nurse assistants	148 (19.0)
Other (office-cleaners, social workers, technical workers)	61 (7.9)

Table 2: Length of work experience in medicine (n=777).

Length of work experience	Number (%)
<10 years	217 (27.9)
10-15 years	87 (11.2)
16-20 years	89 (11.5)
>20 years	372 (47.9)
not provided	12 (1.5)

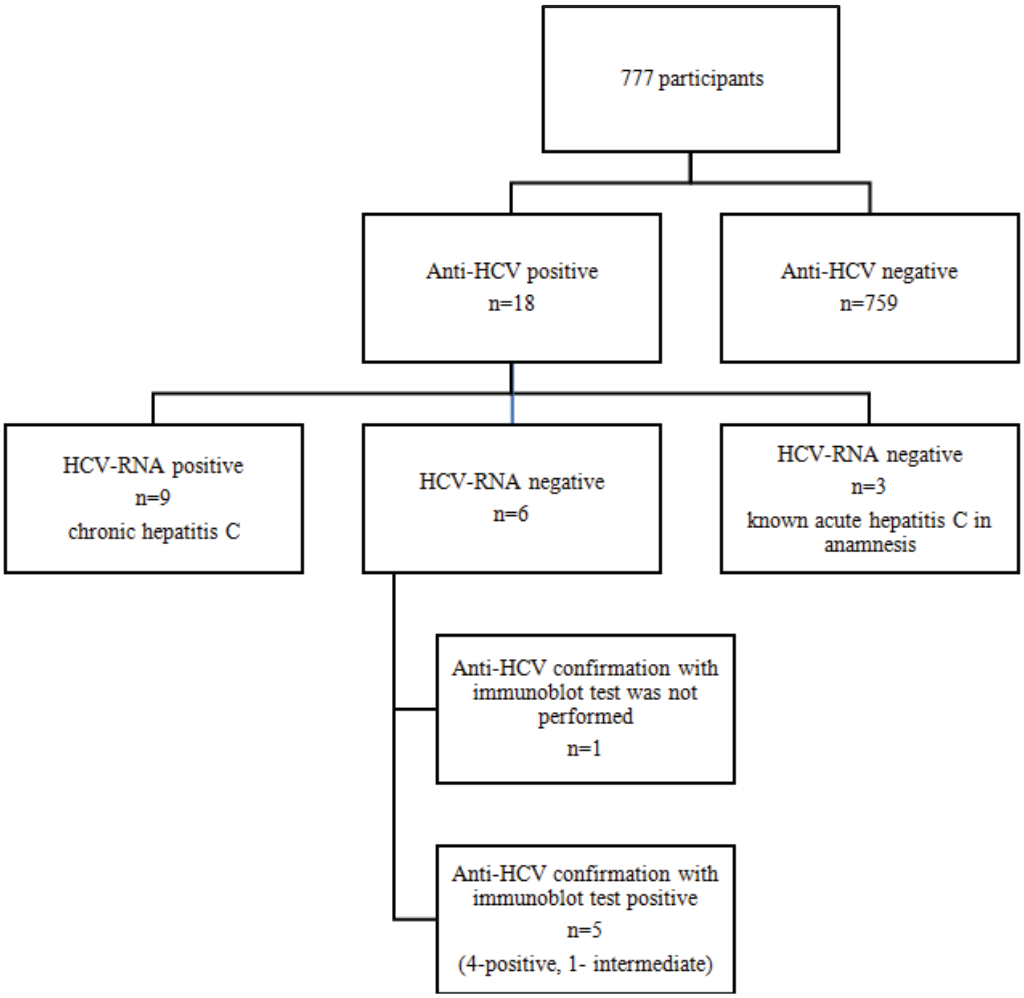

Figure 1: Grouping the study participants based on the test results.

chronic hepatitis C, three (16.7%) had acute hepatitis C in anamnesis, which was defined according to EASL guidelines (positive HCV-RNS plus known seroconversion or ALAT 10 times upper normal limit or known transmission episode), six (33.3%) were positive for anti-HCV, but negative for HCV-RNA. All three participants with diagnosed acute hepatitis C in past (years 1995, 2012 and 2014) also cleared the virus, and only one of those three (33.3%) received treatment with alpha interferon for 6 months. The immunoblot antibody test result was positive for four and intermediate-for one out of the six participants who had positive anti-HCV result but negative HCV-RNA, and in one person confirmatory test was not performed because of loss of follow-up.

Out of the 777 study participants, 471 (60.6%) performed previous anti-HCV testing, while 254 (32.7%) had not been tested never before, 52 (6.7%) did not respond regarding previous HCV testing.

All 777 participants completed the research questionnaires at least partially. Among the 777 participants, 464 (59.7%) indicated previous accidents at work, such as – needle stick or other injuries with items potentially contaminated with patient's material. Out of the 464 participants with previous work-related accidents, 316 (68.1%) had multiple accidents.

Three hundred and thirteen participants (67.5% out of 464 with previous accidents at work) indicated that they applied local preventive techniques to prevent HCV infection as the only post-exposure intervention following work-related accidents (Table 3). These include forcing blood from the wound, washing the wound, and applying aseptic wound dressing. Twenty two (4.7% out of 464 with previous accidents at work) participants performed wound washing and sterile dressing, and tested the source of exposure (i.e. the patient associated with the accident) for HCV following the accident. Seventy six (16.4% out of 464 with previous accidents at work) study participants performed wound washing, self-testing for HCV and screening for HCV of the source of exposure. Out of the 464 participants who indicated previous accidents at work, 289 (62.3%) participants performed local post-exposure prophylactic methods after each work-related accident, 156 (33.6%) did not perform post-exposure prophylaxis after each accident, and 19 (4.1%) did not indicate whether or not preventative measures were performed after each accident.

Discussion

According to study results, the prevalence of anti-HCV in healthcare professionals of intensive care units in Latvia can be considered as high. Anti-HCV prevalence was 2.3%-similar to that of Latvian population. One

Table 3: Post-exposure interventions following work-related accidents (n=464).

Post-exposure interventions	Number (%)
Local techniques	313 (67.5)
Self-testing for HCV	3 (0.6)
Local techniques+self-testing for HCV	38 (8.2)
Local techniques+self-testing for HCV+HCV testing of the source of exposure	76 (16.4)
Local techniques+HCV testing of the source of exposure	22 (4.7)
No post-exposure interventions	2 (0.4)
No data	10 (2.2)

immunoblot antibody test result was intermediate, which was considered antibodies positive result according to laboratory test description, rules and professional's experience. The prevalence of anti-HCV among healthcare professionals of intensive care units in Latvia correlates with the rate among medical personnel in other regions of Europe with high HCV prevalence. There are no publications available about hepatitis C prevalence among healthcare professionals in other Baltic states (Lithuania and Estonia). Highest prevalence of anti-HCV for healthcare professionals in Europe from analyzed publications was reported in study published in 2004 from hospital in Central Italy -overall prevalence for all study groups tested was found to be 3.8% [15]. Another study published in 1996 reported also high anti-HCV prevalence - 2.4% - in personnel of hospital in Budapest, Hungary [19]. One study from Sicily reported overall anti-HCV prevalence in medical personnel from two hospitals to be 2.1%, results reported in 2003 [21]. With regard to other Eastern European countries, study of personnel in two hospitals in Warsaw, Poland in 2012 reported prevalence of anti-HCV to be 1.7% [23]. One more study from Northern Poland 2009 reported 1.3% anti-HCV prevalence [28]. Lowest anti-HCV prevalence was reported in study from Scotland where it was as low as 0.1% for dental personnel [22]. Thus the anti-HCV prevalence in nearest countries varies from 0.1-3.8%, and our study shoved 2.3% which is in between the data in nearest countries.

The prevalence of HCV-RNA among medical professionals included in the study was lower than that of the general Latvian population. This could be due to study participants who had been successfully treated or previously had acute HCV infection resulting in spontaneous virus clearance, thus they now are negative for HCV-RNA. The slightly lower prevalence of chronic hepatitis C among healthcare professionals than persons in the general population could be also explained by readily accessible post-exposure preventative measures and early diagnosing and treatment of hepatitis C. Thus, the findings demonstrated that treatment can significantly reduce the prevalence of chronic hepatitis C in medical personnel and in the general population.

Five out of those nine HCV-RNA positive medical professionals with newly diagnosed chronic hepatitis C during our study underwent treatment with pegylated interferon and ribavirin right after the study. The treatment was successful and all five patients achieved sustained virological response.

Several studies have been conducted worldwide based on the hypothesis that prevalence of hepatitis C among medical personnel may be higher than that of the general population as they are considered as one of the risk groups [11,13,20-22,24,27]. However, most studies showed a comparable hepatitis C prevalence between medical professionals and the general population [11,13,20-22,24,27]. Recent studies have mostly focused on evaluating a specific group of medical professionals performing exposure-prone procedures (EPP) [11,25,27]. These are invasive procedures, during which the blood of medical professionals may be in contact with patients' biomaterial in an event of injury. In particular, EPP refers to procedures that involve hand contact with sharp tools or bone/tooth fragments inside the patient's body, where hands and fingers are not in constant visual control. These include invasive manipulations in surgery, orthopedics, emergency medicine, obstetrics, gynecology, dentistry, and certain procedures in intensive care for example open-chest cardiac massage [27,29]. In addition as there is increased risk of healthcare professionals to become infected with HCV [11,25,27], these procedures serve also as a risk factor for HCV transmission from medical professionals to patients. However, cases of patients infected by medical personnel are rare and these mostly involved severe breaches of infection control measures [27]. Nevertheless, studies focusing on at-risk healthcare professionals failed to show significant differences in the prevalence of hepatitis C between the healthcare professionals group and the general population [11,25,27]. Although not all studies showed higher hepatitis C prevalence among healthcare professionals, particularly those conducted after 2000 [11], this group is generally at a greater cumulative risk for HCV infection [11].

As expected, the majority of the medical professionals enrolled in this study disclosed work-related accidents and most of them had repeated accidents. Post-exposure interventions were limited to local ones such as forcing the blood from wound and wound washing in the majority of participants. Essential post-exposure measures were carried out in only 16.4% of these healthcare professionals. Probably there are several reasons for this. First, the source of exposure is not always available after an accident, especially if accident has happened at out-patient department and patient is already gone, when healthcare professional starts thinking about all necessary preventive actions. Second, the procedure for documenting work-related accidents and organizing post-exposure laboratory tests is time-consuming in certain regions of Latvia, sometimes it takes 2 to 3 hours to carry samples for testing, as test samples need to be delivered to the specific laboratory equipped for infectious diseases testing. But still there is a possibility in Latvia to test patient and source of infection twenty-four hours a day including weekends, which is especially important in case of HIV infection post exposure prophylaxis (PEP). Probably healthcare professionals sometimes do not see or not aware of the real threat to their health – this could be the reason for not performing PEP.

Almost one-third (32.7%) of medical professionals enrolled in this study had not been tested for HCV before. The practice of HCV testing for employees differs among facilities in Latvia. Moreover, the decision is often made by the healthcare professional and the cost is not typically covered by the employer and there is no routine health insurance for employees in state hospitals. In similar studies conducted in other countries, material used to evaluate the prevalence of hepatitis C in medical professionals were typically obtained either during mandatory health checks, from blood serum samples collected to test for antibodies after hepatitis B vaccination, or during investigations following work-related accidents [11,25-27]. Therefore it is essential to consider implementation of more comprehensive post-exposure preventative measures and HCV testing in all Latvian healthcare facilities.

Physicians had the lowest response rate based on the rates in different groups of healthcare professionals; the response rate among mid-level and lower-level healthcare professionals was higher. These figures suggest that the difference in the response rates cannot be solely explained by better awareness and more frequent HCV testing among physicians. Unfortunately, these differences may be due to limitations of this study.

Limitations of the study

This study was conducted through head-nurses of the units (head-nurses asked personal to participate at the study), who often have better contact with mid- and lower-level personnel, that is why response rate in these groups was higher than in physicians group. Second, the recruitment of additional study personnel for sample collection and delivering samples

to testing laboratory was not possible due to restricted research funding, therefore hospitals were asked to collect and deliver the samples. Lastly, it was rather challenging to recruit participants in hospitals with a greater number of employees, because many employees in Latvia, especially physicians, work part time in several healthcare facilities. Considering these limitations, the sample collection for future studies in Latvia should be conducted in a wider scale and the studies should be coordinated by the research contractors.

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