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SHORT COMMUNICATION

SCREENING OF HEALTH CARE WORKERS FOR HEPATITIS B VIRUS AND HEPATITIS C VIRUS: CRITERIA FOR FITNESS FOR WORK

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The aim of this study was to propose a protocol for assessment of markers of infection with hepatitis B virus (HBV) and hepatitis C virus (HCV) in exposed health care professionals and to define criteria for evaluation of fitness for the job of the infected personnel. The study comprised 800 persons involved in operative procedures, including 414 surgeons, 275 nurses, and 111 anaesthetists. A graduated protocol was created for monitoring markers of HBV and HCV infection. A well-defined combination of markers of antigen-antibody systems enabled identification of four groups of persons with HBV infection differing in fitness for work: 1) HBsAg-positive, HBeAg-positive, HBV DNA-positive; 2) HBsAg-positive, anti-HBe-positive, HBV DNA-positive; 3) HBsAg-positive, anti-HBe-positive, HBV DNA-negative; and 4) anti-HBs-positive, anti-HBc-positive, anti-HBe-positive group. For HCV infection, two groups with different job fitness were identified: 1) anti-HCV-positive, HCV RNA-negative and 2) anti-HCV-positive, HCV RNA-positive. Screening of hospital personnel at risk to HBV and HCV infection requires a well-defined protocol which may help to evaluate the fitness of the infected personnel for a specific job.

Key words:
antigen-antibody system, graduated protocol, markers of infection, occupational exposure

In the hospital environment, particularly in some wards, there is a high risk of contact with biological agents. The risk of infection by hepatitis B virus (HBV) and hepatitis C virus (HCV) in occupationally exposed health care workers is a matter of considerable concern. This is due to high prevalence of these infections in the general population, high infection capacity of these viruses, and everyday contact with biological liquids and potentially contaminated surgical or medical instruments (1, 2).

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Hepatitis B virus

Hepatitis B virus is the most thoroughly characterised and complex aetiologic agent. The infective (so-called Dane) particle consists of a viral core plus an outer surface coat (3). Surface coat can be detected in serum by immunologic means as hepatitis B surface antigen (HBsAg, formerly Australia antigen). Its presence in serum is usually the first evidence of acute HBV infection and implies infectivity of the blood. The corresponding protective antibody (anti-HBs) appears after clinical recovery and usually persists for life. Other two antigen-antibody systems are associated with the viral core of HBV. They are core antigen (HBcAg) and e antigen (HBeAg). HBcAg can be found in infected liver cells and is not detectable in serum except by special techniques that disrupt the Dane particle. Antibody to HBcAg (anti-HBc) generally appears at the onset of clinical illness and thereafter gradually diminish. It is regularly found in chronic HBsAg carriers. In acute infection, anti-HBc is predominantly in IgM class. The e antigen (HBeAg) can be found only in HBsAg-positive serum and it tends to parallel the production of viral DNA polymerase. Presence of anti-HBe points to relatively lower infectivity.

HBV has a high prevalence in the Italian population (0.5 to 5.6%) (4). It shows strong resistance to environment and disinfection as well as high transmissibility with a minimum dose (1/10,000 ml of infected plasma). The risk estimations for a single exposure run between 20% and 40% per HBsAg and HBeAg-positive or pre-core variant subjects and about 6% for contact with blood type HBsAg-positive but HBeAg-negative and anti-HBe-positive (5, 6).

The annual incidence of infection with HBV among health workers is between 0.5% and 5% (7). In the face of these unfavourable figures we would like to point out the possibility of an accurate prevention by vaccination and the availability of post-exposure prophylaxis for non-vaccinated subjects that consists of vaccine and specific immunoglobulins.

Hepatitis C virus

Hepatitis C virus is now known to cause most cases of what was previously termed non-A, non-B hepatitis. Most cases of hepatitis C are subclinical, even in the acute stage. The infection has a much higher rate of chronicity (about 75%) than hepatitis B. Therefore, it is often uncovered by the serendipitous detection of anti-HCV in apparently healthy persons (3).

HCV has a high prevalence in general population (2% in Italy) and in some categories of patients (5.2% in surgical patients, 39.4% in dialysed patients) (8). The exposure risk is estimated at 1.8% (9, 10). Its resistance to environment and disinfection is still unknown and neither active nor passive prophylaxis is efficient.

By adopting the EU regulations for safety of health workers exposed to the risk of transmission of biological agents the Italian government has acknowledged the problem of occupational infections (11). Beside the legal aspects of the issue, it is important to recognise the need to evaluate the suitability of a worker for a specific job which involves exposure to biological agents and to recognise situations which may determine the course of an occupational or non-occupational infection.

This paper proposes a protocol for risk assessment of infection by HBV and HCV in personnel occupationally exposed to biological agents and to define criteria for evaluation of working ability of a health worker infected by HBV and/or HCV.

SUBJECTS AND METHODS

The study comprised 800 health care professionals in hospital wards involved in operating procedures, of whom 414 were surgeons, 275 nurses, and 111 anaesthetists (Table 1). The investigation used protocols for monitoring markers of HBV and HCV infection.

Table 1 *Number of health care workers exposed to biological agents by wards*

	Surgeons	Nurses	Anaesthetists
General surgery	131	80	
Cardiosurgery	30	71	
Gynaecology	77	52	
Ophthalmology	37	7	
Otorhinolaryngology	31	11	
Orthopaedics	14	13	
Paediatrics	21	10	
Emergency surgery	17		
Urology	44	20	
Vascular surgery	12	11	
Total	414	275	111

We defined a graduated protocol to detect the following markers of HBV infection using the enzyme-linked immunosorbent assay (ELISA): HBsAg, anti-HBs, anti-HBc, anti-HBc IgM, HBeAg, and anti-HBe. Molecular hybridisation and polymerase chain reaction (PCR) were used to detect HBV DNA.

To detect HCV markers, we used the third generation ELISA as a screening test, the third generation recombinant immunoblot assay (RIBA 3) to confirm the screening test, and PCR to detect HCV RNA.

First we looked for HBsAg, anti-Hbs, anti-Hbc, and anti-HCV in non-vaccinated subjects. The results of the markers, considered case by case, served to identify the necessity for further serologic investigation. Further investigation of HBeAg/anti-HBe status did not appear necessary in the first stage, but it was important in the evaluation of illness and infectivity of HbsAg-positive subjects. The first step of the second level of investigation was to search for anti-HBc IgM indicators of viral replication. The last step of the protocol was to search for HBV DNA using molecular hybridisation, radiolabeled tube, and PCR (Figure 1).

The first thing to do in the evaluation of risk of HCV infection is to test anti-HCV with ELISA (Figure 2). Positive results prompt the next step, that is, the investigation of HCV RNA by PCR, as it indicates the persistence of the virus in the organism. The application of RIBA 3 that detects antibodies for structural and non-structural antigens of the virus and serves to confirm the infection with HCV is justified only if the reaction to the anti-HCV test with ELISA can not be clearly interpreted.

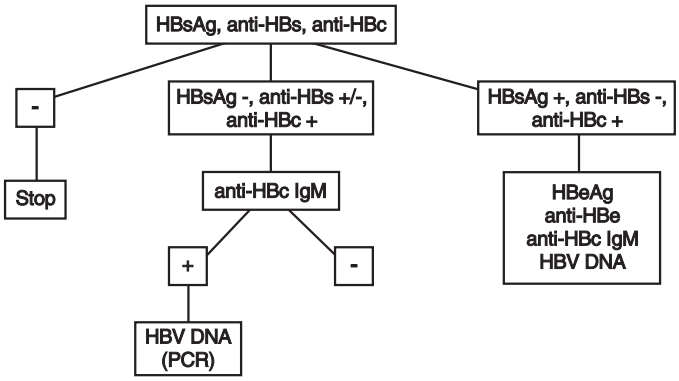

Figure 1 *Check-up protocol for the assessment of markers of infection with hepatitis B virus (HBV). HBsAg – HBV surface antigen (former Australia antigen); anti-HBs – HBV surface antibody; anti-HBc – HBV core antibody; HBeAg – HBV e antigen; Ig – immunoglobulin; PCR – polymerase chain reaction; »+« – positive result; »-« – negative result*

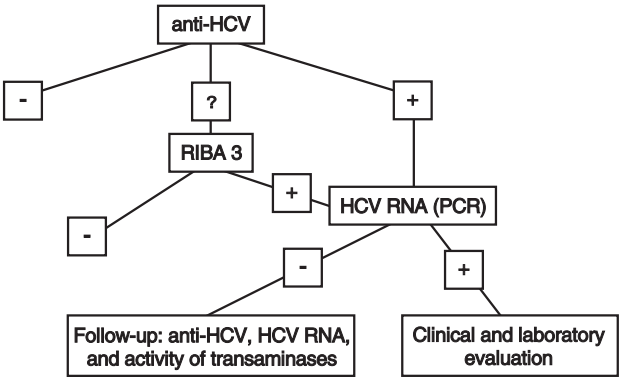

Figure 2 *Check-up protocol for the assessment of markers of infection with hepatitis C virus (HCV). ELISA – enzyme-linked immunosorbent assay; RIBA 3 – third generation recombinant immunoblot assay; PCR – polymerase chain reaction; »+« – positive result; »-« – negative result*

RESULTS AND DISCUSSION

Positive HBV and/or HCV markers were found in 77 health professionals, that is, nearly 10% of the examined subjects. Fifty-nine were positive to HBV markers of whom 8 HbsAg-positive. Of 13 subjects found to be anti-HCV-positive, 11 were HCV RNA-positive.

Five persons were found positive to both HBV and HCV. One of them was HbsAg-positive and one was HCV RNA-positive.

We defined four combinations of antigen-antibody systems to identify groups of persons with different suitability for a specific job, as follows.

HBsAg-positive, anti-HBc-positive, HBeAg-positive, anti-HBc IgM-positive, and HBV DNA-positive

This combination reveals acute HBV infection, persistence of viral replication, infectivity of the blood, and the onset of clinical illness. It is necessary to temporarily remove the worker from work and to periodically control the markers of HBV infection and activity of transaminases. In any case, it is necessary that the worker is not exposed to environments that bear high risk of another infection by HBV or a serious infection by HCV, HIV, or hepatitis D virus (HDV) such as wards for infectious diseases, gastroenterology, haemodialysis, and operating rooms for liver transplantation. Furthermore, stress and heavy physical activities with potential exposure to hepatotoxic agents must be avoided.

HBsAg-positive, anti-HBc-positive, HBeAg-negative, anti-HBe-positive, anti-HBc IgM-positive, and HBV DNA-positive

This serological pattern shows the appearance of a mutant pre-core variant in the subjects. It is generally associated with increased enzymatic activity that can be related to a serious condition of progressive hepatitis. It is therefore necessary to apply the same criteria as in the first group.

HBsAg-positive, anti-HBc-positive, HBeAg-negative, anti-Hbe-positive, anti-HBc IgM-negative, and HBV DNA-negative

This combination in most cases reveals an asymptomatic carrier of the virus. It is advisable to avoid the risk of another infection as the illness can be exacerbated. The risk can be prevented by removing a worker from potentially infectious environment and by avoiding exposure to hepatotoxic agents. This state can persist or can eventually disappear with the appearance of anti-HBs, as verified in about 1.5–2% of the patients. Mutant pre-core with positive HBV DNA findings and elevated transaminases activity is also possible. Should that be the case, the procedure is to take the same course as in the two previous groups. In HbsAg-positive patients, it may be required to determine anti-HDV (total and IgM) and HDV RNA, particularly in the presence of a clinically overt acute infection or of a significantly increased activity of transaminases.

Anti-HBs-positive, anti-HBc-positive, anti-HBc IgM-negative, and anti-HBe-positive

This indicates past infection and relative immunity. An anti-HBs-positive patient maintains an acquired immunity which is evaluated by determining anti-HBs titre. The presence of anti-HBc with anti-HBs is not significant beyond indicating previous HBV infection whereas the presence of anti-HBe points to low infectivity. There are no contraindications to resuming work.

The following cases can be taken into consideration if the worker is infected by HCV.

Anti-HCV-positive and HCV RNA-negative (by PCR)

The presence of anti-HCV does not indicate immunisation, but a past contact with HCV (12). If the pattern appears for the first time it is necessary to check the activity of transaminases every three months and anti-HCV and HCV RNA (by PCR) every six to twelve months.

Should the activity of transaminases stabilise at the normal level and HCV RNA result negative, the subject is clinically considered recovered. While waiting for confirmation of recovery, the patient must stay away from a working environment associated with high risk of infection by the hepatitis virus. Once the work is resumed, health personnel exposed to biological agents will be required to observe all related protective measures.

Should, however, elevated activity of transaminases persist regardless of negative HCV RNA findings, it is necessary to keep the subject under observation for a longer period and remove her/him from exposure to hepatotoxic agents and potentially infectious environment, as described above.

Anti-HCV-positive and HCV RNA-positive (by PCR)

This denotes persistent condition of viral replication, viremia, and development of a disease. Beside an extended clinical and laboratory follow-up and likely removal from work for a certain period, it is necessary for a patient to stay away from environment bearing high risk of exposure to hepatotoxic agents and to blood-borne pathogens, especially hepatitis B and C viruses.

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In conclusion, occupational Health Services in Italy do not to evaluate risk of transmission of HBV and HCV infection by health care workers to patients. Our data suggest that screening of hospital personnel exposed to occupational risk of HBV and HCV infection requires a well-defined protocol based on a graduated evaluation of markers of HBV and HCV infection. Such protocol may serve in evaluation of the fitness of infected personnel for a specific job.

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Sažetak

KRITERIJI ZA OCJENU SPOSOBNOSTI ZA RAD U ZDRAVSTVENIH RADNIKA INFICIRANIH VIRUSIMA HEPATITISA B I C

U priopćenju je predložen stupnjevani protokol za procjenu pokazatelja infekcije virusom hepatitisa B (HBV) i virusom hepatitisa C (HCV) u profesionalno izloženih zdravstvenih radnika kao i za utvrđivanje kriterija za ocjenu sposobnosti za rad inficiranog osoblja. U istraživanju je obuhvaćeno 800 zdravstvenih radnika koji sudjeluju u operativnim zahvatima: 414 kirurga, 275 medicinskih sestara i 111 anesteziologa.

Prema definiranim kombinacijama ispitivanih pokazatelja u sustavima antigen-antitijelo, ispitanici inficirani virusom hepatitisa B razvrstani su u četiri skupine s različitom sposobnošću za rad, prema ovim nalazima:

1) HBsAg pozitivan, HBeAg pozitivan, HBV DNK pozitivan;

2) HBsAg pozitivan, anti-HBe pozitivan, HBV DNK pozitivan;

3) HBsAg pozitivan, anti-HBe pozitivan, HBV DNK negativan;

4) anti-HBs pozitivan, anti-HBc pozitivan, anti-HBe pozitivan.

Slično su razvrstane osobe inficirane virusom hepatitisa C u dvije skupine, prema ovim nalazima:

1) anti-HCV pozitivan, HCV RNK negativan;

2) anti-HCV pozitivan, HCV RNK pozitivan.

Zaključeno je da, budući da u Italiji Služba medicine rada nema u nadležnosti nadzor medicinskog osoblja koje je u povećanom riziku od infekcije HBV-om i HCV-om, valja usvojiti jasno definirani protokol za utvrđivanje pokazatelja infekcije u profesionalno izloženih osoba. Takav protokol mogao bi poslužiti za donošenje kriterija za ocjenu sposobnosti za rad inficiranog osoblja.

Ključne riječi.
pokazatelji infekcije, profesionalna izloženost, stupnjevani protokol, sustavi antigen-antitijelo

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