

Hepatitis B, hepatitis C, and other blood-borne infections in healthcare workers

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Part I Hepatitis B, hepatitis C, and other blood-borne infections in healthcare workers

– bibliography (in alphabetical order) –

AIDS/TB Committee of the Society for Healthcare Epidemiology of America. Management of healthcare workers infected with hepatitis B virus, hepatitis C virus, human immunodeficiency virus, or other bloodborne pathogens. *Infect Control Hosp Epidemiol* 1997; 18:349-363.

This article provides the current recommendations of the Society for Healthcare Epidemiology of America (SHEA) regarding the management of healthcare workers infected with hepatitis B virus (HBV), hepatitis C virus (HCV), or the human immunodeficiency virus (HIV). For the reasons cited in the article, SHEA now maintains that separate virus-specific management strategies are appropriate for healthcare workers who are infected with these unrelated viruses. SHEA emphasizes the use of appropriate infection control procedures to minimize exposure of patients or providers to blood, emphasizes that transfers of blood from patients to providers and from providers to patients should be avoided, and argues that infected healthcare workers should not be prohibited from participating in patient-care activities solely on the basis of their blood-borne pathogen infection. SHEA recommends that hepatitis B e-antigen-positive healthcare workers routinely should double glove and should not perform those activities that have been identified epidemiologically as associated with a risk for provider-to-patient HBV transmission despite the use of appropriate infection control procedures. SHEA also recommends that HCV- and HIV-infected providers use double gloving for procedures, but recommends that these providers not be excluded from any aspect of patient care unless epidemiologically incriminated in the transmission of these infections despite adequate precautions. SHEA argues for comprehensive education concerning bloodborne pathogens for all healthcare providers and trainees and against mandatory pathogen-specific educational requirements for infected providers. SHEA recommends against specific competence-monitoring procedures directed at these healthcare workers infected with bloodborne pathogens, arguing for managing infected providers in the context of a comprehensive approach to the management of all impaired providers. SHEA emphasizes the importance of worker privacy and medical confidentiality. SHEA emphasizes the importance of offering employees who have disabilities reasonable accommodation for their disabilities. The article discusses exposure management in detail and, in general, recommends adherence to existing guidelines for managing exposures to these agents. Finally, SHEA recommends against routine mandatory testing of providers. Specific details and the rationale for these recommendations are included in the body of the article.

Alter MJ. Prevention of spread of hepatitis C. *Hepatology* 2002; 36(5 Suppl 1):S93-S98.

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Hepatitis C virus (HCV) is transmitted by percutaneous or permucosal exposure to infectious blood or blood-derived body fluids. Based on the results of cohort and acute case control studies, risk factors associated with acquiring HCV infection in the United States have included transfusion of blood and blood products and transplantation of solid organs from infected donors, injecting drug use, occupational exposure to blood (primarily contaminated needle sticks), birth to an infected mother, sex with an infected partner, and multiple heterosexual partners. Nosocomial and iatrogenic transmission of HCV primarily are recognized in the context of outbreaks, and primarily have resulted from unsafe injection practices. Transmission from HCV-infected health care

workers to patients is rare. Transfusions and transplants have been virtually eliminated as sources for transmission, and most (68%) newly acquired cases of hepatitis C are related to injecting drug use. The primary prevention of illegal drug injecting will eliminate the greatest risk factor for HCV infection in the United States. Other prevention strategies that need to be widely implemented include risk reduction counseling and services and review and improvement of infection control practices in all types of health care settings. Testing for HCV infection should be routinely performed for persons at high risk for infection or who require postexposure management. There are no recommendations for routine restriction of professional activities for HCV-infected health care workers, and persons should not be excluded from work, school, play, and child care or other settings on the basis of their HCV infection status.

Araujo MW, Andreana S. Risk and prevention of transmission of infectious diseases in dentistry. *Quintessence Int* 2002 ; 33:376-382.

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Health care providers are at risk for infection with bloodborne pathogens, including hepatitis B virus, human immunodeficiency virus, and hepatitis C virus. Recommended infection control practices are applicable to all settings in which dental treatment is provided. Dentists remain at low risk for occupationally acquired human immunodeficiency virus. Dental health care workers, through occupational exposure, may have a 10 times greater risk of becoming a chronic hepatitis B carrier than the average citizen. Tuberculosis is caused by *Mycobacterium tuberculosis*. In general, persons suspected of having pulmonary or laryngeal tuberculosis should be considered infectious if they are coughing, are undergoing cough-inducing or aerosol-generating procedures, or have sputum smears positive for acid-fast bacilli. Although the possibility of transmission of bloodborne infections from dental health care workers to patients is considered to be small, precise risks have not been quantified by carefully designed epidemiologic studies. Emphasis should be placed on consistent adherence to recommended infection control strategies, including the use of protective barriers and appropriate methods of sterilization or disinfection. Each dental facility should develop a written protocol for instrument reprocessing, operatory cleanup, and management of injuries. Such efforts may lead to the development of safer and more effective medical devices, work practices, and personal protective equipment.

Baffoy-Fayard N, Maugat S, Sapoval M, Cluzel P, Denys A, Sellier N, Desruennes E, Legmann P, Thibault V, Brucker G, Astagneau P, on behalf of the Study Group on Hygiene Practices in Interventional Radiology. Potential exposure to hepatitis C virus through accidental blood contact in interventional radiology. *J Vasc Interv Radiol* 2003; 14:173-179.

Inter-regional Center for Nosocomial Infection Control, Hospital European Georges Pompidou, Villejuif, France.

The aim was to quantify the prevalence of accidental blood exposure (ABE) among interventional radiologists and contrast that with the prevalence of patients with hepatitis C virus (HCV) undergoing interventional radiology procedures. A multicenter epidemiologic study was conducted in radiology wards in France. The risk of ABE to radiologists was assessed based on personal interviews that determined the frequency and type of ABE and the use of standard protective barriers. Patients who underwent invasive procedures underwent prospective sampling for HCV serologic analysis. HCV viremia was measured in patients who tested positive for HCV. Of the 77 radiologists who participated in 11 interventional radiology wards, 44% reported at least one incident of mucous membrane blood exposure and 52% reported at least one percutaneous injury since the beginning of their occupational activity. Compliance with standard precautions was poor,

especially for the use of protective clothes and safety material. Overall, 91 of 944 treated patients (9.7%) tested positive for HCV during the study period, of whom 90.1% had positive viremia results, demonstrating a high potential for contamination through blood contacts. The probability of HCV transmission from contact with contaminated blood after percutaneous injury ranged from 0.013 to 0.030; the high frequency of accidental blood exposure and high percentage of patients with HCV could generate a risk of exposure to HCV for radiologists who perform invasive procedures with frequent blood contact. The need to reinforce compliance with standard hygiene precautions is becoming crucial for medical and technical personnel working in these wards.

Baldo V, Floreani A, Dal Vecchio L, Cristofolletti M, Carletti M, Majori S, Di Tommaso A, Trivello R. Occupational risk of blood-borne viruses in healthcare workers: a 5-year surveillance program. *Infect Control Hosp Epidemiol* 2002; 23:325-327.

Department of Environmental Medicine and Public Health, Institute of Hygiene, University of Padua, Italy.

This study presents the results of a 5-year surveillance program involving the prospective follow-up of healthcare workers (HCWs) in the Veneto region of Italy exposed to blood-borne viruses. All HCWs who reported an occupational exposure to blood-borne infection joined the surveillance program. Both HCWs and patients were tested for viral markers (hepatitis B surface antigen [HBsAg], antibody to hepatitis B surface antigen [anti-HBs], antibody to hepatitis B core antigen [anti-HBc], antibody to hepatitis C virus [anti-HCV], HCV RNA, and antibody to human immunodeficiency virus [HIV]) and had these markers plus transaminases assayed at 3, 6, and 12 months and then yearly thereafter. Moreover, a program of hepatitis B virus (HBV) prophylaxis was offered to those whose anti-HBs levels were less than 10 IU/ml. Two hundred forty-five HCWs (156 women and 89 men) with a mean age of 37 (+/- 10) years who reported occupational exposure during the 5-year period. At the time of exposure, 1 HCW was positive for HBsAg (0.4%) and 2 were positive for HCV RNA (0.8%). Among the patients involved, 28 (11.4%) were positive for HBsAg, 68 (27.8%) were positive for HCV RNA, 6 (2.4%) were positive for HIV, and 147 (60.0%) were negative for all viral markers (4 patients were positive for both HCV and HIV). During the follow-up period after exposure (mean, 2.7 [+/- 1.6] years), there was no increase in transaminases or seroconversions to any of the viral markers. Our accurate postexposure follow-up revealed a lack of transmission of HBV, HCV, and HIV.

Barrigar DL, Flagel DC, Upshur RE. Hepatitis B virus infected physicians and disclosure of transmission risks to patients: a critical analysis. *BMC Med Ethics* 2001; 2:E4.

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The potential for transmission of blood-borne pathogens such as hepatitis B virus from infected healthcare workers to patients is an important and difficult issue facing healthcare policymakers internationally. Law and policy on the subject is still in its infancy, and subject to a great degree of uncertainty and controversy. Policymakers have made few recommendations regarding the specifics of practice restriction for health care workers who are hepatitis B seropositive. Generally, they have deferred this work to vaguely defined "expert panels" which will have the power to dictate the conditions under which infected health care workers may continue to practice. In this paper we use recent Canadian policy statements as a critical departure point to propose more specific recommendations regarding disclosure of transmission risks in a way that minimizes practice restriction of hepatitis B seropositive health care workers without compromising patient safety. The range of arguments proposed in the literature are critically examined from the perspective of ethical analysis. A process for considering the ethical implications of the disclosure

of the sero-status of health care workers is advanced that considers the varied perspectives of different stakeholders.

Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. *Clin Microbiol Rev* 2000; 13:385-407.

HIV Infections Branch, Hospital Infections Program, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, U.S. Department of Health and Human Services, Atlanta, Georgia 30333, USA. ebj4@cdc.gov

Exposure to blood-borne pathogens poses a serious risk to health care workers (HCWs). We review the risk and management of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) infections in HCWs and also discuss current methods for preventing exposures and recommendations for postexposure prophylaxis. In the health care setting, blood-borne pathogen transmission occurs predominantly by percutaneous or mucosal exposure of workers to the blood or body fluids of infected patients. Prospective studies of HCWs have estimated that the average risk for HIV transmission after a percutaneous exposure is approximately 0.3%, the risk of HBV transmission is 6 to 30%, and the risk of HCV transmission is approximately 1.8%. To minimize the risk of blood-borne pathogen transmission from HCWs to patients, all HCWs should adhere to standard precautions, including the appropriate use of hand washing, protective barriers, and care in the use and disposal of needles and other sharp instruments. Employers should have in place a system that includes written protocols for prompt reporting, evaluation, counseling, treatment, and follow-up of occupational exposures that may place a worker at risk of blood-borne pathogen infection. A sustained commitment to the occupational health of all HCWs will ensure maximum protection for HCWs and patients and the availability of optimal medical care for all who need it.

Beltrami EM, Kozak A, Williams IT, Saekhou AM, Kalish ML, Nainan OV, Stramer SL, Fucci MC, Frederickson D, Cardo DM. Transmission of HIV and hepatitis C virus from a nursing home patient to a health care worker. *Am J Infect Control* 2003; 31:168-175.

Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, GA 30333, USA.

We report a case of simultaneous HIV and hepatitis C virus (HCV) transmission from a nursing home patient to a health care worker (HCW) whose HIV and HCV infections were diagnosed during routine blood donor screening. Detailed information about the HCW, possible occupational and nonoccupational blood and body fluid exposures, and possible source patient was collected. Blood samples were drawn from the HCW and patient, and HIV and HCV laboratory testing was performed at the Centers for Disease Control and Prevention. The HCW, who worked as a nursing home aide, had no nonoccupational risk factors for HIV or HCV infection but provided care for 1 HIV-infected patient with dementia and urinary and fecal incontinence. The HCW had numerous exposures to the patient's emesis, feces, and urine to unprotected chapped and abraded hands. HCW and patient blood samples were positive for anti-HCV by enzyme immunoassay and recombinant immunoblot assay testing. The HCW's and patient's HCV were genotyped as 1a, and their HIV-1 was genotyped as subtype B. HIV and HCV ribonucleic acid (RNA) sequence analysis showed that the HCW's and patient's viruses were very closely related. HIV and HCV transmission from the patient to the HCW appears to have occurred through nonintact skin exposure. Bloodborne pathogen transmission may have been prevented in this situation by consistent, unflinching use of barrier precautions.

Birrell LN, Cooke RA. Hepatitis B – are surgeons putting patients at risk? *Occup Med* 1998; 48:529-531.

Princess of Wales Community Hospital, Bromsgrove, Worcestershire, UK.

The 1993 Department of Health guidelines permit a surgeon who is hepatitis B surface antigen (HBsAg) positive but e-antigen (HBeAg) negative to perform exposure prone procedures, unless demonstrated to have infected patients. However, there is increasing evidence of transmission of hepatitis B to patients from health care workers in this supposedly low infectivity category. The Occupational Physician must decide whether existing guidelines represent an adequate risk assessment and indeed whether this is an acceptable risk for patients. If an NHS Trust continues to follow these guidelines it may be in breach of its duty of care to patients. Yet refusing to allow such carriers to operate without testing for additional serological markers may be unlawful discrimination. Further research is clearly needed as well as an urgent review of the guidelines.

Blatchford O, O'Brien SJ, Blatchford M, Taylor A. Infectious health care workers: should patients be told? *J Med Ethics* 2000; 26:27-33.

Department of Public Health, University of Glasgow.

The risk of transmission of HIV or hepatitis B from infectious health care workers to patients is low. However, inadvertent exposure causes great concern amongst patients of an infected health care worker. The patients of a Scottish dentist diagnosed hepatitis B e antigen positive were informed by letter of their exposure. A sample of patients was sent a postal questionnaire. Most (56%) respondents reported feeling anxious on receiving the letter but almost all (93%) thought patients should always be informed following treatment by an infectious health care worker, although the risk was very small. We discuss clinical and ethical factors relating to informing patients following exposure to an infectious health care worker. We suggest that a balance should be struck between patients' wishes to know of risks to which they have been exposed, however small, and the professional view that when risks are negligible, patients need not be informed.

Buster EH, van der Eijk AA, Schalm SW. Doctor to patient transmission of hepatitis B virus: implications of HBV DNA levels and potential new solutions. *Antiviral Res* 2003; 60:79-85.

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Hepatitis B virus (HBV)-infected health care workers (HCWs) can infect patients undergoing exposure prone procedures. Until now reviews have focused on the problem of the HBeAg-positive HCWs. After transmission of HBV by HBeAg-negative surgeons, the focus of Public Health Policy in the UK and the Netherlands has changed from HBeAg status to serum HBV DNA level. Viral load and the volume of blood transmitted determine the transmission risk of HBV. We have estimated the number of infectious particles transmitted by needlesticks, in comparison with those attributed in maternal-fetal transfusion. The blood volume transmitted by needlestick is roughly 1-30% of that of delivery. As vertical transmission with maternal HBV DNA levels below 10^7 g Eq./ml is rarely documented, HBV transmission by needlesticks is, according to our assumptions, unlikely to occur with HBV DNA levels below 10^7 g Eq./ml. Sera of transmitting HCWs contained HBV DNA levels between 5.0×10^9 and 6.35×10^4 g Eq./ml. Interpretation of these levels is hampered as the sera were taken at least 3 months after transmission. To prevent both loss of expertise and nosocomial infection, highly viremic HCWs can be offered antiviral therapy. Lamivudine and alpha-interferon can now be complemented with adefovir, tenofovir and entecavir to provide effective new therapies for chronic HBV-infected HCWs.

Buster EH, van der Eijk AA, de Man RA, Schalm SW. Doctor-to-patient transmission of hepatitis B virus: the potential of antiviral therapy for prevention. *Scand J Gastroenterol* 2004; 241(Suppl.):45-49.

Department of Gastroenterology and Hepatology, Erasmus MC, University Medical Center Rotterdam, The Netherlands.

Hepatitis B virus (HBV)-infected health-care workers (HCWs) have infected patients during medical procedures. In many countries HBV-infected HCWs are restricted in performing exposure prone procedures based on either HBeAg status or serum HBV DNA level. To prevent loss of skilled HCWs and to minimize transmission risk, highly viraemic HCWs can be offered antiviral therapy. Nucleoside analogues have proven to be effective in reducing transmission of HIV and HBV in the setting of vertical mother-to-infant transmission. Following the same rationale, suppression of viral load in HBV-infected HCWs could minimize the risk of doctor-to-patient transmission to such an extent that job modifications are no longer indicated. To limit the risk of drug resistance, the use of combination therapy is advocated. We describe two chronic HBV-infected HCWs treated with antiviral therapy, eventually leading to well-tolerated and highly effective combination therapy with lamivudine and tenofovir, with continuation of medical practice.

Centers for Disease Control and Prevention. Pressure mounts for CDC to change guidelines for infected HCWs. *Aids Alert* 1998; 13:49-52.

The Centers for Disease Control and Prevention (CDC) are currently reviewing the guidelines for handling HIV-positive health care workers (HCWs). The Advisory Committee on HIV and STD Prevention and the Hospital Infection Control Practices Advisory Committee are working together to change these recommendations based on problems arising under the present regulations. Worker's lack of confidentiality in disclosing their HIV status to patients, and ambiguous terminology stating that HCWs should not perform procedures that are exposure-prone, are among the problems that need to be addressed. Current practices have shown that health care personnel with HIV and hepatitis B (HBV) should be dealt with separately, and disclosure of HIV status should not be mandated because the risk of transmission to patients is very low. The group suggests that self-disclosure is warranted in specific cases, and may be mitigated by a supervisor who could oversee the worker's health condition. Additional recommendations include concentrating efforts on preventing injury to health care workers, studying transmission risks for hepatitis C, and analyzing the methods for preventing transmission. Results from a look-back study conducted by the CDC suggest that there is no data to demonstrate transmission between 53 HIV-positive health care providers and their 22,759 patients. The working group also recognizes the need for review panels, but feels that they should be decentralized to fit the needs of individual health care providers.

Cleveland JL, Cardo DM. Occupational exposures to human immunodeficiency virus, hepatitis B virus, and hepatitis C virus: risk, prevention, and management. *Dent Clin North Am* 2003; 47:681-696.

Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Mailstop F-10, 4770 Buford Highway, Chamblee, GA 30341, USA. jlcleland@cdc.gov

Current data indicate that the risk for transmitting bloodborne pathogens in dental health care settings is low. Pre-exposure hepatitis B vaccination and the use of standard precautions to prevent exposure to blood are the most effective strategies for preventing DHCP from occupational infection with HIV, HBV or HCV. Each dental health care facility should develop a

comprehensive written program for preventing and managing occupational exposures to blood that: (1) describes the types of blood exposures that may place DHCP at risk for infection; (2) outlines procedures for promptly reporting and evaluating such exposures; and (3) identifies a health care professional who is qualified to provide counseling and perform all medical evaluations and procedures in accordance with the most current USPHS recommendations. Finally, resources should be available that permit rapid access to clinical care, testing, counseling, and PEP for exposed DHCP and the testing and counseling of source patients.

Cleveland JL, Gooch BF, Shearer BG, Lyerla RL. Risk and prevention of hepatitis C virus infection. Implications for dentistry. *J Am Dent Assoc* 1999; 130:641-647.

Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA 30341, USA.

The occupational risk of hepatitis C virus, or HCV, infection in dentistry is very low. Nonetheless, the lack of an effective vaccine, the high rates of chronic infection and the limited effectiveness of treatment may cause concern for dental workers who come into contact with blood in their daily practices. The authors discuss the natural history, diagnosis and treatment, and patterns of transmission of HCV infection, including the Centers for Disease Control and Prevention's recommendations for management and follow-up of health care workers after occupational exposure to HCV. In the absence of an effective vaccine or postexposure prophylaxis, prevention of occupational transmission of HCV in dental settings continues to rely on the use of universal precautions, including barrier precautions and the safe handling of sharp instruments.

Cockcroft A. Surgeons who test positive for hepatitis C should not be transferred to low risk duties. *Rev Med Virol* 2000; 10:79-82.

Department of Occupational Health, Royal Free Hampstead NHS Trust, London, UK.

Current UK guidelines allow surgeons who are antibody-positive for hepatitis C virus (HCV) to continue performing exposure-prone procedures (EPPs) unless they have been shown to transmit HCV to a patient. Given the low rate of recognised transmission from surgeon to patient, this recommendation is probably reasonable and is consistent with the management of eAg negative carriers of hepatitis B who are also allowed to continue operating. It seems likely that, in the future, pressure will increase to remove surgeons who are HCV-positive (or positive for HBsAg without HBeAg or HIV-positive) from the list of those able to perform EPPs. If implemented, this would require surgeons to be tested at regular intervals for HCV status. There are no data to demonstrate that such an approach would benefit patients overall and the ethical costs would be high because many surgeons will have acquired HCV occupationally. The financial costs would also be high and, in my opinion, would be better deployed by ensuring that existing simple preventative measures are routinely applied to prevent patient-surgeon-patient transmission of all blood-borne viruses.

Cody SH, Naiman OV, Garfein RS, Meyers H, Bell BP, Shapiro CN, Meeks EL, Pitt H, Mouzin E, Alter MJ, Margolis HS, Vugia DJ. Hepatitis C transmission from an anesthesiologist to a patient. *Arch Intern Med* 2002; 162:345-350.

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An anesthesiologist was diagnosed as having acute hepatitis C 3 days after providing anesthesia during the thoracotomy of a 64-year-old man (patient A). Eight weeks later, patient A was diagnosed as having acute hepatitis C. We performed tests for antibody to hepatitis C virus (HCV)

on serum samples from the thoracotomy surgical team and from surgical patients at the 2 hospitals where the anaesthesiologist worked before and after his illness. We determined the genetic relatedness of the HCV isolates by sequencing the quasispecies from hypervariable region 1. Of the surgical team members, only the anaesthesiologist was positive for antibody to HCV. Of the 348 surgical patients treated by him and tested, 6 were positive for antibody to HCV. Of these 6 patients, isolates from 2 (patients A and B) were the same genotype (1a) as that of the anaesthesiologist. The quasispecies sequences of these 3 isolates clustered with nucleotide identity of 97.8% to 100.0%. Patient B was positive for antibody to HCV before her surgery 9 weeks before the anaesthesiologist's illness onset. The anaesthesiologist did not perform any exposure-prone invasive procedures, and no breaks in technique or incidents were reported. He denied risk factors for HCV. Our investigation suggests that the anaesthesiologist acquired HCV infection from patient B and transmitted HCV to patient A. No further transmission was identified. Although we did not establish how transmission occurred in this instance, the one previous report of bloodborne pathogen transmission to patients from an anaesthesiologist involved reuse of needles for self-injection.

Corden S, Ballard AL, Ijaz S, Barbara JA, Gilbert N, Gilson RJ, Boxall EH, Tedder RS. HBV DNA levels and transmission of hepatitis B by health care workers. *J Clin Virol* 2003; 27:52-58.

Department of Virology, Public Health Laboratory, Birmingham Heartlands Hospital, UK.

Laboratory-based study funded by the Research and Development Division of the Department of Health to inform the decision making on guidelines for the conduct of exposure prone procedures (EPPs) by health care workers who are hepatitis B carriers. Define the quantity and nature of hepatitis B virus (HBV) DNA in hepatitis carriers whose serum does not contain hepatitis B e antigen (HBeAg) and in surgeons previously cleared to conduct EPPs who have transmitted HBV to their patients. Cross-sectional survey using HBV DNA quantification, genotyping and sequencing comparing transmitting surgeons and asymptomatic carriers. HBV DNA could be detected and quantified in 64.5% (136 of 211) of carriers whose serum did not contain HBeAg with a median level 3.6 log₁₀ copies/ml (range of 5.7 log₁₀ copies). Pre-core mutation appeared not to affect the HBV DNA level, however, all surgeons carried codon 28 variants and transmitted these variants to their patients. The lowest HBV DNA level in a transmitting surgeon was 4 x 10⁴ copies/ml. Pre-core mutations are common in carriers whose serum does not contain HBeAg and do not specifically identify carriers whose HBV DNA levels are high. It was possible to define a level of virus above which transmission of hepatitis B during conduct of EPPs could not be excluded.

Cutter J, Jordan S. Uptake of guidelines to avoid and report exposure to blood and body fluids. *Journal of Advanced Nursing* 2004; 46:441-452.

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Mucocutaneous and percutaneous exposure to blood and body fluids (inoculation injury) are major risk factors for occupational acquisition of bloodborne infection in health care professionals. Compliance with prescribed 'universal precautions' during exposure-prone procedures has been shown to reduce the risk of acquiring bloodborne viral infection. In addition, reporting such exposures facilitates prophylaxis. AIM: The aim of this paper is to report a study to identify strategies to minimize professionals' risks of acquiring bloodborne infections during exposure-prone procedures. All surgeons, theatre nurses who scrub for surgery and midwives employed in general operating theatres and delivery suites within one UK National Health Service trust (n = 276) were surveyed by postal questionnaire. Data were analysed using univariate and bivariate techniques in SPSS version 10. Content analysis was undertaken on the one open-ended question.

The response rate was 72.5% (200/276). Only 1.5% (3/200) of respondents adopted universal precautions for all patients irrespective of whether their bloodborne viral status was known. On average, only half the recommended theatre-specific precautions were always adopted (mean 3.725/7, SD = 1.385). Most respondents (63.3%) admitted making judgements related to nationality, lifestyle or sexual orientation when making decisions about protective clothing. Many respondents (74%, 145/196) reported sustaining an inoculation injury in the 10 years prior to the study. However, under-reporting of injuries was common, and 32.4% (47/145) admitted failing to report injuries. Guideline adherence was influenced by profession, but not by time since qualification. The findings suggest that strategies must be developed to improve compliance with universal precautions and reporting guidelines by all health care professionals. The extent of, and reasons for, non-compliance with both local and national guidelines remain relatively unexplored.

Daley J. Bloodborne pathogen exposures and prevention in the perioperative environment. *Can Oper Room Nurs J* 2003; 21:7-8, 31-3, 36.

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The fear of exposure to bloodborne pathogens and disease transmission from patients to health care professionals or health care professional to patients is real. Perioperative nurses and other surgical personnel should be aware of the dangers and risks of exposure to these viruses. Patients may be infected with one of the currently recognized bloodborne viruses including Hepatitis B (HBV), Hepatitis C (HCV) and the Human Immunodeficiency Virus (HIV). It is imperative that accidental exposure during surgical procedures be avoided. The most common means of exposure are percutaneous and mucous membrane routes. The persistence of HBV, HCV and HIV infections, long incubation periods, and the likelihood of frequent asymptomatic carrier states remain continuing threats to the surgical team and makes it difficult to rely on a diagnosis. Infection prevention and control strategies to reduce the risk of exposures and prevent transmission are based on a number of approaches including engineering, administrative and works practice controls and the proper selection and use of personal protective equipment.

De Carli G, Puro V, Ippolito G, on behalf of the Studio Italiano Rischio Occupazionale da HIV Group. Risk of hepatitis C virus transmission following percutaneous exposure in healthcare workers. *Infection* 2003; 31(Suppl 2):22-27.

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We wanted to determine the incidence of anti-hepatitis C virus (HCV) seroconversion after percutaneous exposure to infectious fluids of an anti-HCV positive source in healthcare workers (HCW) and to investigate related risk factors. Prospective observation in 55 Italian hospitals of anti-HCV-negative exposed HCW were followed clinically and serologically for at least 6 months. Of 4,403 exposed HCW, 14 seroconverted (0.31%; 95% CI 0.15-0.48) after an injury with a hollow-bore, blood-filled needle (14/1,876=0.74%; 95% CI 0.41-1.25). Deep injuries increased the seroconversion risk (OR 6.53; 95% CI 2.01-20.80). Exposure to an HIV co-infected source was associated with an higher, though not yet statistically significant, risk (OR 2.76, 95% CI 0.49-10.77). Source's HCV viremia was available in 674 cases, 566 of whom tested positive, including the nine seroconversion cases for whom this information was available. The risk of acquiring HCV after percutaneous exposure seems to be lower than previously reported. Deep injury, injury with a blood-filled needle and HIV co-infection of source seem to be associated with occupational transmission. Needlestick prevention devices could decrease the risk of infection with HCV and other bloodborne pathogens in HCW.

De Paola LG. Managing the care of patients infected with bloodborne diseases. *J Am Dent Assoc* 2003; 134:350-358.

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The emergence of the bloodborne pathogens HIV, the cause of AIDS; hepatitis B virus, or HBV; and hepatitis C virus, or HCV, has been a milestone in the history of the dental profession. In the early 1980s, new cases of AIDS increased dramatically, and fear of acquiring this disease compelled clinicians to modify the delivery of medical and dental care to allay fears of transmission on the part of both patients and health care workers. Arguably, the AIDS pandemic has been the most significant factor in the evolution and delivery of modern medical and dental care in the last century. To help allay fears and remove barriers to caring for the HIV population, the Centers for Disease Control and Prevention, or CDC, introduced the concept of universal precautions in 1983. This was followed by the Occupational Safety and Health Administration's Bloodborne Pathogens Standard in 1991. Specific to the dental profession was the development of the principles of infection control in dentistry recommended by the CDC (1993); the American Dental Association (1995) and the Organization for Safety & Asepsis Procedures (1997). While initially difficult for some clinicians to acknowledge, these recommendations now are universally accepted throughout the profession, and provision of oral health care to patients infected with bloodborne disease is becoming commonplace. Compliance with recommended infection control practices remains an important component of dental practice. But it must be accompanied by an understanding of infectious and bloodborne diseases and the medical/dental management of the care of infected dental patients. The emergence of the bloodborne pathogens and the increasing number of infected patients who seek oral health care compel clinicians to have a thorough knowledge about bloodborne diseases and the medical/dental management of the care of patients presenting with HIV, HBV or HCV infection.

Dresing K, Pouwels C, Bonsack S, Öllerich M, Schworer H, Uy A, Sturmer KM. HCV, HBV and HIV infections: risk for surgeon and staff. Results and consequences of routine screening in emergency patients. *Chirurg* 2003; 74:1026-1033. [Article in German]

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Trauma and emergency surgeons (S) are in contact with high-risk patients (P) infected with HBV, HCV, and HIV without knowing which P is and which is not infected. The aim of this paper was to analyze routine screening (SCR) in trauma care. Microparticle enzyme immunoassays (MEIA) (Abbott Axym system) were analyzed from routine blood samples: HBsAg (V2), HCV version 3.0, HIV 1/2gO. All positive or uncertain samples were confirmed with ELISA/PCR. From January 2002 to October 2002 a total of 1074 emergency P were examined. The results were available within 50 min after admittance to the emergency room. In 53 of 1074 (4.9%) the MEIA was positive or in threshold margins (LV): HBV 15 P plus 3 LV (9 secured by ELISA/PCR), prevalence (PV) 0.84%. HCV 34 P plus 1 LV (31 secured with ELISA/PCR), PV 2.9%. HIV 2 P, PV 1.86 per thousand, 1 in co-infection with HCV, 1 with HBV. Of 42 infections, 21 were unknown before screening, and in 5 P the S suspected an infection. After screening, nine surgical procedures were changed to safer procedures. MEIA is a good tool for quick SCR of HCV, HBV, and HIV in emergency surgery (ES). When the infection is known the S is more aware to perform only safe procedures during surgery (no touch technique) or to use more protective devices (e.g., fluid shield, double gloves). Our results indicate that surgeons and nurses in ES are exposed four to six times more often to infection with HCV, HBV, and HIV than represented by officially published data. We recommend routine SCR of HBV, HCV, and HIV for all P in ES. Prevention procedures are discussed.

Duckworth GJ, Heptonstall J, Aitken C, on behalf of The Incident Control Team.

Transmission of hepatitis C virus from a surgeon to a patient. *Commun Dis Public Health* 1999; 2:188-192.

East London and the City Health Authority, London. g.duckworth@cdsc.nthames.nhs.uk

An investigation was carried out to find the source of infection in a patient who developed hepatitis C virus (HCV) infection after cardiothoracic surgery, and to determine whether other patients had become infected. Virological tests on specimens from the patient and potential sources (blood donors and members of the surgical team) showed that the patient and the surgeon who acted as first assistant were infected with HCV of the same genotype: 4a. No other source of infection was identified. Ninety-one per cent (277) of the 304 other exposed patients available for follow up were tested--none had antibody to HCV. It was concluded that hepatitis C may be transmitted from surgeon to patient during exposure prone procedures, and that the transmission rate in this incident was 0.36% (1/278; 95% confidence interval 0.0061%-1.98%).

Du Plessis R, Webber L, Saayman G. Bloodborne viruses in forensic medical practice in South Africa. *Am J Forensic Med Pathol* 1999; 20:364-368.

Department of Forensic Medicine, Institute of Pathology, University of Pretoria, Republic of South Africa. rdplessi@medic.up.co.za

Health care workers are at risk of exposure to bloodborne viruses including human immunodeficiency virus types 1 and 2 (HIV-1 and -2), hepatitis B virus (HBV) and hepatitis C virus (HCV). However, limited data is available regarding these risks to forensic medical personnel who are exposed daily to large numbers of severely traumatized bodies in South Africa, a country that has an existing and growing HIV epidemic and a high HBV seroprevalence. Because no specific prescriptions ensuring occupational safety in this regard exist for forensic medical personnel in South Africa, the prevalence of bloodborne viruses within this setting must be determined. Blood was taken randomly from 263 bodies examined at the Medicolegal Laboratory in Pretoria. Serologic tests to detect antibodies to HIV, HCV, and human T-cell lymphotropic virus types I and II (HTLV-I and -II) and to detect the presence of HBV surface antigen (HBsAg) were performed and positive results confirmed using conventional serologic assays. Serologic tests detected at least one of the four bloodborne viruses in 21% of cases. The overall seroprevalence for HIV-1/2 was 11%, rising to 19% in the sexually active reproductive age group (15 - 49 years). The HBsAg prevalence overall was 8%, rising to 9% in sexually active reproductive individuals. There was a low overall HCV seroprevalence of 1% and an even lower HTLV-I/II seroprevalence of 0.01%. Forensic medical personnel in South Africa are therefore at risk of exposure to bloodborne viral pathogens in, on average, 1 of 5 bodies autopsied. This risk is compounded by the high daily workload, traumatized state of many of the bodies, and adverse working conditions. It is imperative that occupational health safety guidelines be created for the forensic medicine discipline and crime scene attendants in South Africa.

Duseja A, Arora L, Masih B, Singh H, Gupta A, Behera D, Chawla YK, Dhiman RK.

Hepatitis B and C virus – prevalence and prevention in health care workers. *Trop Gastroenterol* 2002; 23:125-126.

Department of Hepatology, Postgraduate Institute of Medical Education and Research, Chandigarh, India.

Hepatitis B and C viruses are important causes of liver related morbidity and mortality. We aimed at determining the presence of hepatitis B and C virus infections in the health care workers (HCWs) and their compliance for the HBV vaccination. Three thousand five hundred and fifty six

health care workers were screened for HBsAg and 115 for anti-HCV by ELISA. HBsAg negative individual were offered HBV vaccination and record of their compliance was kept. Anti-HBs titers were determined one month after 2nd or 3rd dose of vaccine in 273 subjects. Out of 3556 health care workers, 61 (1.7%) were found to be positive for HBsAg. One out of 115 HCWs (0.87%) was found to be positive for anti-HCV. Fifteen percent of HCWs received only one dose, 26% received two doses 59% received three doses and 2.5% also received the booster dose of the HBV vaccine. All those tested had anti-HBs titers more than 10 mUI/ml. In HCWs, HBsAg and anti-HCV prevalence was found to be 1.7% and 0.87% respectively. HCWs in our hospital, despite the awareness on HBV and HCV infection are noncompliant for HBV vaccination.

Ennigrou S, Ben Ameer Khechine I, Cherif A, Najah N, Ben Hamida A. Analysis of knowledge, attitudes and practices of health care workers facing blood exposure accidents in a general surgery service. *Tunis Med* 2004; 82:492-505. [Article in French]

Département de Médecine Préventive et Sociale, Faculté de Médecine de Tunis.

In order to assess the degree of knowledge, attitudes and the personnel's practices exercising in a service of general surgery of the hospital Charles Nicolle of Tunis, concerning blood exposure accidents, we did a transverse survey during the month of January of the year 2002. A questionnaire has been addressed to 114 people while using the technique of the direct interview. The middle age of investigated is 35.7 years. The sex ratio is 0.7. Only the 2/3 declare have been vaccinated against the B hepatitis. The results show a good knowledge of the exposure risk to a communicable disease by blood (95.6%), but less good for the risk of contamination by the three viruses HBV, HCV and HIV. The resheathing of needles, considered like gesture to risk, is underestimated by 71.2% of investigated. The majority of investigated declare to know universal precaution principles (85.8%). However, to the maximum 4 measures only on the 10 advisable have been mentioned by investigated. The conduct to hold in case of blood exposure accident seems insufficiently known by our sample. It is represented, in 78.8% of cases, in the application of disinfectants Betadine type or alcohol iodized, whereas the practice of a serology to the patient source is ignored completely. 75% of investigated having had a blood exposure accident lasting the last 12 months (n = 44) didn't declare their blood exposure accident and only 11.4% declare to have undergone cares. Actions of information and formation, to the intention of the whole of the personnel of the service, on risks incurred by the nursing, gestures and procedures to risk, the universal precaution respect, the conduct to hold in case of a blood exposure accident, the interest of the declaration and the interest of the vaccination against the B hepatitis, are primordial.

Fischer F, Nauert T. Nosocomial transfer of HBV and HCV by public health workers. *Gesundheitswesen* 2003; 65:270-274. [Article in German]

Abteilung Gesundheitsschutz der Volkswagen AG, Wolfsburg.

Transmission of HBV and HCV from people who work in medical professions to their patients is still an unsolved hygienic and legal problem. In Germany, cases of nosocomial hepatitis virus infection in health care units have received great public interest. Medical examinations of the employees according to occupational safety regulations aim at the employees only. Legal regulations including regulations of the European Union limit the purpose of these examinations on safety and health of the employees. These examinations do not serve the safety of patients. Protection against infections is regulated by the relevant German public health law, however regulations – especially those that concern the protection of the public – are incomplete. In Germany it is mandatory to inform the public health departments only in cases of acute hepatitis. Doctors do not need to give information about chronic liver infections. This may lead to the situation that a health care worker is unaware of a chronic, potentially infectious condition and his immunological status may remain unknown for a long period. Examinations in occupational

medicine cannot solve this problem. In order to improve the protection of the public, there is a need to extend the regulations concerning the notification of chronic hepatitis and to implement solutions for this difficult and sensible problem in Germany.

Fisker N, Mygind LH, Krarup HB, Licht D, Georgsen J, Christensen PB. Blood borne viral infections among Danish health care workers – frequent blood exposure but low prevalence of infection. *Eur J Epidemiol* 2004; 19:61-67.

Department of Clinical Immunology, Odense University Hospital, Odense C, Denmark.
niels.fisker@dadlnet.dk

Denmark is a country with low prevalence and incidence of blood borne viral infections. Among health care workers (HCWs) vaccination for hepatitis B is only offered to high-risk groups. The aims of this cross sectional survey were to determine the prevalence of hepatitis B, -C, and human immunodeficiency virus (HIV) among the staff at a Danish University hospital and to correlate this with risk factors for transmission. Additionally, we wanted to examine the current frequency of blood exposure, reporting habits and hepatitis B vaccination status in the staff. Of 1439 eligible hospital staffs included, 960 (67%) were HCWs. The overall human immunodeficiency virus (HIV)-, hepatitis C Virus (HCV)- and hepatitis B Virus (HBV)-prevalence was 0% (0/1439), 0.14% (2/1439) and 1.6% (23/1439), respectively. Twenty-three percent of HCWs were vaccinated against HBV. Age, blood transfusion and stay in endemic areas were associated independently to HBV infection as opposed to job-category, duration of employment, HBV vaccination status and blood exposure. Based on a 4-week recall period, the incidence of percutaneous blood exposure was 1.5/person-year. In conclusion the HIV and hepatitis prevalence was low despite frequent blood exposure and the principal risk factors were unrelated to work. Danish HCWs do not seem to be at increased risk of hepatitis B even though universal HBV vaccination has not been implemented.

Froom P, Ribak J, Cohen H. The risk of bloodborne infections in health care workers and their patients: possible preventive steps. *Harefuah* 2001; 140:977-982, 990. [Article in Hebrew]

National Institute for Occupational and Environmental Health Care, Raanana.

Hospital-based bloodborne infections are generally limited to viruses; hepatitis B virus, hepatitis C virus and the human immunodeficiency virus. The risk of infection by an infected patient to the health care worker is substantial. All preventable actions should be taken, including 3 injections of vaccine for hepatitis B, serological confirmation of protection, and further treatment if necessary. Since no preventable risk to a patient is acceptable, policies need to be set on the fitness-for-work of the infected surgeon. This article reviews the risks of bloodborne infections and preventive measures.

Ganju SA, Goel A. Prevalence of HBV and HCV infection among health care workers (HCWs). *J Commun Dis* 2000; 32:228-230.

Department of Microbiology, IGMC, Shimla, India.

Hepatitis B virus along with hepatitis C virus infection form a major cause of morbidity and mortality. In order to know the present status in Indira Gandhi Medical College, Shimla, a total of 400 samples were screened from Feb'98 to Jan'99. Two hundred samples from HCWs and the same number of samples from the apparently healthy population which served as the control group were collected. They were screened for the presence of hepatitis B surface antigen (HBsAg) and anti-HCV antibodies by the third generation ELISA. HBsAg was positive in 5% of HCWs while

amongst the control group seropositivity was 3.5%. Amongst the HCWs, the laboratory technicians showed highest seropositivity which was 40%. Anti-HCV antibody was not detected in any of the HCWs screened. HCWs form a major risk group for contracting HBV infection. It is therefore of utmost importance to take strict universal precautions and also the need for implementation of immunisation against HBV among HCWs.

Gerlich WH. Hepatitis B and C. Risk of transmission from infected health care workers to patients. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2004; 47:369-378. [Article in German]

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Hepatitis B and C viruses (HBV, HCV) cause chronic infections and high viremia which often remain undetected. Health care workers have an elevated risk of acquiring HBV or HCV when performing exposure-prone procedures and transmitting these viruses to patients. The extent of viremia varies considerably in different carriers and the risk of transmission is different for the various procedures. According to reports from the last 15 years, highly viremic HBV carriers with HBeAg transmit the virus on average to 4% of their patients when performing operations with high risk of injuries. HBeAg-negative surgeons with a viremia between 10⁶ and 10⁷ HBV DNA molecules/ml transmit to 1.5% of the patients. The absence of reports on proven transmission caused by viremia <10⁵ molecules/ml suggests a residual risk below 1:100,000 that a surgeon with lower virus load transmits to one patient within 15 years. Eight cases were reported where HCV-infected surgeons transmitted the virus to 0.15% of their patients (17/11,119) and had (as far as tested) around 10⁶ HCV RNA molecules/ml or more. Current recommendations of the relevant professional associations and institutions require vaccination of medical staff against HBV with control of immunity, regular examinations of staff for HCV, and in cases of missing immunity for HBV. Infected staff with viremia must either abstain from exposure-prone procedures or have a decision from an expert committee on the acceptability of such procedures in view of the individual infection status.

Gillcrist JA. Hepatitis viruses A, B, C, D, E and G: implications for dental personnel. *J Am Dent Assoc* 1999; 130:509-520.

Oral Health Services Section, Tennessee Department of Health, Nashville 37247, USA.

This article provides dental personnel with a brief overview of the different types of viral hepatitis, including their epidemiology, clinical features, prevention and treatment. It also explores the ramifications of these diseases for the practice of dentistry. Viral hepatitis is an inflammation of the liver caused by one of at least six distinct viruses. The hepatitis A and E viruses, or HAV and HEV, are enterically transmitted viruses that produce acute disease only. The hepatitis B, C and D viruses, or HBV, HCV and HDV, are most efficiently transmitted by infected blood, but also can be transmitted by exposure to other infectious bodily fluids. These three viruses can cause acute or chronic hepatitis. People with chronic viral hepatitis can develop chronic liver disease, cirrhosis and hepatocellular carcinoma. The hepatitis G virus was recently identified, and its ability to cause clinically significant acute or chronic hepatitis is unknown. Dental health care workers, or DHCWs, should be concerned primarily with HBV, HCV and HDV, as occupational exposure to these pathogens places them at risk of developing acute or chronic infections. Vaccines and immune globulins are available and effective in protecting against infections with HAV, HBV and HDV, but not HCV. DHCWs should become knowledgeable about viral hepatitis. They should be vaccinated against hepatitis B. Adherence to infection control measures will help prevent occupational transmission of all bloodborne pathogens, including hepatitis viruses.

Goldmann DA. Blood-borne pathogens and nosocomial infections. *J Allergy Clin Immunol* 2002; 110(2 Suppl):S21-S26.

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Guidelines to prevent the transmission of blood-borne infections have evolved rapidly since the recognition that "serum hepatitis" could be transmitted to health care personnel via percutaneous exposure to blood. The HIV epidemic focused renewed attention on the problem of protecting health care personnel, culminating in "standard precautions" for patient care, which emphasized the use of gloves for all contact with blood and body fluids. This focus on protection of the health care worker sometimes obscures the other important functions of gloves: protection of patients from microorganisms on the hands of providers and prevention of patient-to-patient transmission of nosocomial pathogens. The risk of infection after percutaneous exposure to the 3 major blood-borne viruses-hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV-varies greatly. The risk for a nonimmune individual exposed to HBV may be > 30% if the source is HB(e)Ag-positive. The average infection rate for HCV is 1.8%. For HIV, the average risk is 0.3%, but is higher with deep injury, when there is visible blood on the device, when a needle has been in an artery or vein, or when the source patient is in the terminal phase of HIV. Prompt administration of anti-HIV therapy reduces risk by about 80%. Mucous membrane and cutaneous exposures carry less risk. Recent efforts to reduce needlestick injuries in hospitals have reduced the risk to health care providers. Surgeons and other health care professionals who are infected with HIV or HCV pose a very small risk to their patients, although a number of outbreaks have been traced to surgeons who are HBV carriers; most have been HB(e)Ag-positive.

Gostin LO. A proposed national policy on health care workers living with HIV/AIDS and other blood-borne pathogens. *JAMA* 2000; 284:1965-1970.

Georgetown University Law Center, 600 New Jersey Ave NW, Washington, DC 20001-2075, USA. gostin@law.georgetown.edu

In 1991, scientific uncertainty about the risk of transmission of human immunodeficiency virus or hepatitis B virus (hepatitis B e antigen [HBeAg]-positive) led the Centers for Disease Control and Prevention to recommend that infected health care workers (HCWs) be reviewed by an expert panel and inform patients of their serologic status before engaging in exposure-prone procedures. The data demonstrate that risks of transmission in the health care setting are exceedingly low, suggesting that the national policy should be reformed. Implementation of the current national policy at the local level poses significant human rights burdens on HCWs, but does not improve patient safety. A new national policy should focus on the management of the workplace environment and injury prevention by creating a program to prevent blood-borne pathogen transmission; by encouraging infected HCWs to promote their own health and well-being; by discontinuing expert review panels and special restrictions for exposure-prone procedures, which stigmatize HCWs; by discontinuing mandatory disclosure of a HCW's infection status in low-level risk procedures; and by imposing practice restrictions to avert significant risks to patients. Inclusion of these principles would achieve high levels of patient safety without discrimination and invasion of privacy.

Gruppo Italiano per lo Studio delle modalita di Gestione Intraospedaliera dei Lavoratori con Malattie Pericolose per il Pubblico. Fitness for work and public health in hospital workers. *Med Lav* 2001; 92:295-306. [Article in Italian]

Transmission of infection to patients from health-care workers has recently become a topic in medical literature. The Centers for Disease Control (CDC) and the Society for Healthcare

Epidemiology of America (SHEA) in the US, and the UK Health Departments in the UK issued guidelines for professionals performing invasive procedures who may be infected with human immunodeficiency virus (HIV) or hepatitis B virus. The Italian Istituto Superiore di Sanita (ISS) in 1999 held a Consensus Conference advocating routine mandatory testing of health-care workers and a general restriction on performing exposure-prone invasive procedures. Nevertheless, the ISS failed to identify the institution that should be responsible for these controls. Harmful behavior of health-care workers comprises not only the risk of the impact of blood-borne infections but also the impact of, for example, depression, substance misuse, side effects of medication, family problems, fatigue or lack of insight. Time and effort is required for drafting, revising and refining policy in this area. The complexity of the matter hampers the standardisation of guidelines internationally: American and British policies are hardly enforceable in the Italian context. The Italian Study Committee for the Hospital Management of Workers affected by illnesses hazardous for the public (GIS GILMaPP) here discusses the legal and ethical issues surrounding the risk of "provider-to patient" transmission of disease. The policy dilemma involving patients' rights and sick workers should be addressed on a case-by-case basis. Strenuous efforts should be made to respect ethical and legal issues, such as informed consent, confidentiality, and to avoid discrimination. There is an urgent need for the medical community to find a broad consensus that would be acceptable for both the healthcare worker and the patient.

Gunson RN, Shouval D, Roggendorf M, Zaaijer H, Nicholas H, Holzmann H, De Schryver A, Reynders D, Connell J, Gerlich WH, Marinho RT, Tsantoulas D, Rigopoulou E, Rosenheim M, Valla D, Puro V, Struwe J, Tedder R, Aitken C, Alter M, Schalm SW, Carman WF, on behalf of the European Consensus Group. Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections in health care workers (HCWs): guidelines for prevention of transmission of HBV and HCV from HCW to patients. *J Clin Virol* 2003; 27:213-230. [Link to the full paper enclosed in Annex 1 of this document]

West of Scotland Specialist Virology Centre, Gartnavel General Hospital, 1053 Great Western Road, G12 OZA Glasgow, UK.

The transmission of viral hepatitis from health care workers (HCW) to patients is of worldwide concern. Since the introduction of serologic testing in the 1970s there have been over 45 reports of hepatitis B virus (HBV) transmission from HCW to patients, which have resulted in more than 400 infected patients. In addition there are six published reports of transmissions of hepatitis C virus (HCV) from HCW to patients resulting in the infection of 14 patients. Additional HCV cases are known of in the US and UK, but unpublished. At present the guidelines for preventing HCW to patient transmission of viral hepatitis vary greatly between countries. It was our aim to reach a Europe-wide consensus on this issue. In order to do this, experts in blood-borne infection, from 16 countries, were questioned on their national protocols. The replies given by participating countries formed the basis of a discussion document. This paper was then discussed at a meeting with each of the participating countries in order to reach a Europe-wide consensus on the identification of infected HCWs, protection of susceptible HCWs, management and treatment options for the infected HCW. The results of that process are discussed and recommendations formed. The guidelines produced aim to reduce the risk of transmission from infected HCWs to patients. The document is designed to complement existing guidelines or form the basis for the development of new guidelines. This guidance is applicable to all HCWs who perform EPP, whether newly appointed or already in post.

Hasselhorn HM, Hofmann F. Nosocomial hepatitis B virus, hepatitis C virus and HIV infections by infectious medical personnel. *Gesundheitswesen* 1998; 60:545-551. [Article in German]

Lehrstuhl für Arbeitsphysiologie, Arbeitsmedizin und Infektionsschutz, Bergische Universität, Gesamthochschule Wuppertal.

Transmission of Hepatitis-B virus (HBV), Hepatitis-C virus (HCV) and Human immunodeficiency virus (HIV) from medical personnel to patients has been observed by many authors. In Germany, however, neither this type of nosocomial infection nor preventive measures have been discussed to date. This review deals with 302 cases documented in national and international journals (HBV 289, HCV 6, HIV 7). Methods of prevention (especially in surgery) are discussed.

Hasselhorn HM, Hofmann F. Transmission of HBV, HCV and HIV by infectious medical personnel – presentation of an overview. *Chirurg* 2000; 71:389-395. [Article in German]

Lehrstuhl für Arbeitsphysiologie, Arbeitsmedizin und Infektionsschutz, Bergische Universität/Gesamthochschule, Wuppertal. hans-martin.hasselhorn@arbmed.uni-wuppertal.de

This report analyzes 46 cases of personnel-to-patient transmissions of hepatitis B (HB), hepatitis C (HC) and HIV in health care settings. Similar circumstances were found for transmission of HB (40 cases, 404 infected patients), HC (4 cases, 224 infected patients) and HIV (2 cases, 7 infected patients). Cases with the highest number of transmissions (one anesthesiologist with 217 HC transmissions, and one EEG technologist with 75 HB transmissions) were attributed to poor infection control practices. As long as infected health care workers (HCW) adhere to general infection control measures, a risk for transmission to patients exists only from infected surgeons who perform 'exposure-prone invasive procedures'. Whether changes in duties of infected HCW are necessary should be decided on an individual basis. Often, the infected personnel were assumed to have acquired the disease occupationally. Medical practices and devices bearing a risk of infection should constantly be reviewed with regard to risk for patients and personnel.

Head KC, Bradley-Springer L, Sklar D. The HIV-infected health care worker: legal, ethical, and scientific perspectives. *J Emerg Med* 1994; 12:95-102.

University of New Mexico School of Medicine, Albuquerque.

Emergency medical health care workers may face restrictions on their practices as state responses to federal mandates concerning human immunodeficiency virus (HIV) and hepatitis B virus (HBV) evolve. This article presents an analysis of legal, ethical, and scientific considerations for making decisions about the practices of HIV-infected health care workers (HCWs). A four-factor product analysis is proposed for risk assessment, and recommendations are developed related to decreasing the risk of HIV transmission in the health care setting while maintaining HCW rights.

Heptonstall J. Surgeons who test positive for hepatitis C should be transferred to low risk duties. *Rev Med Virol* 2000; 10:75-78.

16A Rochester Square, London NW1 9SA, UK.

HCV-infected surgeons may transmit HCV to patients during exposure-prone procedures. Current UK policy allows HCV-infected surgeons to practise unrestricted unless they have been associated with transmission, and, at present, surgeons are not routinely tested for HCV infection. The overall outcome for patients exposed to an HCV-infected surgeon may be worse than that for patients exposed to a surgeon who is an HBeAg negative carrier of HBV. However, because most acute HCV infections are anicteric, surgeon associated HCV transmission is less likely to be detected by surveillance. Surgeons have been observed to sustain intraoperative injuries in around 5% of procedures. If surgeons were required to report every intraoperative injury and to be tested to determine whether the patient could have been exposed to HCV, compliant surgeons would be tested for HCV at least annually. Investigations of HBV transmission, however, have suggested

that patients may be exposed to a surgeon's blood in as many as 1 in 5 procedures, and that much surgeon to patient transmission is the result of inapparent intraoperative exposure, which the surgeon does not recognise. Thus, requiring surgeons to report intraoperative injuries would not identify all those patients who might have been exposed to HCV, and, since no vaccine or prophylaxis is available, could not prevent infection. A more satisfactory alternative is regular testing of surgeons for HCV, coupled with restriction of practice of those found to be infected.

Hofmann F, Michaelis M, Rieger MA, Hasselhorn HM, Berthold H. Occupational medicine significance of hepatitis C in health care employees. *Gesundheitswesen* 1997; 59:452-460. [Article in German]

Bergische Universität/Gesamthochschule Wuppertal, Lehrstuhl für Arbeitsphysiologie, Arbeitsmedizin und Infektionsschutz.

Transmission of Hepatitis C virus (HCV) is similar to the one observed with hepatitis B virus. The most important route of infection in health care personnel is by needlestick injury. In the course of a literature review 44 publications on HCV prevalence or incidence among hospital employees were studied and an overall transmission incidence of 2.2% was found. As none of the publications dealt with the problem of chronic Hepatitis C, 245 persons with elevated transaminases occupied Freiburg University Hospital were tested for HCV antibodies. 3 out of 82 non-medical professionals and 19 out of 163 health care workers were anti HCV positive (RR = 3.22; $p < 0.05$). Charwomen in medical departments, nurses and dentists had a higher relative risk than physicians and technical assistants. As no HCV vaccine is available the only way of HCV-prevention is compliance with universal precautions.

Hofmann F, Kralj N, Beie M. Needle stick injuries in health care – frequency, causes und preventive strategies. *Gesundheitswesen* 2002; 64:259-266. [Article in German]

Arbeitsphysiologie, Arbeitsmedizin und Infektionsschutz, Fachbereich Sicherheitstechnik, Universität Wuppertal, Germany.

Healthcare workers (HCW) are at risk for infections with blood-borne pathogens – especially hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) – resulting from occupational blood-exposure through injuries with sharp instruments and needle sticks. Results of a study on the epidemiology of needle stick injuries (NSI) among HCW in two German hospitals indicate that 500,000 NSI occur annually in Germany. Most of these injuries occur during disposal of used syringes and "recapping". Administration of the post-exposure prophylaxis is recommended for HCW who are occupationally exposed to HBV (vaccine/immunoglobulin) and HIV (antiretroviral drugs) i.e. the immediately reporting of blood exposure is very important. Comprehensive programmes to prevent NSI – e.g. avoiding of recapping, use of disposal containers, surgical gloves and in particular safety devices - minimize a high cost of NSI due to the administration of PEP, developing of chronic hepatitis, cirrhosis and liver cancer.

Husa P, Husova L. What risk presents a health care worker infected with hepatitis B or C virus for his patients? *Vnitř Lek* 2004; 50:771-776. [Article in Czech]

Klinika Infekčních Chorob Lékařské Fakulty MU a FN, Brno.

Presently, there are no legislative standards in the Czech Republic banning health care workers with chronic hepatitis B virus (HBV) or hepatitis C virus (HCV) infection to do activities with a risk of the transmission of these viral infections to patients (surgeries and other invasive interventions). In a range of developed countries in the world individuals with chronic HBV infection, HBeAg positive

individuals, have a restricted access to the risk interventions. A quantitative assessment of viremia is important in the health care workers infected with HBeAg-minus mutant of the virus. There are particular critical viremia values set up (serum HBV DNA levels) which exceeding in the health care workers leads to banning them to do the risk interventions. In cases of proved transmission of hepatitis B infection from a health care worker to a patient, the ban of doing risk interventions is a rule. Transmission of HCV infection from a health care worker to a patient is much less probable so the individuals with chronic hepatitis C are usually not forbidden to make invasive procedures. An exception are cases when there was a patient infected by a particular health care worker in the past. There are various attitudes to the health care workers with chronic HBV or HCV infection in various countries of the world. A necessity to reach a definite consensus is necessary. The first step to it are common recommendations of 12 European countries and the USA which are repeatedly cited in the text. We can expect that these problems will have to be solved very soon in the Czech Republic too.

Ippolito G, Sagliocca L, D'Ubaldo C, Ruggiero A, Fabozzi OC, De Masi S, Petrosillo N. The knowledge, attitudes and practice in regard to the risk for occupational HIV infection in a group of gynecologists from 3 Italian regions. *Epidemiol Prev* 1995; 19:276-281. [Article in Italian]

Centro di Riferimento AIDS, Ospedale Lazzaro Spallanzani, Roma.

The risk of occupational infection by blood-borne pathogens has been well evaluated. However, a low perception of this risk among health care workers (HCWs) and a low compliance to infection control measures has been documented by several studies. During a meeting of gynecologists of Southern Italy, a survey of knowledge, attitudes and practices (K.A.P.) on HIV and other blood-borne viral infections was conducted among 143 obstetricians-gynecologists. 133 (93%) HCWs answered the questionnaire. 81% of them recalled almost one occupational exposure during their career and 54% almost two in the past year. Our data suggest a low knowledge about HIV and the other blood-borne viral infections and Universal Precautions (UP): only 16% of HCWs knew the rate of vertical transmission of HIV, less than 15% knew the rate of seroconversion after occupational exposure to HBV and HCV, and finally only 33% knew to which body fluids apply UP. Moreover, 93.7% of HCWs believed that HIV antibody screening of all patients is an effective strategy to reduce the risk of occupation HIV infection. More than 90% of gynecologists used to request HIV-antibodies to pregnant women, 21% after the first trimester. Although HCWs interviewed can not be considered representative of Italian gynecologists, our data suggest the need of an intensive training to increase gynecologists' knowledge about HIV, other blood-borne pathogens and the risk of occupational infections also in order to modify attitudes and practices.

Ippolito G, Puro V, Heptonstall J, Jagger J, De Carli G, Petrosillo N. Occupational human immunodeficiency virus infection in health care workers: worldwide cases through September 1997. *Clin Infect Dis* 1999; 28:365-383.

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The average estimated risk of human immunodeficiency virus (HIV) infection for health care workers following a percutaneous or mucous exposure is <0.5% in incidence studies, although a case-control study suggests it is much higher for highest-risk percutaneous exposure. To characterize exposures resulting in HIV transmission, we reviewed available data on occupational cases reported worldwide, identifying 94 documented and 170 possible cases. The majority of documented infections occurred in nurses, after contact with the blood of a patient with AIDS by means of percutaneous exposure, with a device placed in an artery or vein. High-exposure job categories, e.g., midwives and surgeons, are represented mostly among possible cases. Transmission occurred also through splashes, cuts, and skin contaminations, and in some cases despite postexposure prophylaxis with zidovudine. Health care

workers could benefit if these data were incorporated in educational programs designed to prevent occupational bloodborne infections.

Kelentey B, Balogh F. Hepatitis C virus infection and its dental implications. *Fogorv Sz* 2002; 95:149-154. [Article in Hungarian]

Debreceni Egyetem Orvos- es Egészségtudományi Centrum, Általános Orvostudományi Kar, Fogorvostudományi Intézet, Debrecen.

In the last two decades dentists and other dental workers have been called attention to the risk of infection with blood-borne pathogens by a few reports. Before hepatitis B vaccine became available in 1982, dentists and oral surgeons were reported to have a higher prevalence of hepatitis B Virus (HBV) than other health-care workers and the general population. The first cases of AIDS were recognised in 1981, and in 1988 dentists infected with Human Immunodeficiency Virus was already registered without any other potential risk factor except his occupation. Hepatitis C Virus (HCV), a positive stranded RNA virus was isolated for the first time from a chronically infected chimpanzee by a human VIII factor concentrate. Now HCV is regarded to be the cause of most cases of non-A-non-B hepatitis. Although the risk of HCV infection among health-care workers is lower than it was in the case of HBV infection, there is some evidence of occupational transmission of HCV. The lack of effective vaccine, the proportion of chronic infections, and the limited success of therapy emphasises the importance of the problem for the dentists in practice. In this report the authors surveyed the epidemiology, transmission, and nature of HCV infection, and suggested some possible connection between the virus and certain oral diseases. The authors expounded some general aspects of management of HCV-infected patients in the dental practice and underlined the importance of preventing occupational transmission.

Kosgeroğlu N, Ayrancı U, Vardareli E, Dincer S. Occupational exposure to hepatitis infection among Turkish nurses: frequency of needle exposure, sharps injuries and vaccination. *Epidemiol Infect* 2004; 132:27-33.

Department of School of Nursing, Osmangazi University, 26480 Meselik/Eskisehir, Turkey.

The aim of this study was to assess the demographic factors and pattern of injuries sustained by nurses, and to determine the occupational hazard of exposure to hepatitis B (HBV) and C (HCV) viruses among nurses. The study involved 906 hospital-based nurses working in three large hospitals. Between August 2002 and January 2003 a total of 595 practising nurses were accepted for inclusion. The results of questionnaires completed were collated and chi² and ratios were used for analysis. Of the 595 nurses, 111 (18.7%) had evidence of previous or current HBV infection and 32 (5.4%) of HCV infection. We found that 11.2% of the nurses who had worked for a period of between 0 and 5 years and 37.1% of those who had worked for a period between 16 and 20 years had evidence of HBV or HCV infection. Of the nurses working in surgical clinics, 59.4% had evidence of previous HBV or HCV infection and those working in hospital clinics had an 18.2% infection rate. Of the nurses occupationally exposed to HBV and HCV infections, 22.4% had received sharps injuries from apparatus and 63.6% had suffered needlestick exposure. Findings also showed 2.7% HBsAg positivity and 5.4% anti-HCV positivity. Of the 452 (76%) nurses who faced the occupational hazard of exposure to hepatitis infections, 27.7% (125/452) had not been vaccinated against HBV. Nurses working in our health-care sector are frequently exposed to occupational exposure for HBV and HCV infections. In order to prevent the infection of nurses with hepatitis, we advocate precautions and protection from sharps injuries. A programme of education, vaccination and post-exposure prophylaxis must be implemented.

Kralj N, Beie M, Hofmann F. Surgical gloves – how well do they protect against infections?. *Gesundheitswesen* 1999; 61:398-403. [Article in German]

Bergische Universität Gesamthochschule Wuppertal.

Health care workers (HCW) in surgery are at high risk for bloodborne infections (BBI) e.g. by hepatitis-B(HB)-, hepatitis-C(HC)- and HI-virus. On the other hand, infectious medical staff can cause nosocomial BBI in patients, too. Intact gloves provide an efficient barrier against BBI but glove perforations are common during several surgical procedures. A review of studies on glove perforations during different surgical operations was carried out with special regard to user, number and location of perforations, duration and kind of operation. We compared the results with the frequency of glove perforation during operations in 1938 single used gloves. They were collected after different surgical procedures in a department for general surgery and tested for perforation by 1-liter-water-filling method according to DIN 455/1. The product used during the period of this investigation was Sempermed sterile latex surgical glove. Most perforations were found on the index finger and thumb of the non-dominant hand. Duration of operation, role of the user (primary surgeon) and kind of operation are predictors for the incidence of glove perforations. Double gloving, endoscopic and no-touch techniques decrease the possibility of blood contact during operation. Indicator systems are useful for detection of the loss of glove integrity. Due to the high perforation rate found in this study glove change as a routine during surgical procedures should be discussed (e.g. every 30 minutes).

Kuo YH, Fabiani JN, Mohamed AS, Couetil JP, Levy M, Gutmann L, Carpentier AF, Belec L. Decreasing occupational risk related to blood-borne viruses in cardiovascular surgery in Paris, France. *Ann Thorac Surg* 1999; 68:2267-2272.

Laboratoire de Virologie, Service de Chirurgie Cardiovasculaire, Hôpital Broussais, Paris, France.

Surgeons face the risk of patient-to-physician transmission of blood-borne viruses. This risk is related to the seroprevalence of the viruses in the patient population. The seroprevalence of the human immunodeficiency virus, hepatitis B virus, and hepatitis C virus were determined in cardiovascular patients at Hôpital Broussais in Paris, France, over a 5-year period (1994 to 1998). Hepatitis C virus is the most prevalent virus in the patient population, whereas human immunodeficiency virus is the least frequent. The seroprevalence of hepatitis C virus and human immunodeficiency virus has decreased over time, whereas hepatitis B virus has remained constant. We apply the seroprevalence data to a mathematical model to estimate the occupational risk of seroconversion faced by surgeons over the length of their career. Our results show that the principal risk faced by the surgeon arises from hepatitis B virus and hepatitis C virus. The decreasing seroprevalence of the hepatitis C virus has resulted in a decrease in the occupational risk. The probability of becoming infected with a blood-borne virus over the career of the surgeon is notable. The greatest occupational risk to the surgeon is from the hepatitis viruses and not HIV.

Lazzari S, Allegranzi B, Concia E. Making hospitals safer: the need for a global strategy for infection control in health care settings. *World Hosp Health Serv* 2004; 40:32, 34, 36-42.

World Health Organization.

Healthcare Associated Infections (HAI) have a substantial impact on morbidity, mortality and health costs. At least 5 to 10% of patients admitted to acute care hospitals acquire an infection. Factors that promote HAI include underlying diseases and decreased patient immunity; invasive diagnostic and therapeutic techniques, the widespread antimicrobial resistance, lack of infection control measures and environmental hygiene. HAI are preventable and infection control programmes are cost-effective. Health care workers education, HAI surveillance, appropriate legislation and basic infection control measures are the essential elements of an infection control programme. A recent consultation on the 'Prevention and Control of HAI' identified the need for

an international strategy that would establish standards, procedures and methods for HAI surveillance, prevention and control and promote their implementation at national level.

Luu NS. Dental students with Hepatitis B: issues to be considered when defining policies. *J Dent Educ* 2004; 68:306-315.

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Carriers of the hepatitis B virus represent a significant proportion of the world's population. Since the existing policies on how to manage infected dental students lack clarity, the issues related to hepatitis B and a set of recommendations for the adoption of a new policy will be presented here. After considering the virology, epidemiology, prevention, and treatment of hepatitis B, the current health management policies will be reviewed, and ethical considerations, including the issue of disclosure, will be explored. The recommendations presented here for a new Canadian policy on infected health care workers include universal immunization, assessment of infectivity by measuring hepatitis B DNA levels, and disclosure to patients on the basis of scientific evidence. These recommendations are intended to aid Canadian dental schools, and dental schools in other nations, with students who are carriers of hepatitis B.

Mahoney FJ, Stewart K, Hu H, Coleman P, Alter MJ. Progress toward the elimination of hepatitis B virus transmission among health care workers in the United States. *Arch Intern Med* 1997; 157:2601-2605.

Hepatitis Branch, Centers for Disease Control and Prevention, Atlanta, GA 30333, USA.
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Hepatitis B virus (HBV) infection is a well-recognized occupational risk for health care workers (HCWs). Vaccination coverage, disease trends, and the need for booster doses after hepatitis B vaccination of adults have been the subject of intense study during the 15 years of the vaccine's availability. Vaccination coverage of HCWs was determined from a review of medical records on a sample of employees from 113 randomly selected hospitals. The number of HBV infections among HCWs and the general US population for 1983 through 1995 was estimated from national surveillance data. Studies on long-term protection after hepatitis B vaccination of adults were reviewed. A total of 2837 employee medical records were reviewed; 2532 employees (90%) were eligible to receive hepatitis B vaccine, and 66.5% of them (95% confidence interval, 61.9%-70.9%) had received 3 doses of hepatitis B vaccine. Vaccination coverage was highest (75%) for personnel with frequent exposure to infectious body fluids (phlebotomists, laboratory personnel, and nursing staff) and lowest (45%) for employees at low risk for exposure (dietary and clerical staff). The number of HBV infections among HCWs declined from 17,000 in 1983 to 400 in 1995. The 95% decline in incidence observed among HCWs is 1.5-fold greater than the reduction in incidence in the general US population. Studies on long-term protection demonstrate that vaccine-induced protection persists at least 11 years even when titers of antibody to hepatitis B surface antigen decline below detectable levels. Although a high percentage of HCWs have been fully vaccinated with hepatitis B vaccine, efforts need to be made to improve this coverage. There has been a dramatic decrease in the number of HBV infections among HCWs who are now at lower risk of HBV infection than the general US population. Vaccine-induced protection persists at least 11 years and booster doses are not needed at this time for adults who have responded to vaccination.

Maugat S, Astagneau P, Thibault V, Desruennes E, Baffoy N, Desenclos JC, Brucker G. Nosocomial risk factors of hepatitis C infection. A multicenter study in a hospital-based population. *Rev Epidemiol Sante Publique* 2003; 51:301-308. [Article in French]

Centre de Coordination de la Lutte contre l'Infection Nosocomiale pour l'Inter-région Nord, Paris, Institut Biomédical des Cordeliers, 15-21, rue de l'Ecole-de-Médecine, 75006 Paris.

Drug abuse and blood transfusion are well known risk factors for hepatitis C virus (HCV) infection. However, the route of transmission remains undetermined for 30% of HCV infections. The potential for nosocomial transmission of HCV in health care settings has been suggested but remains poorly estimated. The aim of the study was to assess the prevalence and to identify risk factors for hepatitis C virus (HCV) infection in hospitalized patients frequently exposed to invasive procedures. A multi-center sero-prevalence study was conducted in hospitalized patients who underwent invasive procedures in interventional radiology wards in 6 University hospitals in Paris between 1998 and 1999. Each patient presenting in the ward was consecutively interviewed by a medical investigator. Data were collected on a standardized questionnaire including items on socio-demographic characteristics, past exposure to intravenous drug use, blood transfusions, underlying diseases and type and number of previous invasive procedures. Before procedure, HCV antibody testing (ELISA) was performed in all patients after informed consent. In all HCV-positive patients, HCV viremia was detected using polymerase chain reaction. Overall, 91 of 944 (9.7%) patients were HCV-positive, of whom 90% had positive viremia and 10 were identified HCV positive by the screening. HCV prevalence decreased with age and ranged from 4.5% to 22% according to center. Logistic regression analysis showed that intravenous drug use, history of blood transfusions and endoscopy were found as independent risk factors for HCV infection (odds ratio [CI95%]: 77.3 [23.3-256.3], 4.7 [2.7-8.2] et 1.20 [1.01-1.44]). No other risk factor for nosocomial or iatrogenic transmission was identified. The results suggest that, except for blood transfusions, other healthcare-related procedures may partly explain HCV transmission. This emphasizes the need to reinforce compliance with standard precautions of hygiene.

McGaw T, Peters E, Holton D. Dental Students with hepatitis B e antigen: a survey of Canadian dental schools. *J Can Dent Assoc* 2000; 66:562-563.

Faculty of Dentistry, University of Alberta, Edmonton, Alberta, Canada.

Health care workers who are e-antigen-positive carriers of hepatitis B virus have become a significant focus of concern in the development of public health policy. In cases of needle-stick injury, the risk of transmission of HBV has been estimated at 60-fold greater if the carrier is positive for e antigen than if the carrier does not have the e antigen. Debate continues regarding proposed public health policies to restrict e-antigen-positive health care workers from performing "exposure-prone procedures". Given the potentially greater risk of disease transmission to patients and the potential career implications for infected students, dental schools must responsibly address the issue of dental students and dental school applicants who have the hepatitis B e antigen. This paper reviews the controversies surrounding this issue and reports a survey of Canadian dental schools.

Mele A, Ippolito G, Craxi A, Coppola RC, Petrosillo N, Piazza M, Puro V, Rizzetto M, Saggiocca L, Taliani G, Zanetti A, Barni M, Bianco E, Bollero E, Cargnel A, Cattaneo M, Chiaramonte M, Conti E, D'Amelio R, De Stefano DM, Di Giulio S, Franco E, Gallo G, Levrero M, Mannella E, Merli S, Milazzo F, Moiraghi A, Polillo R, Prati D, Ragni P, Sagnelli E, Scognamiglio P, Sommella L, Stroffolini T, Terrana T, Tosolini G, Vitiello E, Zanesco L, Ziparo V, Maffei C, Moro ML, Satolli R, Traversa G. Risk management of HBsAg or anti-HCV positive healthcare workers in hospital. *Dig Liver Dis* 2001; 33:795-802.

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Recommendations are made for controlling the transmission of the hepatitis B and hepatitis C viruses

from healthcare workers to patients. These recommendations were based both on the literature and on experts' opinions, obtained during a Consensus Conference. The quality of the published information and of the experts' opinions was classified into 6 levels, based on the source of the information. The recommendations can be summarised as follows: all healthcare workers must undergo hepatitis B virus vaccination and adopt the standard measures for infection control in hospitals; healthcare workers who directly perform invasive procedures must undergo serological testing and the evaluation of markers of viral infection. Those found to be positive for: 1) HBsAg and HBeAg, 2) HBsAg and hepatitis B virus DNA, or 3) anti-hepatitis C virus and hepatitis C virus RNA must abstain from directly performing invasive procedures; no other limitations in their activities are necessary. Infected healthcare workers are urged to inform their patients of their infectious status, although this is left to the discretion of the healthcare worker; whose privacy is guaranteed by law. If exposure to hepatitis B virus occurs, the healthcare worker must undergo prophylaxis with specific immunoglobulins, in addition to vaccination.

Moloughney BW. Transmission and postexposure management of bloodborne virus infections in the health care setting: where are we now? *CMAJ* 2001; 165:445-451.

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There has been considerable debate about the need for mandatory serologic testing of individuals who are the source of bloodborne pathogen exposures in health care and other occupational settings. The transmission of hepatitis B (HBV), hepatitis C (HCV) and HIV between patients and health care workers (HCWs) is related to the frequency of exposures capable of allowing transmission, the prevalence of disease in the source populations, the risk of transmission given exposure to an infected source and the effectiveness of postexposure management. Transmission of HBV from patients to HCWs has been substantially reduced by vaccination and universal precautions. The transmission of HCV and HIV to HCWs does occur, although postexposure prophylaxis (PEP) is available to reduce the risk of HIV transmission. Transmission of bloodborne pathogens from infected HCWs to patients has also been documented. Policy-making concerning the mandatory postexposure testing of patients who may be the source of infection must weigh the relative infrequency of patients' refusals to be tested and the consequences for PEP recommendations with the ethical and legal considerations of bypassing informed consent and mandating testing. Mandatory postexposure testing of HCWs who are the source of infection will have a limited impact on reducing transmission because of the lack of recognition and reporting of exposures. Comprehensive approaches have been recommended to reduce the risk of transmission of bloodborne virus infections.

Norsayani MY, Noor Hassim I. Study on incidence of needle stick injury and factors associated with this problem among medical students. *J Occup Health* 2003; 45:172-178.

Department of Occupational Safety and Health, Kuantan, Pahang, Malaysia.

Medical students face the threat of needle stick injury with the consequent risk of acquiring blood-borne infection by pathogens such as HIV, Hepatitis B and Hepatitis C while performing their clinical activities in the hospitals. A cross-sectional study was conducted among 417 final year medical students from Universiti Kebangsaan Malaysia (UKM), University Malaya (UM) and Universiti Putra Malaysia (UPM). The aims of the study were to determine the incidence of cases and episodes of needle stick injury among them in the past year. This study was also done to find out the factors that might be associated with the occurrence of this problem. The factors were sociodemographic factors, duration of exposure, level of knowledge of blood-borne diseases and Universal Precaution, perception of risk of blood-borne diseases and level of practice of Universal Precaution. The incidence of needle stick injury among medical students was 14.1% (59 cases). The total number of episodes of needle stick injury was 87 and the incidence of episodes among respondents was high i.e. 20.9%. The highest incidence of episodes of needle stick injury occurred in Obstetric & Gynaecology postings, followed by Medicine and Surgery. For clinical procedures, venepuncture had the highest incidence followed by setting up

drips and giving parenteral injections. The results showed the students who had needle stick injury (cases) had lower scores in the practice of Universal Precautions than non-cases ($p < 0.05$). There was a significant association between the level of practice of Universal Precautions and the number of episodes of needle stick injury, i.e. the higher the score for the practice of Universal Precautions, the lower the number of episodes ($\beta = -2.03 \times 10^{-2}$, $p < 0.05$). This study showed that medical students are at risk of needle stick injury and blood-borne infections during their clinical activities while performing procedures on patients especially for those who were poor at practising Universal Precautions. Therefore some preventive measures should be taken by the management of the universities and medical students to avoid the occurrence of these problems.

Patterson JM, Novak CB, Mackinnon SE, Ellis RA. Needlestick injuries among medical students. *Am J Infect Control* 2003; 31:226-230.

Division of Plastic and Reconstructive Surgery, Washington University School of Medicine, St. Louis, Missouri, USA.

Concern about occupational exposure to bloodborne pathogens exists, and medical students, who lack in experience in patient care and surgical technique, may be at an increased exposure risk. This prospective cohort study evaluated needlestick injuries and practices regarding the use of protective strategies against bloodborne pathogens in medical students. A questionnaire was developed and sent to 224 medical students. Of 224 students, 146 students (64%) returned questionnaires. Forty-three students (30%) reported needlestick injuries that most commonly occurred in the operating room; 86% of students reported always using double gloves in the operating room; 90% reported always wearing eye protection, and all but one student had been vaccinated against hepatitis B. A concern about contracting a bloodborne pathogen through work was noted in 125 students, although they usually reported that this concern only slightly influenced their decision regarding a career subspecialty. Medical students have a high risk for needlestick injuries, and attention should be directed to protection strategies against bloodborne pathogens.

Peplonska B, Szeszenia-Dabrowska N. Epidemiologic analysis of infectious diseases identified as occupational diseases in Poland in the years 1998-2002. *Med Pr* 2003; 54:521-528. [Article in Polish]

Zakładu Epidemiologii Środowiskowej, Instytutu Medycyny Pracy im. prof. J. Nofera w Łodzi.
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In spite of some unquestionable positive tendencies observed over the last few years, occupational infectious diseases still pose a serious problem in Poland. During the last thirty years overall as many as 41,000 cases of occupational contagious and invasive diseases were identified. The analysis covered all cases of occupational diseases, reported by sanitary and hygiene stations on a specially designed form, to the Register of Occupational Diseases in Poland over the years 1998-2002. The analyses were performed by the disease entities, the job name, and activity sections classified according to Polish Classification of the Economy, and also by voivodeships. Crude numbers of the diseases reported and rates are presented. For the calculation of incidence rates, the statistics of the national economy employees provided by the Central Statistical Office was applied. In total, 4153 cases of infectious diseases were reported to the Register in 1998-2002. Viral hepatitis, tuberculosis, brucellosis and Lyme borelliosis covered (94.3%) of all cases. The analyzed diseases were identified mostly in two economic activity sections: Health and Social Works and Agriculture, Forestry and Hunting. About 63% of all cases were recorded in health care personnel, mostly in nurses, 1372 cases (33%), physicians (9.9%), laboratory workers (8.1%), orderlies (6.5%), dentists, dental assistants and dental technicians (1.9%). A substantial number of infectious diseases were recorded in forestry workers (16.2), mostly foresters (10.9%). The highest rates of occupational diseases were found in the Podlaskie, Mazowieckie, Wielkopolskie, Pomorskie and Slaskie voivodships. At present, Lyme borelliosis and viral hepatitis pose the most serious problem of all infectious occupational diseases in Poland. Despite extensive programs

of vaccination against viral hepatitis B, implemented since 1989, this pathology has not as yet been fully eradicated. It can be predicted that in the near future, viral hepatitis C and Lyme borelliosis will mostly influence the epidemiology of infectious occupational diseases in Poland. This situation will continue until relevant vaccines are developed and used in high risk occupational groups.

Petrosillo N, Puro V, De Carli G, Ippolito G, on behalf of the *Studio Italiano Rischio Occupazionale da HIV (SIROH)*. Risks faced by laboratory workers in the AIDS era. *J Biol Regul Homeost Agents* 2001; 15:243-248.

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Laboratory workers are at occupational risk of exposure to microorganisms that cause a wide variety of diseases, from inapparent to life-threatening ones. Principal routes of transmission include percutaneous and permucosal inoculation (comprising clinical inapparent cutaneous or mucosal exposure to blood or blood products), inhalation, and ingestion. The appearance of the Acquired Immunodeficiency Syndrome (AIDS) epidemic and the first reports of occupational Human Immunodeficiency Virus (HIV) infections in health care workers resulted in high anxiety among laboratory workers. Indeed, 21% of worldwide documented cases of occupational HIV infection occurred among laboratory workers. Research laboratories pose the highest risk of infection. Safe methods for managing infectious agents ("containment") in the laboratory setting include laboratory practice and technique, safety equipment, and facility design. Infection control in the laboratory setting should take into account adherence to guidelines (biosafety levels), education and training, and the development of safety products designed to reduce the risk of exposure.

Prati F, Lodi V, D'Elia V, Truffelli D, Lalic H, Raffi GB. Screening of health care workers for hepatitis B virus and hepatitis C virus: criteria for fitness for work. *Arh Hig Rada Toksikol* 2000; 51:19-26.

Unit of Occupational Medicine, S. Orsola-Malpighi Polyclinic, Bologna, Italy.

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.

Proietti L, Fantauzzo R, Longo B, Malaguarnera M, Trizzino M, Duscio D. Viral hepatitis B among the health care workers. Experience at a health facility in Eastern Sicily. *Recenti Prog Med* 2004; 95:196-199. [Article in Italian]

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The aim was to estimate the prevalence of HBV positivity considering the qualifications of workers exposed to biological risk in a hospital in Eastern Sicily. 1800 people exposed to biological risk: surgeons, physicians, laboratory workers, rehabilitation therapists, midwives, biologists and technicians underwent a test for HBV. 25 workers resulted positive to HBsAg, that is 1.3 % of the total population examined; the professional categories mostly resulting positive were the auxiliaries with a 2% prevalence, and professional nurses with 1.5%, followed by surgeons resulting 1% positive. In the positive group of HBsAg, 16 workers, equal to 64%, were also positive to the viral replication test. Regarding the antibody coverage, the distribution among workers evidenced that 30.4% of the nurses was vaccinated, against 15% of the surgeons and 11.7% of the physicians. 6.4% of the total population studied had a natural immunity, with an absolute prevalence in the auxiliary group-OTA: 9.3%, followed by the professional nurses with a 7.8% positivity. It is shown that the health care workers do not have a sufficient perception of the biological risk, so it is necessary to adopt new strategies to promote the vaccination and increase formation activities and general information.

Puro V, D'Ubaldo C, De Carli G, Petrosillo N, Ippolito G, on behalf of the Gruppo Studio Italiano sul Rischio di Infezione Occupazionale da HIV. HIV occupational infections in gynecology: risk assessment, post-exposure management, and drug prophylaxis. *Minerva Ginecol* 2000; 52(Suppl 1):25-33. [Article in Italian]

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The average risk of HIV infection after percutaneous exposure to HIV-infected blood is 0.3%. Higher risk factors of HIV transmission to health care worker after percutaneous exposure are deep injury, visible blood on device, procedure involving needle in artery or vein and terminal: illness in source patient or high viremia. It has been shown that post-exposure use of zidovudine diminishes risk of transmission. In Italy 5 occupational HIV infections in health care workers have been documented. Although prevention of exposure to blood is the best method to avoid occupational risk of HIV infection, nevertheless an adequate management of blood-borne exposure is essential for achieving a safer health care workplace. In this paper we reviewed the modality and the frequency of blood-borne exposures in Italian health care setting, focusing on in obstetric and gynaecology. Finally, Italian recommendation for the management of blood-borne exposure, including post-exposure chemoprophylaxis are discussed.

Puro V, De Carli G, Petrosillo N, Ippolito G, on behalf of the Studio Italiano Rischio Occupazionale da HIV Group. Risk of exposure to bloodborne infection for Italian healthcare workers, by job category and work area. *Infect Control Hosp Epidemiol* 2001; 22:206-210.

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To analyze the rate of occupational exposure to blood and body fluids from all sources and specifically from human immunodeficiency virus (HIV)-infected sources among hospital workers, by job category and work area. Multicenter prospective study. Occupational exposure data (numerator) and full-time equivalents ([FTEs] denominator) were collected over a 5-year period (1994-1998) and analyzed. 18 Italian urban acute-care hospitals with infectious disease units. A total of 10,988 percutaneous and 3,361 mucocutaneous exposures were reported. The highest rate of percutaneous exposure per 100 FTEs was observed among general surgery (11%) and general medicine (10.6%) nurses, the lowest among infectious diseases (1.1%) and laboratory (1%) physicians. The highest rates of mucocutaneous exposure were observed among midwives (5.3%)

and dialysis nurses (4.7%), the lowest among pathologists (0%). Inadequate sharps disposal and the prevalence of sharps in the working unit influence the risk to housekeepers. The highest combined HIV exposure rates were observed among nurses (7.8%) and physicians (1.9%) working in infectious disease units. The highest rates of high-risk percutaneous exposures per 100 FTE were again observed in nurses regardless of work area, but this risk was higher in medical areas than in surgery (odds ratio, 2.1; 95% confidence interval, 1.9-2.5; $P < 0.0001$). Exposure risk is related to job tasks, as well as to the type and complexity of care provided in different areas, whereas HIV exposure risk mainly relates to the prevalence of HIV-infected patients in a specific area. The number of accident-prone procedures, especially those involving the use of hollow-bore needles, performed by job category influence the rate of exposure with high risk of infection. Job- and area-specific exposure rates permit monitoring of the effectiveness of targeted interventions and control measures over time.

Puro V, De Carli G, Scognamiglio P, Porcasi R, Ippolito G, on behalf of the *Studio Italiano Rischio Occupazionale HIV*. Risk of HIV and other blood-borne infections in the cardiac setting: patient-to-provider and provider-to-patient transmission. *Ann N Y Acad Sci* 2001; 946:291-309.

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Health care workers (HCWs) face a well-recognized risk of acquiring blood-borne pathogens in their workplace, in particular hepatitis B and C viruses (HBV/HCV) and human immunodeficiency virus (HIV). Additionally, infected HCWs performing invasive exposure-prone procedures, including in the cardiac setting, represent a potential risk for patients. An increasing number of infected persons could need specific cardiac diagnostic procedures and surgical treatment in the future, regardless of their sex or age. The risk of acquiring HIV, HCV, HBV infection after a single at-risk exposure averages 0.5%, and 1-2%, and 4-30%, respectively. The frequency of percutaneous exposure ranges from 1 to 15 per 100 surgical interventions, with cardiothoracic surgery reporting the highest rates of exposures; mucocutaneous contamination by blood-splash occurs in 50% of cardiothoracic operations. In the Italian Surveillance (SIROH), a total of 987 percutaneous and 255 mucocutaneous exposures were reported in the cardiac setting; most occurred in cardiology units (46%), and in cardiovascular surgery (44%). Overall, 257 source patients were anti-HCV+, 54 HBsAg+, and 14 HIV+. No seroconversions were observed. In the literature, 14 outbreaks were reported documenting transmission of HBV from 12 infected HCWs to 107 patients, and 2 cases of HCV to 6 patients, during cardiothoracic surgery, especially related to sternotomy and its suturing. The transmission rate was estimated to be 5% to 13% for HBV, and 0.36% to 2.25% for HCV. Strategies in risk reduction include adequate surveillance, education, effective sharps disposal, personal protective equipment, safety devices, and innovative technology-based intraoperative procedures.

Puro V, Scognamiglio P, Ippolito G. HIV, HBV, or HDV transmission from infected health care workers to patients. *Med Lav* 2003; 94:556-568. [Article in Italian]

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The report of transmission of viruses, such as human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV), from health care workers (HCWs) to patient has alarmed public opinion with potential repercussions on health organisation. To review available information on cases of transmission of HIV, HBV and HCV from HCW to patient reported worldwide. A literature review was conducted with a Medline search of English language full papers, using the following key terms: HIV, HBV, HCV; healthcare workers, occupational and hospital transmission, outbreak, look back investigation. The Medline search was supplemented by

a manual search using reference lists of published studies and proceedings of meetings, including some personal communications already reported in a previous review. Since 1972, 50 outbreaks have been reported in which 48 HBV infected HCWs (39 surgeons) transmitted the infection to approximately 500 persons. To date, 3 cases of transmission of HIV and 8 confirmed cases of transmission of HCV (to a total of 18 patients) from infected healthcare workers to patients have been reported. The factors influencing the transmissibility of infection include: type of procedures performed, surgical techniques used, compliance with infection control precautions, the clinical status and viral burden of the infected HCW and susceptibility of the patient to infection. The risk of transmission of HIV, HBV and HCV from HCWs to patients is associated primarily with certain types of surgical specialties (obstetrics and gynaecology, orthopaedics, cardiothoracic surgery) and surgical procedures that can expose the patient to the blood of the HCW: exposure-prone procedures. Since the early 90's industrialized countries have issued recommendations for preventing transmission of blood-borne pathogens to patients during "exposure prone" invasive procedures. With regard to HBV there is common consent to restricting or excluding HCWs tested HBeAg positive or HBV DNA-positive from performing exposure-prone procedures, while there are still some discrepancies in the different countries for dealing with HCV-infected personnel and in some cases also for those with HIV infection. Efforts to prevent surgeon-to-patient transmission of blood-borne infections should focus not only on ascertaining the infection status of the HCW but principally on eliminating the cause of blood-borne exposures, for example by the use of blunt suture needles, improved instruments, reinforced gloves, changes in surgical technique and the use of less invasive alternative procedures. These measures should be implemented in order to minimize the risk of blood exposure and consequently of virus transmission both to and from HCW to patients.

Puro V, Cicalini S, De Carli G, Soldani F, Antunes F, Balslev U, Begovac J, Bernasconi E, Boaventura JL, Marti MC, Civljak R, Evans B, Francioli P, Genasi F, Larsen C, Lot F, Lunding S, Marcus U, Pereira AA, Thomas T, Schonwald S, Ippolito G. Post-exposure prophylaxis of HIV infection in healthcare workers: recommendations for the European setting. *Eur J Epidemiol* 2004; 19:577-584.

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The European Commission funded a project for the standardisation of the management of occupational exposures to HIV/blood-borne infections and antiretroviral post-exposure prophylaxis (PEP) in Europe. Within this project, the following recommendations and rationale were formulated by experts representative of participating countries. Based on assessment of the exposure, material, and source characteristics, PEP should be started as soon as possible with any triple combination of antiretrovirals approved for the treatment of HIV-infected patients; initiation is discouraged after 72 hours. Rapid HIV testing of the source could reduce inappropriate PEP. HIV testing should be performed at baseline, 4, 12, and 24 weeks, with additional clinical and laboratory monitoring of adverse reactions and potential toxicity at week 1 and 2. HIV resistance tests in the source and direct virus assays in the exposed HCW are not recommended routinely. These easy-to-use recommendations seek to maximise PEP effect while minimising its toxicity and inappropriate use.

Puro V, Cicalini S, De Carli G, Soldani F, Ippolito G, on behalf of the European Occupational Post-Exposure Prophylaxis Study Group. Towards a standard HIV post exposure prophylaxis for healthcare workers in Europe. *Euro Surveill* 2004; 9:3-4.

INMI L. Spallanzani, Roma, Italy.

Antiretroviral prophylaxis (PEP) after occupational exposure to HIV in healthcare workers

(HCWs) is used across Europe, but not in a consistent manner. A panel of experts, funded by the European Commission, formulated a set of recommendations. When it has been decided that the characteristics of the exposure indicate the initiation of PEP, PEP should be started as soon as possible; initiation is discouraged after 72 hours. PEP should be initiated routinely with any triple combination of antiretrovirals approved for the treatment of HIV-infected patients; a two class regimen is to be preferred. The source patient's treatment history should be sought. Counselling, psychological support, HIV testing and clinical evaluation should be performed at baseline, at 6-8 weeks, and at least 6 months post exposure. Additional clinical and laboratory monitoring at one and two weeks should be considered, as adherence with and tolerance of the regimen can highlight adverse reactions and potential toxicity. Routine HIV resistance tests in the source patient, and direct virus assays in the exposed HCW are not recommended.

Ramsay ME, on behalf of the Advisory Committee on Blood Borne Viruses. Guidance on the investigation and management of occupational exposure to hepatitis C. *PHLS Commun Dis Public Health* 1999; 2:258-262.

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This document updates previous PHLS guidance on the risks and management of occupational exposure to hepatitis C. In line with recent guidance from the UK Health Departments, the PHLS now recommends that all source patients, subject to appropriate consent, should be tested for evidence of hepatitis C infection. A baseline serum should be obtained from the exposed health care worker and stored for at least two years. Health care workers exposed to known infected sources should be followed up at six, 12, and 24 weeks after exposure. Serum taken at six and 12 weeks should be tested for hepatitis C virus (HCV) RNA and serum taken at 12 and 24 weeks for anti-HCV. Health care workers exposed to a source believed not to be infected do not require active follow up for hepatitis C unless requested or if they develop symptoms or signs of liver disease. Management of personnel exposed to a source whose hepatitis C status is unknown or a source unavailable for testing will depend upon a risk assessment by a designated doctor. Health care workers who are found to be positive for HCV RNA or antibody to hepatitis C should be referred to an appropriate consultant for consideration of early treatment.

Richard VS, Kenneth J, Cherian T, Chandy GM. Preventing transmission of blood-borne pathogens to health care workers. *Natl Med J India* 2000; 13:82-85.

Christian Medical College, Tamil Nadu, India.

Health care workers are exposed to blood-borne pathogens, mainly the human immunodeficiency virus, hepatitis B virus and hepatitis C virus. Infection by these viruses leads to chronic or fatal illnesses which are expensive and difficult to treat. Individuals who harbour these viruses may be asymptomatic and hence all patients should be assumed to harbour a blood-borne pathogen. All health care workers should take adequate precautions (a set of guidelines termed 'universal precautions'). Methods of preventing transmission of blood-borne pathogens include vaccination against hepatitis B virus, following universal precautions and taking adequate post-exposure prophylaxis.

Rockstroh JK. Management of hepatitis B and C in HIV co-infected patients. *J Acquir Immune Defic Syndr* 2003; 34(Suppl 1):S59-S65.

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Morbidity and mortality from co-morbid hepatitis B (HBV) and hepatitis C (HCV) infection in HIV co-infected patients are increasing; hence, the management of HIV and HBV or HCV co-infected individuals is now one of the most challenging clinical management issues. Less than 10% of all HIV-infected patients show markers of chronic HBV infection. Hepatitis B in HIV co-infected patients is characterized by high levels of HBV replication and a high risk for cirrhosis. Treatment of HBV with lamivudine (3TC) remains the best treatment option at this time. Initial results of studies of adefovir or tenofovir, however, demonstrate good antiretroviral efficacy, even in patients with 3TC-resistant HBV. In Europe, it is estimated that approximately 30% of HIV-infected individuals are co-infected with HCV. HIV accelerates HCV liver disease especially when HIV-associated immune deficiency progresses. Within 10-15 years of initial HCV infection, 15-25% of patients who are co-infected with HIV develop cirrhosis compared with 2-6% of patients without HIV infection. With the introduction of pegylated interferon in combination with ribavirin, promising treatment options have become available for HIV/HCV co-infected patients leading to early virological response rates of approximately 50%. The high number of HIV/HCV and HIV/HBV co-infections, as well as the much more unfavorable course of HBV and HCV in these patients, underlines the need to establish treatment strategies for HBV and HCV in HIV co-infected individuals.

Ross RS, Viazov S, Roggendorf M. Risk of hepatitis C transmission from infected medical staff to patients: model-based calculations for surgical settings. *Arch Intern Med* 2000; 160:2313-2316.

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Concern is increasing in both the medical community and among the general public about the possible transmission of hepatitis C virus (HCV) from infected health care workers to their patients. Until now, no reliable estimates for the risk of such transmission exist. The objective was to estimate the probability of HCV transmission from a surgeon to a susceptible patient during invasive procedures. A model consisting of 4 probabilities was used: (A) the probability that the surgeon is infected with HCV, (B) the probability that the surgeon might contract percutaneous injuries, (C) the probability that an HCV-contaminated instrument will recontact the wound, and (D) the probability of HCV transmission after exposure. Values for the calculations were taken from published studies. When the surgeon's HCV status is unknown, the risk of HCV transmission during a single operation is 0.00018% +/- 0.00002% (mean +/- SD). If the surgeon is HCV RNA positive, this risk equals 0.014% +/- 0.002%. The likelihoods of transmission in at least 1 of 5000 invasive procedures performed by a surgeon during 10 years are 0.9% +/- 0.1% (HCV status unknown) and 50.3% +/- 4.8% (HCV RNA positive), respectively. The calculated risks for HCV transmission from a surgeon to a susceptible patient during a single invasive procedure are comparable to the chance of acquiring HCV by receiving a blood transfusion. These figures could provide a basis for further discussions on this controversial subject and might also be relevant for future recommendations on the management of HCV-infected health care workers.

Ross RS, Viazov S, Roggendorf M. Phylogenetic analysis indicates transmission of hepatitis C virus from an infected orthopedic surgeon to patient. *J Med Virol* 2002; 66:461-467.

Institute of Virology, National Reference Centre for Hepatitis C, University of Essen, Essen, Germany. stefan.ross@uni-essen.de

During recent years, a controversial discussion has emerged in the medical community on the real number and possible public health implications of hepatitis C virus (HCV) transmissions from infected medical staff to susceptible patients. We report here on molecular virological and epidemiological analyses involving 229 patients who underwent exposure-prone operations by an HCV-infected orthopedic surgeon. Of the 229 individuals affected, 207 could be tested. Three

were positive for HCV antibodies. Molecular and epidemiological investigation revealed that two of them were not infected by the surgeon. The third patient, a 50-year-old man, underwent complicated total hip arthroplasty with trochanteric osteotomy. He harbored an HCV 2b isolate that in phylogenetic analysis of the hypervariable region 1 (HVR 1) was closely related to the HCV strain recovered from the infected surgeon, indicating that HCV-provider-to-patient transmission occurred intraoperatively. To our knowledge, this is the first documented case of HCV transmission by an orthopedic surgeon. The recorded transmission rate of 0.48% (95% confidence interval: 0.09-2.68%) was within the same range reported previously for the spread of hepatitis B virus during orthopedic procedures. Since the result of our investigation sustains the notion that patients may contract HCV from infected health-care workers during exposure-prone procedures, a series of further retrospective exercises is needed to assess more precisely the risk of HCV provider-to-patient transmission and to delineate from these studies recommendations for the guidance and management of HCV-infected medical personnel.

Ross RS, Viazov S, Thormahlen M, Bartz L, Tamm J, Rautenberg P, Roggendorf M, Deister A. Risk of hepatitis C virus transmission from an infected gynecologist to patients: results of a 7-year retrospective investigation. *Arch Intern Med* 2002; 162:805-810.

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Currently, it is not known how often hepatitis C virus (HCV) is transmitted from infected health care workers to patients during medical care. In the present investigation, we tried to determine the rate of provider-to-patient transmission of HCV among former patients of an HCV-positive gynecologist after it was proven that he infected one of his patients with HCV during a cesarean section. All 2907 women who had been operated on by the HCV-positive gynecologist between July 1993 and March 2000 were notified about potential exposure and were offered free counseling and testing. The crucial differentiation between HCV transmissions caused by the gynecologist and infections contracted from other sources was achieved by epidemiological investigations, nucleotide sequencing, and phylogenetic analysis. Of the 2907 women affected, 78.6% could be screened for markers of HCV infection. Seven of these former patients were found to have HCV. Phylogenetic analysis of HCV sequences from the gynecologist and the women did not indicate that the virus strains were linked. Therefore, no further iatrogenic HCV infections caused by the gynecologist could be detected. The resulting overall HCV transmission rate was 0.04% (1 per 2286; 95% confidence interval, 0.008%-0.25%). To our knowledge, this is the largest retrospective investigation of the risk of provider-to-patient transmission of HCV conducted so far. Our findings support the notion that such transmissions are relatively rare events and might provide a basis for future recommendations on the management of HCV-infected health care workers.

Schalm SW, van Wijngaarden JK. Doctor to patient transmission of viral hepatitis B : is it a problem, is there a solution? *J Viral Hepatitis* 2000; 7:245-249.

Department of Hepatogastroenterology, University Hospital Rotterdam, The Netherlands.

It is well-established that hepatitis B may be transmitted from surgeons to their patients. Clear strategies are needed to reduce the risk of transmission whilst not discriminating unnecessarily against surgeons who may pose no risks to their patients. This review outlines the current position and provides a blueprint for action that may reduce the risks to patients whilst minimizing the impact on practising surgeons.

Sepkowitz KA. Occupationally acquired infections in health care workers. Part I. *Ann Intern Med* 1996; 125:826-834.

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Health care workers are at occupational risk for a vast array of infections that cause substantial illness and occasional deaths. Despite this, few studies have examined the incidence, prevalence, or exposure-associated rates of infection or have considered infection-specific interventions recommended to maintain worker safety. The objective was to review all recent reports of occupationally acquired infection in health care workers in order to characterize the type and frequency of infections, the recommended interventions, and the costs of protecting workers. Part I of this two-part review focuses on the historical and ethical aspects of the problem and reviews data on infections caused by specific airborne organisms. Data sources: A Medline search and examination of infectious disease and infection control journals. Data selection: all English-language articles and meeting abstracts published between January 1983 and February 1996 related to occupationally acquired infections among health care workers were reviewed. Outbreak- and non-outbreak-associated incidence and prevalence rates were derived, as were costs to prevent, control, and treat infections in health care workers. Data synthesis: more than 15 airborne infections have been transmitted to health care workers, including tuberculosis, varicella, measles, influenza, and respiratory syncytial virus infection. Outbreak-associated attack rates range from 15% to 40%. Most occupational transmission is associated with violation of one or more of three basic principles of infection control: handwashing, vaccination of health care workers, and prompt placement of infectious patients into appropriate isolation. The risk for occupationally acquired infection is an unavoidable part of daily patient care. Infections that result from airborne transmission of organisms cause substantial illness and occasional deaths among health care workers. Further studies are needed to identify new infection control strategies to 1) improve protection of health care workers and 2) enhance compliance with established approaches. As health care is being reformed, the risk for and cost of occupationally acquired infection must be considered.

Sepkowitz KA. Occupationally acquired infections in health care workers. Part II. *Ann Intern Med* 1996; 125:917-928.

Infectious Disease Service, Memorial Sloan-Kettering Cancer Center, New York, NY 10021, USA.

Health care workers are at occupational risk for a vast array of infections that cause substantial illness and occasional deaths. Despite this, few studies have examined the incidence, prevalence, or exposure-associated rates of infection or have considered infection-specific interventions recommended to maintain worker safety. The objective was to characterize the type and frequency of infections, the recommended interventions, and the costs of protecting health care workers. Part II of this two-part review focuses on infections caused by bloodborne organisms, organisms spread through the oral-fecal route, and organisms spread through direct contact. It also reviews established interventions for controlling transmission. Data sources: A Medline search and examination of infectious disease and infection control journals. Data selection: all English-language articles and meeting abstracts published from January 1983 to February 1996 related to occupationally acquired infections among health care workers were reviewed. Outbreak- and non-outbreak-associated incidence and prevalence rates were derived, as were costs to prevent, control, and treat infections in health care workers. Data synthesis: occupational transmission to health care workers was identified for numerous diseases, including infections caused by bloodborne organisms (human immunodeficiency virus, hepatitis B virus, hepatitis C virus, Ebola virus), organisms spread through the oral-fecal route (salmonella, hepatitis A virus), and organisms spread through direct contact (herpes simplex virus, *Sarcoptes scabiei*). Most outbreak-associated attack rates range from 15% to 40%. Occupational transmission is usually associated with

violation of one or more of three basic principles of infection control: handwashing, vaccination of health care workers, and prompt placement of infectious patients into appropriate isolation. The risk for occupationally acquired infections is an unavoidable part of daily patient care. Occupationally acquired infections cause substantial illness and occasional death among health care workers. Further studies are needed to enhance compliance with established infection control approaches. As health care is being reformed, the risk for and costs of occupationally acquired infection must be considered.

Society for Health Care Epidemiology of America. SHEA proposes separate HIV, HBV strategies. *AIDS Alert* 1998; 13:52-53.

The Society for Health Care Epidemiology of America (SHEA) advises different management for health care workers who are HIV-positive versus workers who have hepatitis B (HBV). HBV is 10 to 100 times more likely to be transmitted than HIV, and HBV continues to be reported, unlike HIV. SHEA does not endorse mandatory testing for providers nor notifying patients of providers' health status. However, SHEA does encourage providers who have been exposed to HIV or hepatitis C to voluntarily seek follow-up testing. Additionally, SHEA supports the rights of infected health care workers to continue to practice, unless they are known to have previously transmitted their infection. SHEA advocates that maintaining workers' confidentiality is the most important issue, and employers should make health programs available to impaired workers.

Spada E, Sagliocca L, Sourdis J, Garbuglia AR, Poggi V, De Fusco C, Mele A. Use of the minimum spanning tree model for molecular epidemiological investigation of a nosocomial outbreak of hepatitis C virus infection. *J Clin Microbiol* 2004; 42:4230-4236.

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The minimum spanning tree (MST) model was applied to identify the history of transmission of hepatitis C virus (HCV) infection in an outbreak involving five children attending a pediatric oncology-hematology outpatient ward between 1992 and 2000. We collected blood samples from all children attending since 1992, all household contacts, and one health care worker positive for antibody to HCV (anti-HCV). HCV RNA detection was performed with these samples and with smears of routinely collected bone marrow samples. For all isolates, we performed sequence analysis and phylogenetic tree analysis of hypervariable region 1 of the E2 gene. The MST model was applied to clinical-epidemiological and molecular data. No additional cases were detected. All children, but not the health care worker, showed genotype 3a. On six occasions, all but one child had shared the medication room with another patient who later seroconverted. HCV RNA detection in bone marrow smears revealed, in some cases, a delay of several months in anti-HCV responses. Sequence analysis and phylogenetic tree analysis revealed a high identity among the isolates. The MST model applied to molecular data, together with the clinical-epidemiological data, allowed us to identify the source of the outbreak and the most probable patient-to-patient chain of transmission. The management of central venous catheters was suspected to be the probable route of transmission. In conclusion, the MST model, supported by an exhaustive clinical-epidemiological investigation, appears to be a useful tool in tracing the history of transmission in outbreaks of HCV infection.

Spijkerman IJ, van Doorn LJ, Janssen MH, Wijkmans CJ, Bilkert-Mooiman MA, Coutinho RA, Weers-Pothoff G. Transmission of hepatitis B virus from a surgeon to his patients during high-risk and low-risk surgical procedures during 4 years. *Infect Control Hosp Epidemiol* 2002; 23:306-312.

Division of Public Health and Environment, Municipal Health Service, Amsterdam, The Netherlands.

We investigated cases of acute hepatitis B in The Netherlands that were linked to the same general surgeon who was infected with hepatitis B virus (HBV). A retrospective cohort study was conducted of 1,564 patients operated on by the surgeon. Patients were tested for serologic HBV markers. A case-control study was performed to identify risk factors. The surgeon tested positive for hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg) with a high viral load. He was a known nonresponder after HBV vaccination and had apparently been infected for more than 10 years. Forty-nine patients (3.1%) were positive for HBV markers. Transmission of HBV from the surgeon was confirmed in 8 patients, probable in 2, and possible in 18. In the remaining 21 patients, the surgeon was not implicated. Two patients had a chronic HBV infection. One case of secondary transmission from a patient to his wife was identified. HBV DNA sequences from the surgeon were completely identical to sequences from 7 of the 28 patients and from the case of secondary transmission. The duration of the operation and the occurrence of complications during or after surgery were identified as independent risk factors. Although the risk of HBV infection during high-risk procedures was 7 times higher than that during low-risk procedures, at least 8 (28.6%) of the 28 patients were infected during low-risk procedures. Transmission of HBV from surgeons to patients at a low rate can remain unnoticed for a long period of time. Prevention requires a more stringent strategy for vaccination and testing of surgeons and optimization of infectious disease surveillance. Policies allowing HBV-infected surgeons to perform presumably low-risk procedures should be reconsidered.

Sridhar MR, Boopathi S, Lodha R, Kabra SK. Standard precautions and post exposure prophylaxis for preventing infections. *Indian J Pediatr* 2004; 71:617-625.

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In health care set up, risk of acquiring infection by both patients and health care worker (HCW) from each other is fairly high. Despite progress, hospital acquired infections (HAI) are a problem in both developed and developing countries and are an important cause of death. Many different microbes cause HAI in both patients and HCW; these include various commensals, pathogenic bacteria, viruses, parasites, and fungi. Among these HIV, hepatitis B, and hepatitis C are of major significance to HCW. 'Standard precautions' have now replaced the term 'universal precautions', and are designed to reduce the risk of transmission of microorganisms in health care set-up from both recognized and unrecognized sources. Ultimate aim is to reduce the risk of disease transmission in the healthcare setting, both to the patient and the provider, and thus reduce morbidity. This applies to all patients, regardless of their diagnosis and expands the coverage of universal precautions by recognizing that any body fluid may contain contagious and harmful microorganisms. This article reviews the standard precautions and discusses current guidelines on post exposure prophylaxis (PEP).

Stein AD, Makarawo TP, Ahmad MF. A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals. *J Hosp Infect* 2003; 54:68-73.

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This study investigated knowledge about infection control amongst doctors and nurses through a cross-sectional survey conducted between March and May 2001 in three Birmingham, UK teaching hospitals. Seventy-five doctors and 143 nurses, representing 7% and 4%, respectively, of potential respondents, participated in the study measuring knowledge of, attitudes towards, and compliance with universal precautions. Overall knowledge of risks of blood-borne virus (BBV)

transmission from an infected patient after needlestick injury was low [44.0% for hepatitis B virus (HBV), 38.1% for hepatitis C virus (HCV), 54.6% for human immunodeficiency virus (HIV)]. There were significant differences between doctors and nurses concerning the estimations of HBV (e antigen +) ($P = 0.006$) and HIV ($P < 0.001$) transmission risks. Eighty-six percent of nurses stated that they treat each patient as if they are carrying a BBV compared with 41% of doctors. Doctors and nurses differed significantly in their attitudes about and reported compliance with washing hands before and after patient contact and with wearing gloves when taking blood ($P < 0.001$ for all). Doctors consistently de-emphasized the importance of, and reported poor compliance with, these procedures. Doctors were also more likely to state that they re-sheath used needles manually than were nurses ($P < 0.001$). Thirty-seven percent of respondents reported that they had suffered a needlestick injury with a used needle, with doctors more likely to be injured than nurses ($P = 0.005$). Twenty-eight percent of these doctors and 2% of the nurses did not report their needlestick injuries ($P = 0.004$). Education, monitoring, improved availability of resources, and disciplinary measures for poor compliance are necessary to improve infection control in hospitals, especially amongst doctors.

Stevens AB, Coyle PV. Hepatitis C virus: an important occupational hazard? *Occup Med* 2000; 50:377-382.

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Infection with hepatitis C virus (HCV) is estimated to affect 3% of the world's population and is an important cause of liver disease. It is most commonly transmitted by percutaneous exposure. Although current evidence does not suggest an increased prevalence of HCV infection among healthcare workers, transmission of infection following occupational exposure has been demonstrated. An average transmission rate of 1.8%, following percutaneous injury, has been reported. The risk of transmission is higher from patients with viraemia, as measured by a positive polymerase chain reaction for HCV RNA. After exposure to HCV, healthcare workers should be actively followed up, initially using a test to detect viral RNA. This may facilitate earlier diagnosis and treatment. Recent reports in the UK, of transmission of infection to patients from HCV infected healthcare workers, have prompted a review of the appropriateness of HCV infected individuals undertaking exposure prone procedures.

St Germaine RL, Hanson J, de Gara CJ. Double gloving and practice attitudes among surgeons. *Am J Surg* 2003; 185:141-145.

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Exposure to blood and body fluids while operating places surgeons at risk. Double gloving is a safety measure, which decreases this risk. However, many surgeons do not incorporate this precaution into their personal practice. This study evaluates surgeons' gloving practices and hepatitis status. A questionnaire was sent to all consultant surgeons and residents in the surgical specialties in the Capital Health region, University of Alberta. A double mail-out design was used. A second questionnaire, containing information on safety issues, was sent to the general surgeons (consultants and residents) who did not double glove to ascertain whether this information would change their practice. In all, 268 surgeons and residents were sent the original questionnaire; 170 replied (63.4% response rate.) Fifty-seven percent of the respondents do not double glove (none of the urologists double glove versus 87% of orthopedic surgeons). The most common reason cited was a decrease in manual dexterity (46%). Ninety-seven percent of respondents are immunized for hepatitis B with 53% having had their titres recently checked. Thirty-seven general surgeons received the evidence on safety issues but only 9 (23%) of them would change their practice as a

result of this information. The majority of surgeons and residents do not double glove. Even when provided with good evidence of efficacy, few surgeons contemplate adopting safety techniques.

Stringer B, Infante-Rivard C, Hanley J. Quantifying and reducing the risk of bloodborne pathogen exposure. *AORN J* 2001; 73:1135-1140, 1142-1143, 1145-1146.

The risk of becoming infected with bloodborne pathogens (e.g., hepatitis B, hepatitis C, HIV) during surgery is real. The degree of risk for perioperative personnel is related to factors that include participating in large numbers of surgical procedures each year; the nature of perioperative work (e.g., use of different types of sharp instruments); exposure to large amounts of blood and body fluids; the prevalence of bloodborne pathogens in the surgical population; the variation in different organisms' ability to be transmitted; the existence of vaccines and the level of vaccination; the availability of postexposure treatment; and the consequences of acquiring the disease. Controlling risks to perioperative personnel can be accomplished by using the Occupational Safety and Health Administration's three methods of control – redesigning surgical equipment and procedures, changing work practices, and enhancing the personal protection equipment of perioperative personnel.

Stroffolini T, Petrosillo N, Ippolito G, Lopalco A, Sagliocca L, Adamo B, Iannotti MP, Simonetti A, Bitti PR, Marzolini A, Forastiere F, Mele A. Hepatitis B vaccination coverage among healthcare workers in Italy. *Infect Control Hosp Epidemiol* 1998; 19:789-791.

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In 1996, the vaccination coverage against hepatitis B virus among 3,157 healthcare workers in Italy was inversely related to the level of hepatitis B virus endemicity in the area of residence. Youngest age and lowest years of employment were independent predictors of the likelihood of vaccine acceptance.

Tereskerz PM, Pearson RD, Jagger J. Infected physicians and invasive procedures: national policy and legal reality. *Milbank Q* 1999; 77:511-29, iii.

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Recent reports of the transmission of hepatitis B, hepatitis C, and HIV from physicians to patients during invasive procedures have again raised the question of whether physicians infected with bloodborne pathogens should perform invasive procedures that place patients at risk, and if so, under what conditions. Attempts to formulate a national policy on this subject must consider the competing interests of the patient's welfare versus the physician's livelihood. A review of the legal aspects of this topic is provided to assist policy makers and to serve as a foundation for the recommended establishment of a multidisciplinary committee to develop a uniform national policy. Both legal and medical realities call for the formulation of a clear policy to guide those who must make the decisions on this issue.

Varghese GM, Abraham OC, Mathai D. Post-exposure prophylaxis for blood borne viral infections in healthcare workers. *Postgrad Med J* 2003; 79:324-328.

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Healthcare workers have a high risk of occupational exposure, more so in developing countries, with high incidence of blood borne diseases and prevalence of unsafe practices. Among the various blood borne diseases, the most common and important ones are HIV infection, hepatitis B, and hepatitis C. Most of the occupational transmission can be prevented and the "standard precaution" has been shown to reduce exposures and hence the transmission of infection. Healthcare workers have to be educated about post-exposure prophylaxis and each institution needs to adopt a clear protocol.

Waclawik J, Gasiorowski J, Inglot M, Andrzejak R, Gladysz A. Epidemiology of occupational infectious diseases in health care workers. *Med Pr* 2003; 54:535-541. [Article in Polish]

Wojewodzkiego Osrodka Medycyny Pracy, Akademii Medycznej we Wroclawiu.

Despite continuous progress in medicine and improvement of quality of work, occupational diseases are still a serious problem. During the last few years, 5000 to 12,000 cases of occupational diseases were annually registered in Poland. Among them, infectious diseases still occupy the third place. The aim of the study was to carry out an epidemiological analysis of occupational infectious diseases identified in health care workers of the Wroclaw region in 1990-2002. Information included in occupational disease identification cards was used as a basis for the study group selection. The form provided data on workplaces with exposure to agents responsible for generation of occupational diseases. Decisions on identification of occupational diseases in workers employed in EKD sections (code 85) were also taken into account. During last years, 136-300 cases of occupational diseases in health care workers were annually diagnosed in the Wroclaw region, and infectious diseases made 10-30% of this number. In this group of diseases, viral hepatitis and tuberculosis were most frequent (45-82%). In 1990-2000, viral hepatitis was identified as an occupational disease in 323 health care workers; nurses formed the major group (195) followed by doctors (39) and lab workers (30). Recently, epidemiological situation of occupational infectious diseases has improved. From 1989, the incidence of occupational viral hepatitis in health care workers is on the systematic decrease (only 17 cases in 1994). Undoubtedly, the introduction of obligatory vaccination against HBV among health care workers has greatly contributed to this improvement. It is found that hepatitis B virus (HBV) is the major factor responsible for infections in professional health care workers. The decrease in HBV infections correlates with a growing proportion of the vaccinated personnel. It should be stressed that infections with HCV are on the increase in this occupational group.

Wilburn SQ. Needlestick and sharps injury prevention. *Online J Issues Nurs* 2004; 9:5.

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Every day while caring for patients, nurses are at risk to exposure to bloodborne pathogens potentially resulting in infections such as HIV or hepatitis B and C. These exposures, while preventable, are often accepted as being a part of the job. In the United States, needlestick injuries have begun to decrease from an estimated one million exposures per year in 1996 to 385,000 per year in 2000. This decline has resulted from the protections afforded by the Occupational Safety and Health Administration's (OSHA) Bloodborne Pathogens Standard. Reasons for the success in decreasing needlestick and sharps injuries may be attributed to the elimination of needle recapping and the use of safer needle devices, sharps collection boxes, gloves and personal protective gear, and universal precautions. The prevention of needlestick injuries has made slow progress over the past 20 years since the HIV epidemic drew attention to the deadly nature of health care work and to protection of health care worker health and safety. In Africa, where the AIDS virus originated and where the prevalence of the human immunodeficiency virus (HIV) among hospitalized patients is highest in the world, attention has been directed only recently at protecting health care workers. Nurses, especially those infected from a preventable exposure, have been at the forefront

of advocacy for prevention. This article includes a review about the hazard of exposure to bloodborne pathogens and epidemiology of occupational infection. The author discusses how to apply standard methods of occupational health and industry hygiene using the hierarchy of controls framework to prevent exposure to blood, and discusses evidence-based prevention and efficacy of particular control measures. Legislative progress and implementation of enforceable policy to protect health care workers is outlined.

Wilburn SQ, Eijkemans G. Preventing needlestick injuries among healthcare workers: a WHO-ICN collaboration. *Int J Occup Environ Health* 2004; 10:451-456.

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Effective measures to prevent infections from occupational exposure of healthcare workers to blood include immunization against HBV, eliminating unnecessary injections, implementing Universal Precautions, eliminating needle recapping and disposing of the sharp into a sharps container immediately after use, use of safer devices such as needles that sheath or retract after use, provision and use of personal protective equipment, and training workers in the risks and prevention of transmission. Post-exposure prophylaxis with antiretroviral medications can reduce the risk of HIV transmission by 80%. In 2003, the World Health Organization and the International Council of Nurses launched a pilot project in three countries to protect healthcare workers from needlestick injuries. The results of the pilot will be disseminated worldwide, along with best policies and practices for prevention.

Williams IT, Perz JF, Bell BP. Viral hepatitis transmission in ambulatory health care settings. *Clin Infect Dis* 2004; 38:1592-1598.

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In the United States, transmission of viral hepatitis from health care-related exposures is uncommon and primarily recognized in the context of outbreaks. Transmission is typically associated with unsafe injection practices, as exemplified by several recent outbreaks that occurred in ambulatory health care settings. To prevent transmission of bloodborne pathogens, health care workers must adhere to standard precautions and follow fundamental infection-control principles, including safe injection practices and appropriate aseptic techniques. These principles and practices need to be made explicit in institutional policies and reinforced through in-service education for all personnel involved in direct patient care, including those in ambulatory care settings. The effectiveness of these measures should be monitored as part of the oversight process. In addition, prompt reporting of suspected health care-related cases coupled with appropriate investigation and improved monitoring of surveillance data are needed to accurately characterize and prevent health care-related transmission of viral hepatitis.

Wolff M. Occupational accidents with exposure to biological fluids. Recommendations for the management of exposed workers. *Rev Med Chil* 1997; 125:605-613. [Article in Spanish]

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Health care workers (HCW) are continually exposed to body fluids from patients. Some of these fluids may carry pathogens potentially transmissible to HCWs if the exposure is considered to be of "high risk" (mainly percutaneous exposure). The main agents that have been transmitted by occupational exposure are hepatitis B and C viruses and human immunodeficiency virus (HIV).

The risk of transmission after risky occupational exposure to these agents is about 2-40%, 3-10% and 0.2-0.3% respectively. This review presents an operational recommendation for the management of HCWs occupationally exposed to patients' body fluids. The recommendations, through a system of algorithms focus in assessing the actual risk of the accident and the body fluid involved, the possibility of the fluid harboring a transmissible pathogen, the susceptibility of the HCW to that pathogen and the post exposure measure to be taken. For hepatitis B, pre exposure immunization is highly recommended and that vaccine in addition to hyperimmune globulin for post exposure prophylaxis is advisable. For risky occupational exposures to HIV counselling is mandatory; the role of post exposure drug prophylaxis is discussed. Hepatitis C can be occupationally transmitted; no known post exposure prophylactic measures are available. Due to the low incidence of these and other transmissible pathogens in the general population the author's recommendation is that occupational exposure to body fluids from unidentifiable or unknown sources or from patients without clinical evidence of these infections be considered as low risk, and no baseline or follow up serologic studies or measures besides counselling be taken. For other causes, the serologic follow up for exposed HCWs for each of these infections is presented.

Wunderle W, Hittmann F, von Schwarzkopf H. Suggested procedure in dealing with chronically infected staff members (infections with HBV, HCV, HIV) in medical institutions in Bremen. *Gesundheitswesen* 2004; 66:121-125. [Article in German]

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The measures necessary for medical staff suffering from acute hepatitis B or C virus infection are determined by the Biological Material Act (*Biostoffverordnung*) and the Federal Infectious Disease Protection Law (*Infektionsschutzgesetz*). Problems can occur in cases of chronic hepatitis B or C virus infections, especially if the infected persons refer to doctor's professional discretion. Bremen experts from the Public Health Authority and the Medical Association, occupational, health, hygiene, juridical and data protection specialists evolved a plan for adequate action. The best possible steps which can be taken within the legal system are described. High priority has the protection of the patients and the infected professional and his or her colleagues, without breaking confidentiality. Several times this practice has been proved and it could be shown that the procedure doesn't conflict with the recommendations of the Federal Institute of Hygiene (*Robert Koch-Institut*) and the German Association for Virus Disease Control (*Deutsche Vereinigung zur Bekämpfung der Viruserkrankungen*).

Yazdanpanah Y, Boëlle PY, Carrat F, Guiguet M, Abiteboul D, Valleron AJ. Risk of hepatitis C virus transmission to surgeons and nurses from infected patients: model-based estimates in France. *J Hepatol* 1999; 30:765-769.

INSERM Unit 444, Institut Fédératif Saint-Antoine de Recherche sur la Santé, Paris, France.

The aim of this study was to estimate the annual number of cases of hepatitis C virus transmission from infected patients to uninfected surgeons or nurses due to percutaneous injury during invasive procedures. The risk of transmission was estimated using a model involving three probabilities: A, that a health care worker sustains at least one percutaneous injury during a procedure; B, that 1 to 10% of patients are seropositive for hepatitis C virus; and C, that infection by this virus is transmitted to the Health Care Worker after such exposure. Probability A was estimated from the results of 2 French multicentric prospective trials. Probability C was estimated from the results of 9 international prospective studies. A ten-fold decreased risk was assumed for surgeons who wear gloves and use solid-bore suture needles. During a single procedure, the estimated probability of hepatitis C virus transmission from an infected patient to an uninfected surgeon ranged from $4.2 \times 10^{-5}\%$ to $4.2 \times 10^{-4}\%$, and from $2.98 \times 10^{-6}\%$ to $2.98 \times 10^{-5}\%$ to an uninfected nurse. For surgeons, the estimated annual cumulative risk of occupational infection ranged from 0.01% to 0.1% (1 in

10,000 to 1 in 1000), and for nurses from 0.0054% to 0.054% (1 in 18,700 to 1 in 1,900). Between 2 and 21 surgeons out of a total 20,000 are estimated to acquire occupationally-related hepatitis C virus infection, and between 16 and 167 nurses out of a total 300,000. These estimates strongly justify introducing preventive measures to protect health care workers from bloodborne infection.

Yerly S, Quadri R, Negro F, Barbe KP, Cheseaux JJ, Burgisser P, Siegrist CA, Perrin L. Nosocomial outbreak of multiple bloodborne viral infections. *J Infect Dis* 2001; 184:369-372.

Laboratory of Virology, Division of Infectious Diseases, Geneva University Hospital, Geneva, Switzerland.

In resource-limited countries, nosocomial transmission of bloodborne pathogens is a major public health concern. After a major outbreak of human immunodeficiency virus (HIV) infection in approximately 400 children in 1998 in Libya, we tested HIV, hepatitis C virus (HCV), and hepatitis B virus (HBV) markers in 148 children and collected epidemiological data in a subgroup of 37 children and 46 parents. HIV infection was detected in all children but one, with HCV or HBV coinfection in 47% and 33%, respectively. Vertical transmission was ruled out by analysis of parents' serology. The children visited the same hospital 1-6 times; at each visit, invasive procedures with potential blood transmission of virus were performed. HIV and HCV genotypic analyses identified a HIV monophyletic group, whereas 4 clusters of HCV sequences were identified. To our knowledge, this is the largest documented outbreak of nosocomial HIV transmission.

Zarski JP, Bohn B, Bastie A, Pawlowsky JM, Baud M, Bost-Bezeaux F, Tran van Nhieu J, Seigneurin JM, Buffet C, Dhumeaux D. Characteristics of patients with dual infection by hepatitis B and C viruses. *J Hepatol* 1998; 28:27-33.

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The purpose of this study was to compare the epidemiological, biochemical, virological and histological characteristics of patients with chronic hepatitis B and C with those of patients suffering from chronic hepatitis C alone. Twenty-three patients with chronic hepatitis C, who were anti-HCV positive and HBs antigen positive, were studied and subdivided into two groups according to the presence or absence of HBV DNA replication. They were compared to 69 age- and sex-matched patients with chronic hepatitis who were anti-HCV positive and HBs antigen negative. All patients were HCV RNA positive by PCR, anti-HIV negative and anti-HDV negative. HBV DNA and HCV RNA were detected in serum by means of a branched DNA assay and PCR. The HCV serotypes were determined by the Chiron Riba HCV serotyping SIA technique. The histological characteristics included the Knodell score. Epidemiological, biochemical and virological parameters were not different between the two groups. Only the prevalence of cirrhosis was greater in chronic hepatitis B and C patients than in patients with chronic hepatitis C alone ($p = 0.01$). Among chronic hepatitis B and C patients, HCV RNA level was significantly lower in HBV DNA positive than in HBV DNA negative patients ($p = 0.01$). Indeed, histological lesions were more severe in HBV DNA positive than in HBV DNA negative patients, including prevalence of cirrhosis ($p = 0.01$), Knodell score ($p = 0.05$) and, among the latter, piecemeal necrosis ($p = 0.01$) and fibrosis ($p = 0.05$). The characteristics of patients with dual infection did not differ according to the mode of contamination and duration of HBV disease, except for a shorter duration in patients contaminated by drug abuse than in other patients. These results suggest that HBV DNA replication inhibits HCV RNA replication in patients with chronic active hepatitis B and C but increases the severity of histological lesions.

Zarski JP, Leroy V. Counselling patients with hepatitis C. *J Hepatol* 1999; 31(Suppl 1):136-140.

Département d'Hépatogastroentérologie. C.H.U. de Grenoble, France.

Hepatitis C virus (HCV) is usually but not exclusively transmitted by the parenteral route. Some precautions are recommended for infected patients as well as his/her close contacts and family members. The risk of sexual transmission and from household contacts is very low. Use of condoms is only recommended in cases of multiple partners and for those at high risk of transmission. Some personal objects should not be shared, i.e. razors, toothbrushes and nail clippers, but it is not necessary to avoid sharing eating utensils. Sexual partners may be tested for anti-HCV. HCV-positive individuals should refrain from donating blood, organs and tissue. Clear and evidenced-based information should be provided to patients as to the means of prevention with special attention to individual risk groups such as IV drug abusers. The risk of HCV transmission after needlestick injury, although low, justifies universal precaution measurements for health-care workers. Nosocomial transmission has been described after medical procedures, especially haemodialysis and endoscopy. Thus, disinfection procedures as well as universal precautions are essential for all health-care workers. It is also important for HCV patients to inform health-care workers beforehand about their HCV status. Perinatal transmission is rare and is usually related to the degree of maternal viral load. Pregnancy is not contra-indicated in HCV-infected individuals and breast-feeding is allowed. Finally, HCV patients with active disease should be advised to refrain from alcohol intake, especially during antiviral therapy. After HCV infection it is necessary to consider not only diagnostic and therapeutic steps but also the risk of transmission in the patient's circle and consequences for the patient.

Zuckerman AJ. Occupational exposure to hepatitis B virus and human immunodeficiency virus: a comparative risk analysis. *Am J Infect Control* 1995; 23:286-289.

Royal Free Hospital and School of Medicine, London, England.

Health care workers have expressed concern regarding the risk of infection from patients with AIDS. Much less attention is given to the possibility of exposure to patients infected with the hepatitis B virus. This article reviews the data on the probability of exposure to HIV or hepatitis B and subsequent seroconversion, as well as the mortality and morbidity rates associated with both viruses. A decision-analytic analysis of the occupational risk for HIV and hepatitis B is also presented. This model indicates that quality-adjusted loss in life expectancy is greater after percutaneous exposure to a patient who is seropositive for the hepatitis B e antigen than after exposure to a patient with symptomatic HIV infection.

Part II Additional bibliographical sources and websites

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Annex 1

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