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**Original Research**

# Naked eyes: Occupational exposure to potentially infectious materials by splashes at a tertiary hospital

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**Key words:** Occupational exposure; Mucous membrane; Body fluid splash

**Abstract**
Background: Occupational transmission of blood-borne pathogens may occur during patient care. The greatest risk is through skin penetration by sharp injuries. However, infectious materials can transmit through mucous membranes and non-intact skin exposures. Aim: The aim of this study is to emphasize the danger of eye exposure by splashes of blood and body fluids at healthcare setting. Methods: This retrospective, analytic study reviews the collected data at a university hospital in Mashhad- Iran- over a period of four years, 2009 Mar–2013 Mar. Results: There were 65 self-reported eye mucous membrane exposures by splashes of blood or other bodily fluids. 58 exposures (89%) occurred during urgent care of critically ill patients while, 3 (5%) occurred in operating room, 2 (3%) during debridement of infected wounds and 2 (3%) involving other invasive procedures. Eye shield and/or mask during body fluid splash used by only 37% (71% nurses, 22% physicians, 7% the others). One nurse contracted crimean-congo hemorrhagic fever (CCHF) but treated appropriately. Conclusions: Practical training on the process of reporting occupational exposures and update training sessions on standard precautions and preventive measures should be available for all healthcare workers in their workplace.



## INTRODUCTION

Blood-borne pathogens are any microorganisms found in the blood or other bodily infectious material that can transmit to humans through parenteral, mucous membrane, and non-intact skin exposure. After an exposure healthcare workers (HCWs) may experience anger, depression, fear, anxiety, difficulty with sexual relations, trouble sleeping, problems concentrating, and doubts regarding their career choice. The emotional effect can be long lasting, even in a low risk exposure that does not result in infection. [1] Factors that may determine the overall risk for occupational transmission of a blood-borne pathogen include the number of infected individuals in the patient population, the chance of becoming infected after a single blood contact from an infected patient, and the type and number of blood contacts. Most exposures do not result in infection. Although many infections may be transmitted by such contact, the most consequential are hepatitis B and C viruses (HBV, HCV) and human immunodeficiency virus (HIV). [2] The risk of developing serologic evidence of HBV infection if the blood is both hepatitis B surface antigen (HBsAg) and

HBeAg positive is 37%--62%. By comparison, the risk of developing clinical hepatitis from a needle contaminated with HBsAg positive, HBeAg negative blood is 1%--6%. This possibility after percutaneous exposure from an HCV-positive source is 1.8% (range: 0%--7%) and transmission rarely occurs from mucous membrane exposures to blood. In prospective studies of HCWs, the average risk of HIV transmission after a percutaneous exposure to HIV-infected blood has been estimated to be approximately 0.3% (95% confidence interval [CI] = 0.2%--0.5%) and after a mucous membrane exposure, approximately 0.09% (95% CI = 0.006%--0.5%). [3]

There are many other pathogenic microorganisms as well, whose transmission to humans through occupational exposures has been documented. Two nosocomial outbreaks of crimean-congo hemorrhagic fever (CCHF) have been published previously by the authors, one involving an eye mucosal exposure by splashes of infectious blood. [4,5] The Occupational Safety and Health Administration (OSHA) standardized the surveillance of occupational blood exposures in 1991. The CDC also established its own surveillance system in 1995. One major component of these strategies is that all equipment and all environmental and working surfaces be cleaned and decontaminated with an appropriate disinfectant after contact with blood or other potentially infectious materials, but avoiding occupational blood exposures is the primary way to prevent transmission of blood-borne pathogens in healthcare settings. [6] The appropriate use of personal protective equipment (PPE) is an important element of standard precautions. Gloves provide a protective barrier between the patient and the healthcare professional and prevent gross contamination of the hands. Gloves do not replace the need for handwashing because the gloves may have small defects, may be torn during use, and hands may become contaminated during glove removal. Masks, goggles, or face shields should be used to protect the mucous membranes of the eyes, nose, and mouth during situations where there is a likelihood of splashes or sprays. Employers should have a system for reporting exposures in order to quickly evaluate the risk of infection, inform the employee about treatments available to help prevent infection, monitor the employee for side effects of treatments, and to determine if infection occurs. This may involve testing the employee's blood and that of the source patient, and offering appropriate post-exposure treatment (DHHS, 2003). [2]

## METHODS

Imam Reza Hospital is a 1000-bed university hospital in Mashhad, northeastern Iran. The hospital Infection Control Committee (ICC) has extensive training programs for HCWs covering various aspects of cross-infection, hand hygiene and occupational exposures. For each case of self reporting accidental exposure counseling is done and a structured pro-forma is filled up to assess the biological risk of injury according to time of injury, date of report, type of injury, job classification of injured person and his/her personal details as well as any history of vaccination and/or previous injury. According to these, appropriate post-exposure prophylaxis (PEP), laboratory investigation or no intervention is advised. This retrospective, analytic study reviews the collected data over a period of four years, 2009 Mar–2013 Mar.

## RESULTS

During the study period, there were 65 self-reported eye mucous membrane exposures by splashes of blood or other bodily blood staining fluids. Of all exposed staff, 46 (71%) were women and 19 (29%) were men. This gender difference was statistically significant ($P$=0.5). Out of 65 exposures 9 (14%) were from known HBsAg positive patients, 3 (5%) from known HIV positive cases and 2 (3%) from CCHF patients. Hepatitis B vaccination history with protective antibody titer were positive in 2 orderlies (100%), 11 surgical technicians (92%) and 24 nurses (86%). However, among physicians/medical students this rate was significantly reduced to just 5 out of 15 (33%). One female nurse was non-responder (eg. Anti-HBs negative despite 2 complete series of vaccination). [Table] 58 exposures (89%) occurred during urgent care of critically ill patients while, 3 (5%) occurred in operating room, 2 (3%) during debridement of infected wounds and 2 (3%) involving other invasive procedures. Among mucosal contact victims 61 (94%) flushed the eye with water, 3 (5%) washed the face with soap and water and one did nothing after exposure. Eye shield and/or mask during body fluid splash used by only 37% (71% of nurses, 22% of physicians, 7% of the others). Appropriate blood investigations were performed on 19 (30%) and post-exposure prophylaxis (PEP) was administered to 11 (15%) exposed personnel. 6 (9.5%) received hepatitis B immunoglobulin (HBIG) plus hepatitis B vaccination as PEP against HBV infection, 3 (5%) received antiretroviral treatment as PEP against HIV infection and 2 nurses received ribavirin for prevention from contracting CCHF. Unfortunately, one of them contracted the disease but treated appropriately.

**Table 1.** Exposed healthcare staff according to gender and HBV vaccination history

| | | Nurse 28 | Orderly 2 | UAP 5 | Surgical technician 12 | Student nurse 3 | Medical student | | Physician 9 | Total 65 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intern 3 | Resident 3 | | | |
| Gender | Male | 3 (11%) | 2 (100%) | 3 (60%) | 3 (25%) | 1 (33%) | 1 (33 %) | 2 (67%) | 5 (56%) | 20 (31%) | |
| | Female | 25 (89%) | - | 2 (40%) | 9 (75%) | 2 (67%) | 2 (67%) | 1 (33%) | 4 (44%) | 45 (69%) | 65 (100%) |
| HBV vaccination | Complete[μ] | 24 (86%) | 2 (100%) | 2 (40%) | 11 (92%) | 2* (67%) | 1 (33%) | 1 (33%) | 3 (33%) | 46 (71%) | |
| | Incomplete | 4 (14%) | - | 3 (60%) | 1 (8%) | 1 (33%) | 2 (67%) | 2 (67%) | 6 (67%) | 19 (29%) | 65 (100%) |

[μ] Complete series with protective antibody titer

* One non-responder

## DISCUSSION

This study reports 65 eye mucous membrane exposures to potentially infectious body fluids during a four year period. This accounts 19% of total self-reported occupational exposures during this time period. In one study a total of 618 health care workers were interviewed about exposure in the past three months prior the interview. Needle stick injury was reported in 106 health care workers (17.2%), 348 (56.3%) had contact of blood and body fluid to their skin and 154 (24.9%) reported exposure to their mucus membrane. [7] In another surveillance study 7 (11%) out of 63 reported exposures were mucosal, involving a splash to the eye of the dental care workers (DCW). [8] Mbaisi et al. accounted splash to mucous membrane by 7.2%. [9] The possibility of exposure to body fluid splashes seems inevitable at healthcare facilities, especially in operating rooms and during surgical and other invasive procedures. Davies et al. have shown a high incidence (45%) of blood and body fluid splashes found on protective glasses and masks. There was a very high incidence (79%) during vascular surgical procedures. [10] In another report, During 100 consecutive procedures the operating burns team wore a clean set of goggles, counting the number of blood splashes on the goggles after each procedure. During this study there were 47 cases of potential eye splash injury, although the individual was only aware of 2 of these intra-operatively. Seven of the splashes involved more than 6 blood droplets on the goggles. [11]

It's worth mentioning that despite this obvious hazard, the adherence of healthcare staff to prophylactic protective measures is disappointing. Hepatitis B vaccination of healthcare workers is mandated in every hospital. Guidelines therefore recommend testing for adequate development of anti-HBs IgG in vaccinated HCWs. In the present study, only 71% of medical personnel completed HBV vaccination series with protective antibody titer and this rate for physicians was reduced to only 33% [Table]. Other studies show comparable results. [12,13,14] Similarly, according to CDC protocols masks, goggles, or face shields should be used to protect the mucous membranes of the eyes, nose, and mouth during situations where there is a likelihood of splashes or sprays. As mentioned before, these equipments used by only 37% (71% nurses, 22% physicians, 7% the others) of staff while exposed to body fluid splashes during the study period. Interestingly, the nurse who contracted CCHF put eyeglasses and refused to wear eye shield. Nevertheless, she received bloody splashes because her glasses didn't have a frame and couldn't cover her eyes. Ogendo et al. reported that only the minority of surgeons (5.2%) and 3.5% of their assistants utilized protective eye goggles during the procedures. [15] Cheng et al. conducted two nationwide cross-sectional

surveys of dentists in Taiwan to investigate compliance with recommended infection control practices. Results showed that although these practices have improved over time, there is still much room to increase rates of wearing a head cap, protective eyewear, and a face mask and disinfecting impression materials. [16]

In summary, it should be emphasized that the role of effective training on hazardous practices to improve utilization of personal protective equipments and adherence to standard precautions is undeniable in healthcare facilities and appropriate preventive measures should be available for all healthcare workers in their own local hospital environment.

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**CONFLICT OF INTEREST**

None reported.

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