contaminated surfaces (ie, cleaning and disinfecting of the environment), decreasing contact opportunities of contaminated surfaces using hands-free equipment (eg, nontouch thermometer, automatic faucet, and sensor-equipped room light), ventilation to dilute and remove contaminated air. However, increasing the compliance rate of hand hygiene and PPE measures by using various inventions, such as a bundle[9] and checklist, improved access to PPE,[10] and the development of a safety culture,[10] is also important. The proposed formula might describe the natural phenomenon of healthcare infection in a simple manner, but it could also be useful to effectively organize the historically accumulated knowledge of infection control and aid in the development of new strategies.

ACKNOWLEDGMENTS

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

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Infect Control Hosp Epidemiol 2014;35(9):1200-1201

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Epidemiology of Sharps Injury and Splash Exposure in an Oncology Care Center in Eastern India

To the Editor—Sharps injury and splash exposure in the healthcare setting represent important occupational hazards and raise considerable concern about infection, psychological distress, and potential cost of management. Understanding the epidemiology of these incidents is essential for improved management strategies. In a 32-month period from May 2011 to January 2014, we report a total of 89 incidents of sharps injury and splash exposure from a 167-bed tertiary care oncology center in the eastern part of India. The male-to-female ratio was 1 : 1.1, and the age of the affected individuals ranged from 18 to 41.5 years for females (median age, 24.7 years) and from 19 to 47.2 years (median age, 25.9 years) for males. Staff distribution showed that 13 doctors, 38 nurses, 29 housekeeping staff, 6 laboratory workers, 2 operating room technologists, and 1 radiotherapy technologist were affected. The sharp injuries were associated with or caused by 54 hollow needles, 11 blades, 5 solid needles, 3 glass pieces, 2 diathermy devices, and 1 each of core biopsy needle, biopsy gun, microtome blade, and needle used for monitoring capillary blood glucose; 5 cases were associated with miscellaneous or unidentified sharps. Five (5.6%) of 89 incidents involved splash exposures. An accelerated course of hepatitis B virus (HBV) vaccination (administered at day 0, 1 month, 2 months, and 12 months followed by postvaccination immunity testing at 6 weeks after the last dose of vaccine) was started for 43 (48%) of 89 affected staff. However, vaccination uptake was not satisfactory in all cases; 11 (25%) of 43 individuals received up to the fourth dose, 12 (38%) of 43 received up to the third dose, and 5 (12%) of 43 received 2 doses only. All staff (4 of 4 individuals) who were tested for hepatitis B surface antibody after the fourth dose had acquired satisfactory immunity (≥10 mIU/mL). Human immunodeficiency virus (HIV) postexposure prophylaxis or hepatitis B immunoglobulin were not required for any staff members (0 of 89). However, 7 staff members required tetanus prophylaxis because of soiling of wound and inadequate previous

https://doi.org/10.1086/677639 Published online by Cambridge University Press

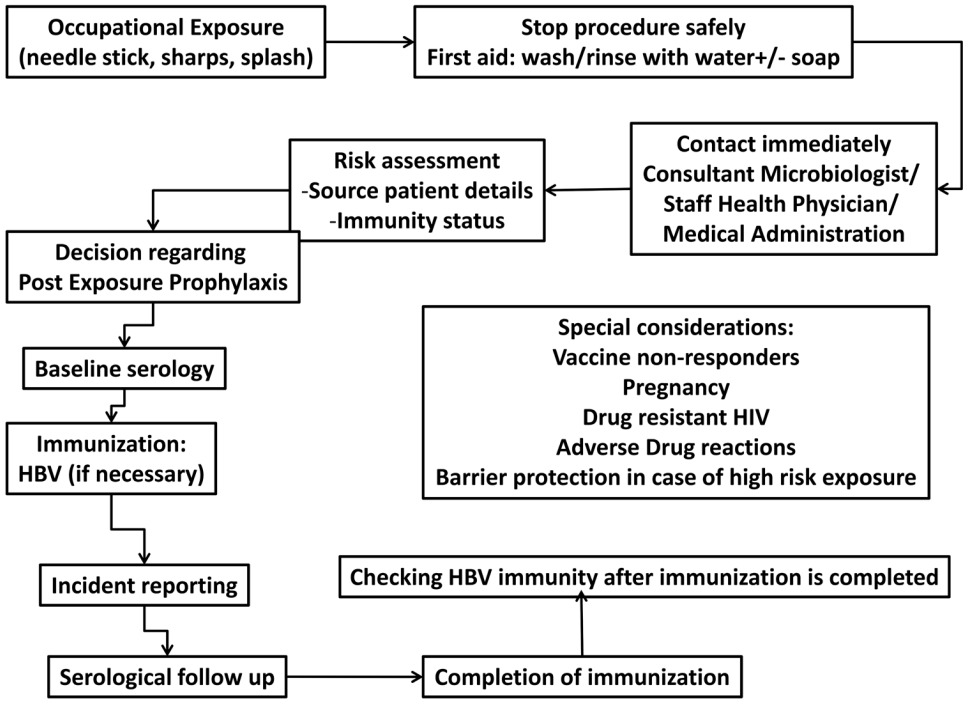

FIGURE 1. Sharps injury and splash exposure management plan. HBV, hepatitis B virus; HIV, human immunodeficiency virus.

immunization. Serological follow up constituted of HIV antigen and antibody, hepatitis B surface antigen (HBsAg), and hepatitis C virus (HCV) antibody testing of baseline blood specimens soon after exposure, followed by testing for the same markers at 3 months and 6 months. For 3 staff members, no baseline blood specimens were received; for 51 staff members (57%), only baseline blood specimens were received (ie, no 3-month or 6-month specimens were received); for 22 staff members (25%), baseline and 3-month blood specimens were received; for 13 staff members (15%), baseline, 3-month, and 6-month blood specimens were received. No HIV, HBV, or HCV seroconversions occurred. With regard to the exposure and the time of the day and injury, most injuries (57%) occurred in the period before lunch (8 AM–2 PM), followed by the period after lunch (25%; 2 PM–6 PM), evening (11%; 6 PM–10 PM), and night and early morning (7%; 10 PM–8 AM). The median time to reporting of these injuries was 90 minutes (range, 5 minutes to 63 days; ideally, post-exposure prophylaxis against HIV should be started within 2 hours of the incident).[1] Parts of the body affected by the sharps injury or splash exposure included left hand in 46 cases; right hand in 36 cases; left foot in 2 cases; right leg in 1 case; right forearm in 1 case; right eye in 2 cases; and mouth, eye, and face in 1 case. Staff were wearing gloves in only 61% of the 78 incidents that affected the hand. The source patient status was known to be reactive in 8 cases (HIV antigen/antibody reactive, 1 case; HBsAg reactive, 3 cases; HCV antibody reactive, 4 cases). The cost of responding to a needle stick injury with 3 types of serological testing and administration of a course of HBV vaccine is close to 5,000 rupees ($83). Every case was managed (Figure 1) under the supervision of a consultant microbiologist trained in the management of needle stick injury and splash exposure. An electronic database was maintained for all cases, and affected staff were counseled individually about the first aid, risk of infection, follow-up serological testing, and infection control precautions. The HBV vaccination and the follow-up serological testing were provided free by the institution. The rate of sharps injury reported in this institution was slightly lower than that described in the EPINET report of 2003 (20 vs 27 cases per 100 beds/year).[2] The seropositivity rates for HIV, HBsAg, and HCV among patient groups in this hospital after the initial screening test by highly sensitive chemiluminescence enzyme immunoassays are 1.8%, 1.5%, and 1.8%, respectively. However, the true positivity rates (based on confirmatory serological testing) vary between 11% for HIV, 70% for HBV, and 29% for HCV. While doing a risk assessment in the management of needle stick injury or splash exposure, an assessment of the probability of true positivity of seroreactive source patients is important. In the absence of confirmatory serological results, signal cut-off ratios of the screening assays are often found to be useful, with high signal cut-off ratios indicating a higher probability of true positivity. An in-depth understanding of blood-borne virus epidemiology (in India, the seroprevalence of HIV, HBV, and HCV is approximately 0.3%, 3%, and 1%, respectively), transmission risks (maximum for HBV followed by HCV and HIV), and the nature of the exposure (deep injury with blood ex-

https://doi.org/10.1086/677639 Published online by Cambridge University Press

posure vs superficial cuts with an apparently clean sharp) and the presence of appropriate personal protective equipment help in optimizing management and reducing infection risks.[1,3,4] Knowledge about this condition and education of healthcare workers about the "dos and don'ts" is essential.

ACKNOWLEDGMENTS

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

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Infect Control Hosp Epidemiol 2014;35(9):1201-1203

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Multidrug-Resistant Gram-Negative Bacteria in Hematology and Oncology

To the Editor—Reports on the current spectrum of infections among patients with cancer with chemotherapy-related neutropenia provide information of major importance for clinicians.[1] However, in sections of such articles regarding gram-negative bacteria (GN), authors deal with many pathogens (eg, extended spectrum β-lactamase [ESBL] producers, carbapenem-resistant Enterobacteriaceae, carbapenemase-producing GN, and nonfermentative GN). Therapy for such infections is becoming ever more difficult because of increasing rates of antibiotic resistance. Over the past several years, the prevalence of multidrug-resistant gram-negative bacteria (MRGN) has increased steadily.[2] In 2012, in Germany, the terms 3MRGN and 4MRGN were introduced to describe gram-negative aerobic rods with in vitro resistance to 3 and 4 groups, respectively, of bactericidal antibiotics.[3] Screening for carriage and the classification of GN as MRGN or non-MRGN are important tools for infection control measures aimed at reducing pathogen transmission among hospitalized patients,[2,3] both because of the major ongoing problem of antibiotic resistance per se and because of the lack of new antibiotics today and in future.[4]

Thus far, epidemiological data on 3/4MRGN in hematology and oncology are lacking. Therefore, we have retrospectively analyzed all consecutive inpatients admitted to our hematology and oncology 26-bed ward from July 1, 2012, through December 31, 2013. Altogether, 493 different patients were admitted (16,525 inpatient-days). Among these, 118 patients (3,411 patient-days; mean age, 61.8 years; male sex, 52.5%; acute leukemia, 32.2%) with colonization or infection due to GN were identified. The 3/4MRGN prevalence among all inpatients seems to be as low as 3.7% (18 of 493 different patients). However, in light of other "bad bugs," such as ESBL producers, vancomycin-resistant *Enterococcus faecium* (VRE), and methicillin-resistant *Staphylococcus aureus* (MRSA)—which had a prevalence of 2.0%, 0.6%, and 1.6%, respectively, in the same time period—the 3/4MRGN prevalence should not be neglected. Among all first isolates of GN ($n = 173$), 12.7% were 3/4MRGN; these were mostly *Escherichia coli* (36.4%), *Pseudomonas aeruginosa* (31.8%), and *Klebsiella pneumoniae* (9.1%), which were mainly associated with urinary tract infections. This high frequency, the high 3/4MRGN incidence of 6.4 cases per 1,000 inpatient-days (among all first isolates of GN), and the limited therapeutic options reflect the importance of hygiene and infection control measures, such as contact precautions or isolation and antibiotic stewardship programs.

Many patients with 3/4MRGN colonization or infection will be readmitted to the hospital for additional chemotherapy courses or complications, and therefore, the prevalence and incidence of 3/4MRGN will increase in the future. Especially among hematology patients, the overall 3/4MRGN incidence seems to be much higher (eg, 1.09 cases per 1,000 inpatient-days found in our department) compared with the overall inpatient population of a university hospital (0.43 cases per 1,000 inpatient-days).[5]

In our experience, the MRGN term is well established in our institution and is used by both clinicians and microbiologists to describe infectious high-risk patients. Because of the major, challenging problem regarding consumption of resources associated with MRGN (eg, contact precautions, cohorting patients or providing single rooms, and administration of antibiotics), we emphasize the use of an "MRGN

https://doi.org/10.1086/677639 Published online by Cambridge University Press