Anesthesiologists’ acquisition of hepatitis B virus infection

Risk and prevention

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Abstract

Occupational exposure remains a serious problem for medical staff, especially those working in operation rooms. Hepatitis B virus (HBV) is prevalent in patients undergoing surgery, and anesthesiologists are at risk of occupational acquisition of blood-borne HBV infection. To the best of our knowledge, there are no data about HBV prevalence and vaccinations, as well as attitudes toward sharp injuries and gloving among anesthesiologists in China, where the HBV prevalence is high. To clarify these, the present study was conducted.

An electronic questionnaire including HBV markers, gloving during practice, and reporting patterns of sharp injuries was created and sent to anesthesiologists.

After excluding 10 uncompleted questionnaires, 1739 questionnaires were included in the final analysis. Of all analyzed anesthesiologists, 1599 (91.9%) had experienced sharp injuries, and 1313 (75.5%) had experienced >1 sharp injury. Considering HBV vaccination histories, 1381 anesthesiologists (79.4%) received 3 vaccination doses, and only half of the immunized anesthesiologists received reminder HBV vaccination doses after work before exposure. There were 696 anesthesiologists (40.0% of all participants) who were ever exposed to HBV, and nearly two-thirds of them (440) were exposed to HBV more than once. There was a more positive attitude toward gloving and double-gloving to reduce HBV exposure.

The incidence of occupational HBV exposure among anesthesiologists is high, and its threat should be considered. HBV vaccinations and adherence to postexposure guidelines are recommended. The high prevalence of sharp injuries during anesthesia practice highlights the importance of safe anesthesia practices, such as gloving or double-gloving, especially when in contact with high-risk body fluids.

Abbreviations: HBIG = hepatitis B immunoglobulin, HBsAb = hepatitis B surface antibody, HBsAg = hepatitis B surface antigen, HBV = hepatitis B virus, HCV = hepatitis C virus, HIV = human immunodeficiency virus, ORs = operation rooms.

Keywords: anesthesiologists, hepatitis B virus, infection

1. Introduction

Occupational exposure remains a serious problem for medical staff, especially for those working in operation rooms (ORs). A high frequency of blood contact and sharp injuries occur in ORs. Factors contributing to the high occupational exposure are open surgical practice, sharp instruments, and frequent contact with blood and body fluids. Furthermore, in ORs, blood-borne pathogens like human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) have been shown to be common.1,2 Therefore, accidental sharp injuries would place personnel at risk for blood-borne pathogens in ORs. Previous surveys have demonstrated that surgeons underestimate the risk of occupational exposure.3–5 Studies have reported HIV and HCV infections after occupational exposure.6,7 In comparison with HIV or HCV, HBV transmission risks from infections to nonimmune individuals through sharp injuries are higher.8,9

In addition to surgeons, anesthesiologists are also exposed to blood-borne pathogens in practice through central venous catheters, arterial catheterization, regional anesthesia, and exposure to blood and body fluids.10,11 However, the report of occupational exposure is low among anesthesia personnel.8 In contrast with other healthcare workers, sharp injuries among anesthesiologists confer a high risk.8 Although wearing gloves could reduce the risk of percutaneous injuries and exposure to
blood and body fluids, some anesthesiologists do not wear gloves during high-risk procedures.[18]

The HBV prevalence is high, especially in China.[12,13] In a Taiwanese study, 16.7% of inpatients were seropositive for the surface antigen of HBV (HBsAg).[9] HBV prevalence is common in patients undergoing surgery, and anesthesiologists are at risk for occupationally acquired blood-borne HBV infections. However, previous studies have focused on surgeons in developed countries and other healthcare workers. To the best of our knowledge, there are no data about the prevalence of HBV and vaccinations, as well as the attitudes toward sharp injuries and gloving among anesthesiologists in China, where the HBV prevalence is high. To clarify these, the present study was conducted.

2. Methods

2.1. Questionnaire

An electronic questionnaire including the seropositivities of HBV markers, gloving during practice, and reporting patterns of sharp injuries was created using www.wenjuan.com, a freely obtained website. The questionnaire was completed at May 18, 2018, and then sent to anesthesiologists of hospitals in Zhengzhou and Shenzhen through WeChat (Tencent, China). The data collected were closed at October 1, 2018. The questionnaire is included in the supplement file, http://links.lww.com/MD/D111.

2.2. Ethics statements

This study was approved by the Ethics Committee of Henan Provincial People’s Hospital. The requirement for informed consent was waived because completing the questionnaire was voluntary. Participants were assured that their answers were confidential and no data compromising privacy could be obtained.

2.3. Statistical analysis

Qualitative data were presented as percentage/composition ratios, and the Pearson Chi-squared test or Fisher exact probabilities were used to compare the differences. Two-tailed P-value < .05 was considered significant. SPSS 19.0 software (SPSS Inc, Chicago, IL) was used to perform statistical analyses.

3. Results

After excluding 10 uncompleted questionnaires, a total of 1739 questionnaires were included in the final analysis. Men comprised 50.6% of the responders. Of all responders, 40.5% were anesthesiology residents. The characteristics of the studied participants are shown in Table 1.

Of the total analyzed anesthesiologists, 1599 (91.9%) had experienced sharp injuries, and 1313 (75.5%) had experienced sharp injuries more than once. Almost half (817, 47.0%) of the responders reported experiencing sharp injuries caused by anesthesia practice, like catheterization and spinal anesthesia. Furthermore, 1251 (71.9%) responders experienced bleeding caused by sharp injuries.

Considering the history of HBV vaccinations, 1381 anesthesiologists (79.4%) received 3 doses of vaccinations, and only half of the immunized anesthesiologists received reminder doses of HBV vaccinations after work before exposure. Among those who had knowledge of their seropositivity of HBV markers (77.1%), the HBsAb(+) prevalence was 44.0%. Nineteen anesthesiologists were HBsAg(+) positive before work.

Of note, there were 4 anesthesiologists whose HBsAg turned from negative before work to positive after work. Two of them did not remember being exposed to HBV during work.

3.1. Exposure to HBV

There were 696 anesthesiologists (40.0% of total participants) who were ever exposed to HBV, and nearly two-thirds of them (440) were exposed to HBV more than once (Table 2). Most of the exposures (84.9%) were self-inflicted. More than two-thirds of participants (73.7%) experienced exposures resulting from anesthesia practice, including catheterization and spinal anesthesia. Although 1251 (71.9%) of exposed anesthesiologists experienced bleeding when exposed to HBV, only 20.1% of responders reported the exposure every time, and 38.4% never reported. Considering the reason, 34.5% responders thought that there was no utility in reporting, 26.9% thought that reporting was complicated, and 11.2% did not know the process of reporting.

![Table 1](image1)

| Characteristics of participants. | N (1739) | %  |
|----------------------------------|---------|---|
| Male/female                      | 880/859 | 50.6/49.4 |
| Sharp injuries                   | 1599    | 91.9 |
| Sharp injuries (1 time)          | 286     | 16.5 |
| >1 sharp injury                   | 1313    | 75.5 |
| Sharp injuries from anesthesia practice | 817     | 47.0 |
| Sharp injuries cause bleeding     | 1251    | 71.9 |
| History of HBV vaccination       |         |     |
| Three doses                      | 1381    | 79.4 |
| Reminder dose                    | 720     | 41.4 |
| Knowledge of HBV markers before work | 1340    | 77.1 |
| HBs-Ag(+) before work            | 765     | 44.0 |
| HBs-Ag(+) before work            | 19      | 1.1  |
| Knowledge of HBV markers current | 1136    | 65.3 |
| HBs-Ag(+) current                | 747     | 43.0 |
| HBs-Ag(+) current                | 25      | 1.4  |

HBsAb= hepatitis B surface antibody, HBV= hepatitis B virus.

![Table 2](image2)

| Characteristics of participants who exposure to hepatitis B virus. | N (696) | %  |
|-------------------------------------------------------------------|---------|---|
| Exposure once                                                     | 256     | 36.8 |
| More than once                                                    | 440     | 63.2 |
| Agent of injuries (self)                                          | 591     | 84.9 |
| Task being performed at the time of injury                        |         |     |
| Anesthesia puncture or suture                                     | 513     | 73.7 |
| Loading syringe                                                    | 287     | 41.2 |
| Injection                                                         | 329     | 42.3 |
| Cleaning up                                                       | 267     | 41.2 |
| Report                                                            |         |     |
| Every time                                                        | 140     | 20.1 |
| Occasionally                                                      | 289     | 41.5 |
| Never                                                             | 267     | 38.4 |
| Reason for not reporting                                          |         |     |
| No utility in reporting                                           | 240     | 34.5 |
| Reporting is complicated                                          | 187     | 26.9 |
| Do not know how to report                                         | 78      | 11.2 |
| Others                                                            | 191     | 27.4 |
4. Discussion

Some anesthesia practices including intravascular catheter insertion and spinal anesthesia might lead to accidental sharp injuries and contact with blood. In agreement with a previous study, the sharp injury incidence was high; 91.9% of anesthesiologists had experienced sharp injuries, and more than 3 quarters experienced more than one sharp injury.\(^5\) In contrast to other medical staff, anesthesiologists spend most of their working time in ORs, where the prevalence of blood-borne pathogens is high.\(^1,2\) Therefore, anesthesiologists’ sharp injuries were riskier than those in other medical staff.\(^11,14\) Sharp injuries place the anesthesiologists at risk for numerous blood-borne infections including HIV, HBV, and HCV. Forty percent of anesthesiologists were exposed to HBV, and nearly two-thirds of them were exposed to HBV more than once.

In mainland China, although the HBV infection incidence has decreased, the prevalence is still above 6%.\(^15\) In comparison with the general population, HBV infection rates are higher in inpatients.\(^9\) HBV transmission from infections to nonimmune exposures through sharp injuries has been estimated to be between 6% and 31%.\(^16,17\) Sharp injuries are almost inevitable over time. The present study demonstrated that with an increase in the number of working years, the incidence of sharp injuries and exposure to HBV increased. On a more serious note, 70% of anesthesiologists did not remember the experience of exposure to HBV. There were 200 HBV infection resolvers among the participants, and 33.5% of them did not remember being exposed to HBV. There were 200 HBV infection resolvers among the participants, and 33.5% of them did not remember the experience of exposure to HBV.

Anesthesiologists who are exposed to HBV are likely to know their own HBV status. However, some anesthesiologists did not receive HBV vaccinations or reminder doses, especially those who were not exposed to HBV. HBV vaccinations were available in 1985 and critical in preventing HBV infection. HBV vaccinations are recommended to all healthcare workers whose activities involve regular physical contact with patients’ blood or

### Table 3

| Attitude toward gloving and double gloving when contact body fluids. | N (1739) | % |
|---------------------------------------------------------------|---------|---|
| **Gloving when contact body fluids**                        |         |   |
| Always                                                        | 745     | 42.8 |
| Occasionally forgot                                            | 944     | 54.3 |
| Never                                                         | 42      | 2.4 |
| Other                                                         | 8       | 0.5 |
| **Double gloving**                                            |         |   |
| Patients with infection                                       | 895     | 51.5 |
| Emergency                                                     | 80      | 4.6 |
| Always                                                        | 29      | 1.7 |
| Never                                                         | 735     | 42.3 |

- HBV = hepatitis B virus.

Among the 429 exposed anesthesiologists who reported at least once, only 156 received hepatitis B immunoglobulin (HBIG). Eighteen exposed anesthesiologists received HBIG without report according to the questionnaire.

### 3.2. Comparison between exposure and nonexposure to HBV

There were no gender differences between anesthesiologists exposed and nonexposed to HBV. The percentage of those receiving 3 doses of vaccination showed no differences between participants who were exposed and nonexposed to HBV. However, the percentage of those receiving reminder doses before exposure was greater in participants exposed than those nonexposed to HBV (46.6% vs 38.0%, \(P < .001\); Table 3).

The HBV infection resolvers were those who spontaneously recovered from HBV infection with normal liver function, seronegativity of anti-HBs and anti-HBe immunoglobulin G, and seronegativity of HBsAg, HBeAg, and anti-HBe. There were 200 HBV infection resolvers among all the participants. More HBV infection resolvers were found in participants exposed to HBV than in those nonexposed to HBV (19.1% vs 6.4%, \(P < .001\)). Noteworthy, the 67 HBV resolvers did not remember the experience of exposure to HBV.

The number of years of experience in anesthesia were greater in participants exposed to HBV compared to those nonexposed to HBV. More participants exposed to HBV experienced sharp injuries than those nonexposed to HBV (97.7% vs 88.1%, \(P < .001\)).

Considering the attitude toward gloving (Table 4), there were significant differences between anesthesiologists exposed and nonexposed to HBV. A more positive attitude toward gloving and double gloving was associated with less exposure to HBV.
In the present study, 79.4% received vaccinations, which was higher than that in previous studies in other developing countries. This might be attributed to the Chinese government initiating a universal HBV immunization program in 1992. It was only mandatory for newborns from 2005. Some of the population failed to be vaccinated, and only 41.4% received reminder doses after work. Previous studies demonstrated that barriers to complete vaccination included low levels of awareness. In addition to failure to receive vaccinations, another reason for nonprotection is nonresponse from revaccination, some healthcare workers did not even know their HBV status.

Although the exposed healthcare workers’ HBV status is critical for HBV exposure transmission, postexposure procedures are also effective for preventing HBV transmission. For those who did not receive vaccinations, HBIG in combination with hepatitis B vaccine is the primary choice for protection. HBIG alone is the choice for those who did not respond to HBV vaccination. Multiple doses of HBIG should be initiated as soon as possible–24 In comparison with single gloving, double gloving could decrease the occupational exposure by reducing perforations and blood or fluid contact.

The present study demonstrated that a more positive attitude toward gloving and double gloving was associated with less exposure to HBV.

Limitations of the present study should be disclosed. First, the accuracy of the questionnaires might be biased by the responders. Although we consulted an infectious disease expert before creating the questionnaire, it still could reflect the attitudes of responders perfectly. Second, the questionnaire was a retrospective survey, and recall bias could not be avoided. Third, although the data of the present study were collected from 2 major regions in China, the results might not be representative of anesthesiologists in mainland China. Last but not least, postexposure prevention in developing countries. World J Hepatol 2012;4:74–78.

In summary, the incidence of anesthesiologists’ occupational exposure to HBV was high. The threat of HBV among anesthesiologists should be considered. Anesthesiologists’ knowledge of HBV infections must be improved, and immunity against HBV and following postexposure guidelines is recommended. The high prevalence of sharp instrument injuries during anesthesia practice highlight the importance of safe anesthesia practice like wearing gloves, or even double gloves, especially during contact with high-risk body fluids or blood.

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