Prevention of and Measures against Needlestick Accidents


Shiro IINO
Seizankai Kiyokawa Hospital

Abstract: Needlestick accident is a term that symbolically expresses blood-related infections seen among healthcare workers. Healthcare workers must understand the nature of such infections, and learn how to prevent and deal with needlestick accidents if they are to protect themselves from such infections. The background and specific preventive measures against HBV, HCV, and HIV infections are herein provided, along with daily measures to be taken so that, more importantly, healthcare workers will become aware that all blood and anything possibly contaminated by blood are potential source of infection.

Key words: HBV infection; HCV infection; HIV infection; Needlestick accidents

Introduction

Needlestick accident is a term that is used to represent injury that is incurred by the handling of instruments with a patient’s blood.

Although such injuries are always likely to occur during daily medical practice, this is the type of accident that can certainly be reduced if each healthcare worker is careful with himself/herself and others.

While HBV (hepatitis B virus) initially drew attention as the cause of infections caused by such injuries, followed by HIV (human immunodeficiency virus) and HCV (hepatitis C virus), it must be recognize that, in reality, infection can be caused not only by these viruses but by any pathogen in a patient’s blood. Although patients with HBV, HCV, and HIV infections tend to get the greatest attention, and the attempts to identify only such patients are prevalent, not all patients can be actually identified since there are patients who have not been tested for these three diseases and unknown carrier of these diseases. The most important thing, therefore, is to consider all blood as a source of infection.

General preventive measures and measures used to deal with accidents caused by the three aforementioned infections are herein discussed.

General Measures for Prevention of Accidents

General measures for prevention of accidents
have been widely taught in the past 20 years, since guidelines for measures against nosocomial infections, such as HBV infection that became a problem first, were prepared and publicized by the Hepatitis B Research Team of the Hepatitis Research and Liaison Council Division of the Health and Welfare Ministry at the time in 1982. The guidelines also became the bases for guidelines for HIV infection and HCV infection. They can be summarized as follows:

- Healthcare workers should prepare for invasive medical practice by protecting themselves with gloves, protective gown, and protective glasses.
- Fingers should not touch the tip of an edged instrument during surgery to the extent possible.
- Edged instruments should be used with the utmost care.
- Edged instruments should not be handled carelessly.
- Instruments that have been used should be immediately rinsed with water or soaked in antiseptic solution or water.
- Disposable needles and edged instruments should be disposed into a special container in accordance with specified methods.

However, even if these acts were carried out very carefully, it is difficult to avoid accidents of irresistible force during medical practice. Be that as it may, as a specialist in the field of viral hepatitis, on an average, I still annually encounter at least one case of hepatitis C that have occurred within 2 to 3 months of receiving medical care. This is solid evidence that healthcare workers mediate HCV infection from patient to patient, and shows that the basic daily preventive measures mentioned earlier have still not been thoroughly implemented. The fact that such situations still remain suggests the necessity for healthcare workers to be aware that the risks are rising.

It is necessary for hospitals to make an effort to maintain awareness of infections among healthcare workers by running workshops from time to time through something like a committee especially set up for prevention of nosocomial infections.

At medical institutions, people are commonly seen eating or drinking with their preventive gowns still on. The first step in preventing nosocomial infections may be to correct the daily habits of healthcare workers by encouraging them to wash their hands, wash their faces, and take off their preventive gowns after work and before eating or drinking.

### Response to Needlestick Accidents

There is a need to check the presence of new HBV or HCV infection during regular medical checkups, and to see the changes in HBs antibody titer for HBV infection. While the aforementioned guidelines previously stated that, depending on the department, tests should be conducted every two to three months for HBV, once a year seems sufficient now that the incidence of actual infections has decreased thanks to various responses.

Next, as something common to all needlestick accidents, wounds should be washed under running water and blood should be squeezed out as soon as it is discovered. The wound must also be disinfected with a disinfectant. At the same time, it should be verified whether or not the patient has been infected with HBV, HCV, or HIV, and the following measures should be taken once it is confirmed that the patient was infected. In this case, it is important to contact the person in charge of a task force for nosocomial infections, and to record the details.

#### 1. Prevention of HBV infection

At least 15 years have past since HB vaccine came onto the market, and all healthcare workers under the age of 31 have supposedly received HB vaccine.

If they had received HB vaccine before or when they started working as healthcare workers, most of such people would have been in their 20s. Therefore, since the HBs antibody
acquisition rate has been at least 98% in all vaccine-related trials, and cases without positive HBs antibody include cases with positive HBc antibody, which show that a person has been infected with HBV, approximately 100% of them are thought to have acquired HBs antibody. In particular, since recombinant vaccines have started to be used, the rate of positive HBs antibody continues to improve even with age, as shown in Table 1, and it is speculated that HBs antibody emerges at least once in vaccinated individuals.

However, since HBs antibody that has been acquired through vaccination decreases with time, as shown in Fig. 1, it may be necessary to get additional vaccinations. On the other hand, however, some have recently reported

### Table 1 Changes in the Ratio of Positive HBs Antibody Test and the Geometric Mean Antibody Titer Following rHB Vaccination in Different Age Groups

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Item</th>
<th>Months after vaccination</th>
<th>Before inoculation</th>
<th>1 month later</th>
<th>6 months later</th>
<th>7 months later</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive ratio</td>
<td></td>
<td>0/144*</td>
<td>49/144 (34.0)</td>
<td>137/142 (96.5)</td>
<td>130/132 (98.5)</td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6**</td>
<td>4.0</td>
<td>60.1</td>
<td>420.7</td>
<td></td>
</tr>
<tr>
<td>&gt;10</td>
<td>Positive ratio</td>
<td>0/197</td>
<td>42/197 (21.3)</td>
<td>192/197 (97.5)</td>
<td>193/194 (99.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6</td>
<td>5.1</td>
<td>33.9</td>
<td>363.1</td>
<td></td>
</tr>
<tr>
<td>10–19</td>
<td>Positive ratio</td>
<td>0/703</td>
<td>113/703 (16.1)</td>
<td>614/696 (88.2)</td>
<td>651/668 (97.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6</td>
<td>2.6</td>
<td>19.5</td>
<td>158.5</td>
<td></td>
</tr>
<tr>
<td>20–29</td>
<td>Positive ratio</td>
<td>0/406</td>
<td>38/406 (9.4)</td>
<td>308/401 (76.8)</td>
<td>368/386 (95.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6</td>
<td>2.5</td>
<td>13.5</td>
<td>64.6</td>
<td></td>
</tr>
<tr>
<td>30–39</td>
<td>Positive ratio</td>
<td>0/281</td>
<td>28/281 (9.9)</td>
<td>194/279 (69.5)</td>
<td>261/273 (95.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6</td>
<td>2.3</td>
<td>9.1</td>
<td>36.3</td>
<td></td>
</tr>
<tr>
<td>40≤</td>
<td>Positive ratio</td>
<td>0/1,731</td>
<td>270/1,731 (15.6)</td>
<td>1,445/1,715 (84.3)</td>
<td>1,603/1,653 (97.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6</td>
<td>3.1</td>
<td>19.6</td>
<td>117.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Positive ratio</td>
<td>0/1,731</td>
<td>270/1,731 (15.6)</td>
<td>1,445/1,715 (84.3)</td>
<td>1,603/1,653 (97.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antibody titer</td>
<td>&lt;0.6</td>
<td>3.1</td>
<td>19.6</td>
<td>117.3</td>
<td></td>
</tr>
</tbody>
</table>

* Number of positive cases/Number of cases from whom blood was collected
** Geometric mean antibody titer: mlU/ml ( ): Percentage of positive antibody

![Fig. 1](image-url) Changes in the antibody titer based on HBs titer seven months following the initial inoculation. 

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S. IINO

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that there is no such need, based on the fact that results of a long-term follow-up study on people who received vaccinations during early childhood show that they did not get infected even without additional inoculation when HBs antibody had turned negative. However, the data in these reports may not be credible as to whether or not infection was truly prevented if circumstance made it difficult for infection to occur, such as through improvement in environmental conditions.

Therefore, in response to specific HBV needlestick accidents, additional inoculation (once) of HB vaccine may be sufficient whether a patient is HBe antigen positive or HBe antibody positive. However, when HB vaccine has never been given, HB vaccine inoculation (three inoculations: at the time of the accident, 1 month later, and 3 months later) and intramuscular injection of HBig (high-strength HBs immunoglobulin) should be given as soon as possible following the accident (without being restricted to the timeframe of 48 hours), as it has always been recommended. For post-accident follow-up, HBs antigen and ALT (GPT) should be tested once a month until six months following the accident.

2. Prevention of HCV infection

Several percent of the elderly population at least 60 years of age are HCV carriers, and only some of them have been identified as carriers. It is necessary to consider HCV to be present in the blood of the elderly.

There are no specific methods to prevent HCV infection as HBV infection is by HBig or HB vaccines. However, it is a relief to know that HCV is less infectious than HBV.

Kiyosawa et al. were the first ones to report HCV infection caused by needlestick accidents. Out of 200 needlestick accidents that happened to 196 healthcare workers, 107 cases of HCV infection were involved. Out of 110 accidents, three healthcare workers developed acute hepatitis (2.7%), and two other workers developed non-B non-C hepatitis. Since first generation HCV antibody tests were used at the time, it is possible that all five cases (4.5%) had acute hepatitis C.

Mitsui et al. have reported on HCV infection in healthcare workers that was caused by needlestick accidents in a dialysis center. Out of 68 cases of accidents, seven cases (10%) developed acute hepatitis. Except for one case, they turned out to be a temporary infection.

Although there are many other reports on HCV infection caused by needlestick accidents, the incidence of the disease and the infection rate in HCV-exposed cases are not clear because not all of the needlestick accidents have been reported. The incidence of the disease is, therefore, assumed to be higher than the actual figures. An investigation in England has shown that only 1/3 of accidents is reported.

The low incidence of the actual establishment of HCV infection caused by needlestick accidents can also be surmised from many reports from various countries that show that there are no differences between the rate of positive HCV antibody among healthcare workers and that among blood donors.

As in the case of HBV infection, the use of commercially available immunoglobulin has been considered as a treatment option following needlestick accidents that may cause infection. Although administration of immunoglobulin was ineffective for prevention of the onset of HBV infection, prevention has become possible through immunoglobulin preparations containing a large quantity of HBs antibody. As for HCV, although there are antibodies that would prevent HCV infection, the protective antibody titer is expected to be much smaller compared with HBV. Therefore, a more condensed and specific immunoglobulin preparation needs to be developed.

Administration of interferon (INF) has also been attempted, but turned out to be ineffective. Since there is a several-hour timeframe before INF can manifest its effects in the body, there is a strong possibility that HCV that had slipped in during that time are attached to
hepatocytes. The rate for HCV infection to be established is low, and considering the adverse effects of INF, INF should not be used. In addition, even if acute hepatitis should occur, the possibility that it would heal is 30 to 40%. Moreover, if it is within one year of the onset of acute hepatitis, HCV can be successfully eliminated by INF at a high rate. 6)

Following HCV needlestick accidents, ALT and at times HC-RNA (qualitative) should be tested once a month for six months.

3. Prevention of HIV infection

The chances of getting infected with viruses as a result of needlestick accidents are found to be in the order of HBV, HCV, and HIV; the possibility of getting infected with HIV as a result of needlestick accidents is approximately 0.4%, the lowest of the three viruses. If the following preventive administration is started within 1–2 hours following the accident, the probability of infection reportedly drops to 1/5.7)

When there is a possibility that the patient is an HIV carrier, the first preventive administration should be started even before it is confirmed by test results. When the patient is an HIV carrier or if test results have confirmed that this is the case, preventive administration should be started in both cases.

The following three drugs are used for preventive administration: Retrovir® 600 mg/day tid (after every meal), Epivir® 300 mg/day bid (after breakfast and supper), and Viracept® 2,250 mg/day tid (after every meal). After this preventive administration has been continued for four weeks, during which any adverse drug events should be carefully monitored, discontinue the administration. Verify that there is no HIV infection by conducting tests on the 6th week, the 12th week, the 6th month, and the 12th month. If HIV infection has been verified, begin treatment for HIV.

The primary adverse drug events of the three drugs are as follows:

- **Retrovir®**: Anemia, headache, malaise, fever, urticaria, gastrointestinal symptoms such as loss of appetite and nausea, mental symptoms such as dizziness and anxiety, respiratory symptoms, renal dysfunction, etc.
- **Epivir®**: Anemia, pancreatitis, neuropathy, confusion, seizure, heart failure, digestive symptoms, rash, etc.
- **Viracept®**: Diarrhea, rash, etc.

**REFERENCES**