Hepatitis B as a hazard to laboratory staff: a re-appraisal

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Present status

Hepatitis B virus is a category B pathogen, by definition offering special hazards to laboratory workers.1

Specialist laboratories deliberately testing for hepatitis B virus or hepatitis B surface antigen (HBsAg) are required to treat the virus as a B1 pathogen and to provide special accommodation and conditions for containment. Other laboratories are allowed in the Code of Practice for the Prevention of Infection in Clinical Laboratories1 to consider hepatitis B virus in category B2; this permits specimens to be handled in an ordinary laboratory but places restrictions on the reception, testing, and disposal of such specimens. Specimens received from groups believed to be ‘at risk’ of suffering from hepatitis B virus infection are also included in B2, and similar restrictions are placed on these specimens.

Difficulties and anomalies of present status

1 It is stipulated in the Code of Practice that B1 or B2 specimens must be processed singly or in batches separate from other specimens, for example, at the end of a session. Batching of B2 specimens in this way is not always acceptable by either the clinician or the laboratory. If a result is required urgently for a B2 specimen it must be processed singly, and if the Code of Practice is followed to the letter any machinery used, for example, in biochemistry or haematology, must then be disinfected with hypochlorite or glutaraldehyde before any further work is undertaken (paragraph 25b, 26b). In all but the smallest laboratories this results in a total upset of working schedules, especially as B2 specimens are likely to be received randomly throughout the day.

2 Certain biochemical analysers cannot be disinfected with either hypochlorite or glutaraldehyde. Theoretically, B2 specimens cannot be processed on these machines. In practice, unknown B2 specimens must be handled regularly in these machines (approx 1 in 800 volunteer blood donors in the UK are HBsAg carriers).2 3 The Code of Practice offers no advice on the procedure to be followed when it is subsequently found that a specimen already processed was in category B2.

3 It is impossible to select HBsAg carriers from general hospital patients without testing all patients for HBsAg. The medical history may be of little help (eg, most HBsAg carriers are totally asymptomatic and give no history of jaundice/hepatitis).4 Biochemical tests may be misleading (most HBsAg carriers have no evidence of abnormal liver function).5 Therefore, a minimum of 1 in 800 of all patients in a general hospital will be an HBsAg carrier and, unless previously a blood donor, will be unaware of his/her status, as will the hospital staff. Specimens from such a patient will be processed as category C.

4 The selection of ‘at risk’ groups is particularly difficult. Drug addicts and the homosexually and heterosexually promiscuous are known to have a much higher prevalence of hepatitis B virus markers than the normal population.6 7 Should all new inpatients be so questioned? Even if they were, would the answer be reliable? Would such questioning lead to the possibility of extremely confidential information passing through too many hands? Should a patient with a broken leg be asked about his/her sexual/social activities?

Jaundiced patients are a particular problem. The vast majority do not have a hepatitis B infection, but too many are labelled with a danger of infection tag. Specimens from these patients cause anxiety to the laboratory and, more seriously, delay in carrying out the requested tests and sending the results to the clinician. In addition, many biochemical and haematology laboratories offer only a minimum essential service on category B2 specimens. The patient given a B2 label, possibly for historical or anecdotal reasons, is automatically a second-class patient not receiving the full benefits of modern
biochemical and haematological technology.

5 The Code of Practice recommends uniform measures to reduce infection by category B pathogens without identifying the source and mode of spread of the pathogen. For example, it lays down that centrifugation of all category B1 and B2 specimens must be carried out in labelled, screw-capped containers within sealed centrifuge buckets that have to be opened in an exhaust protective cabinet. Such measures are to protect against the aerosol-inhalation route of infection whereas hepatitis B is most commonly transmitted by the parenteral route. Aerosol and droplet infection is a very unusual route of transmission, and present evidence indicates that it is inefficient. Experiments to infect chimpanzees by the aerosol route with material proved to be infective by the parenteral route have been unsuccessful. Biochemistry and haematology laboratories do not process sputum specimens, and it thus seems an unnecessary expense to require the purchase of class I cabinets by all such laboratories to protect against an aerosol route of transmission for hepatitis B virus.

Hazard to laboratory workers

By definition, category B pathogens are those that present a hazard to laboratory workers. How serious is this hazard?

1 Laboratory workers handle blood and blood components. Blood is the most effective agent for transmitting hepatitis B virus. Therefore, there is no doubt that laboratory staff must be at greater risk of exposure to hepatitis B virus than the general population.

2 Hepatitis B infection does occur in laboratory staff. The continuing survey by the Association of Clinical Pathologists\(^\text{10-12}\) and the report of Harrington and Shannon\(^\text{13,14}\) document cases in laboratory staff. However, it is very important to remember that the figures of Harrington and Shannon were for 1971 or 1973 and those of the Association show a noticeable decline since 1975 (Table 1). In addition, the figures remained almost static since 1975 the number of staff employed, and especially the number of specimens processed, has increased dramatically. Therefore, it can be concluded that hepatitis B infection in laboratory staff is declining. Polakoff\(^\text{15}\) has also published figures for hepatitis B infection in laboratory staff in England, Wales, and Northern Ireland from 1972 (Table 2). These are taken from returns of all hepatitis B infections sent to the Communicable Diseases Centre, Colindale, and cover a more extensive population than the Association survey and can be taken as particularly reliable after 1975 when hepatitis B virus infection was legally defined as an industrial disease.\(^\text{15}\) Two points are particularly worthy of note: (i) These independently acquired data also show a dramatic drop, from 1975 onwards, in the number of laboratory personnel affected. (ii) Cases in laboratory staff are a tiny fraction (approx 0.3%) of the total number reported. Cases of infection in laboratory staff in Scotland, taken from returns to the Communicable Diseases Scotland Unit, have been added in Table 3 to give comprehensive data for the whole of the UK since 1975.

Table 2  Hepatitis B infection in laboratory staff in England, Wales, and Northern Ireland

<table>
<thead>
<tr>
<th>Epidemiological year</th>
<th>CDR reports of acute hepatitis B</th>
<th>No. of laboratory(^*) staff</th>
<th>Total number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972-</td>
<td>8</td>
<td>681</td>
<td></td>
</tr>
<tr>
<td>1973-</td>
<td>9</td>
<td>779</td>
<td></td>
</tr>
<tr>
<td>1974-</td>
<td>7</td>
<td>913</td>
<td></td>
</tr>
<tr>
<td>1975-</td>
<td>3</td>
<td>1061</td>
<td></td>
</tr>
<tr>
<td>1976-</td>
<td>3</td>
<td>1067</td>
<td></td>
</tr>
<tr>
<td>1977-</td>
<td>4</td>
<td>1223</td>
<td></td>
</tr>
<tr>
<td>1978-79</td>
<td>3</td>
<td>980</td>
<td></td>
</tr>
</tbody>
</table>

\(^*\)Includes all categories working in laboratories: medical, scientific, technical, and ancillary.

Data from Polakoff, Communicable Disease Report 79/4814 of all hepatitis B infections sent to the Communicable Diseases Centre, Colindale, and cover a more extensive population than the Association survey and can be taken as particularly reliable after 1975 when hepatitis B virus infection was legally defined as an industrial disease.\(^\text{15}\) Two points are particularly worthy of note: (i) These independently acquired data also show a dramatic drop, from 1975 onwards, in the number of laboratory personnel affected. (ii) Cases in laboratory staff are a tiny fraction (approx 0.3%) of the total number reported. Cases of infection in laboratory staff in Scotland, taken from returns to the Communicable Diseases Scotland Unit, have been added in Table 3 to give comprehensive data for the whole of the UK since 1975.

Table 3  Hepatitis B infection in laboratory staff in UK\(^*\)

<table>
<thead>
<tr>
<th>Epidemiological year</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975-</td>
<td>3</td>
</tr>
<tr>
<td>1976-</td>
<td>3</td>
</tr>
<tr>
<td>1977-</td>
<td>5</td>
</tr>
<tr>
<td>1978-79</td>
<td>4</td>
</tr>
</tbody>
</table>

\(^*\)Figures from Communicable Disease Report 79/4814 with additional Scottish data from records of Communicable Diseases Scotland Unit.

The conclusion from all these figures is that there is a small number of cases of hepatitis B infection in laboratory staff per year. Are these few all acquired in the laboratory? Almost certainly not. In a population group of over 30,000 laboratory staff, which includes many young people, there must be cases of hepatitis B infection more likely to have been acquired socially than occupationally. Therefore, handling of all specimens with extreme care in ideal conditions could never result in complete elimination.
This page discusses the importance of preventing hepatitis B transmission in laboratory settings. It mentions a severe outbreak in Edinburgh in 1969-70, where 11 fatalities occurred, though death was not the usual outcome. The outbreak was highly atypical and was traced to a small number of hepatitis B infections in the West Scotland region.

Sporadic hepatitis B cases occur in renal units, and screening specimens allows for early identification of positive cases. Practically, only 20% of HBsAg positive blood donors have circulating e-antigen, making screening crucial for patient safety.

Each specimen tested positive for HBsAg and e-antigen. However, if a patient is HBsAg positive and has antibody (anti-e) to the e-antigen, they might transmit infection if not screened.

The Edinburgh outbreak proved that an effective control measure can be implemented to prevent accidental transmission. The lesson is that sporadic hepatitis B infections do occur, and screening is necessary to prevent contamination.

To overcome difficulties, the Code of Practice was updated to allow laboratories to downgrade hepatitis B virus categories. This decision includes the high standards of microbiological technique and safety required in the Code of Practice. The present annual number of hepatitis B infections seen in laboratory staff is significant, indicating a need for further reduction.

If hepatitis B virus is downgraded, policies must be revised to improve safety in laboratories, especially in biochemistry and haematology. The Association of Clinical Pathologists survey recommended improvements, emphasizing the need for upgrading all hepatitis B infections in staff. Additionally, staff should be encouraged to wear gloves properly to reduce accidental inoculation and maintain safety.

The document concludes with the importance of both staff and patients taking precautions to prevent accidents and maintain high standards of safety in laboratory environments.
conjunctivae. However, it seems more sensible to modify the technique so that splashing does not occur.

One unfortunate outcome of the Code of Practice has been the division of laboratory specimens into categories of high and low risk with the further consequence of equating low risk with no risk. It must be emphasised to all laboratory staff that every specimen presents a risk and should be so regarded. It is known that certain viruses and organisms in laboratory specimens can cause infection. There may be others as yet unknown.

In a recent paper we note that Howie and Collins propose that hepatitis B virus should now be downgraded to category C and that this is current practice in the USA. We are of the opinion that hepatitis B virus should still be regarded as a B1 pathogen in laboratories deliberately testing for the presence of markers of virus infection as such laboratories must process positive material daily and must receive a much higher percentage of positive specimens than a general hospital laboratory.

We thank Professor NR Grist for allowing us to quote his latest data before publication, Dr Sheila Polakoff for information, and other colleagues in biochemistry and haematology for discussion.

References

17 Dow BC, Macvarish I, Barr A, Crawford RJ, Mitchell R. Significance of tests for HBeAg and anti-HBe in HBsAg positive blood donors. J Clin Pathol in press.

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This article was submitted to the Joint Working Party on Safety in Clinical Laboratories of the Association of Clinical Biochemists, Association of Clinical Pathologists, Institute of Medical Laboratory Science, and Royal College of Pathologists as a discussion paper to enable a stated case to be drawn up to downgrade hepatitis B virus from category B2 to C. The stated case based on this information was subsequently sent to the Interim Advisory Committee of the Department of Health and Social Security.
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