IN-DEPTH REVIEW

Biological hazards: an overview

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Recent developments include new guidance from the UK Department of Health on the management of hepatitis B infected healthcare workers and evidence of the value of antiretroviral treatment in reducing transmission of HIV. The possibility of greater occupational transmissibility of hepatitis C and increasing antibiotic resistance remain of concern.

Key words: Hepatitis B; hepatitis C; HIV; methicillin-resistant Staphylococcus aureus; tuberculosis, multidrug-resistant.

INTRODUCTION

Biological hazards remain a source of challenge to the health services and to health service occupational health practitioners. The scale of the problem is truly staggering. A report from the Public Health Laboratory Service and the London School of Hygiene and Tropical Medicine has estimated that hospital acquired infections cost the health sector in England almost £1 billion each year.

HEPATITIS B and HIV

For some time occupational health services have recognized blood-borne viruses such as hepatitis B and HIV as significant hazards for workers in the healthcare industry. Due to recent advances in scientific knowledge, developments in drug and vaccine research, and new molecular diagnostic techniques, we are now seeing the sands shifting in the area of biological hazards.

Hepatitis B

The UK incidence of hepatitis B is falling. About 245 cases were reported per quarter in 1998—a marked decrease from just under 2000 reports in 1984. However, the prevalence remains high in other parts of the world and appreciably higher amongst healthcare workers. In Israel in 1994 the prevalence of anti-HBc was 10% in the general population but 24% in hospital employees; no significant change from 27% since 1984.1

Although the first plasma-derived vaccine against the hepatitis B virus (HBV) was introduced in 1982 and recombinant vaccines have been available since 1986, only about 80% of healthy adults achieve a good response (post-vaccination anti-HBs levels greater than 99 mIU/ml). A new triple S recombinant vaccine produced seroconversion in 69 out of 100 healthcare workers who had not responded to standard vaccine.2 It is likely that the new vaccine will become available in the near future and will be indicated for poor- and non-responders and also for rapid vaccination for healthy subjects at risk and for those with poor compliance with current regimens.

There is also a considerable risk of transmission from infected healthcare workers to patients and in order to reduce this risk the Department of Health introduced guidelines in 1993 that barred HBeAg positive surgeons from performing exposure prone operations in the UK. Unfortunately, we now know that the absence of HBeAg does not exclude active replication of HBV. Transmission of HBV to patients has occurred in at least six cases in the UK when HBeAg negative surgeons were found to be infected by a mutant strain which continues to produce virus but prevents expression of HBeAg. HBV DNA was detectable by polymerase chain reaction (PCR) methods in all these surgeons although in much lower quantities than in HBeAg positive controls. Although several assays for measuring HBV DNA are available there is a lack of standardization and it is difficult to compare viral genome concentrations between cases. UK guidelines were updated in June 2000 and fitness to perform exposure prone procedures is now based on measurement of viral load rather than just on HBeAg status.

HIV

Although HIV associated deaths have fallen considerably since 1995, latest figures suggest that the number of HIV infections diagnosed in the UK in 1999 was the highest of the decade. The first documented occupationally acquired case of HIV was reported in 1984 and although the risk of occupational infection is estimated to be only
0.3% (on average), there have been many more since then. The course of HIV infection has changed over recent years. It was previously inexorably progressive. The use of antiretroviral nucleoside analogues, protease inhibitors and non-nucleoside reverse transcriptase inhibitors now means that long-term survival is possible. The Department of Health’s 1997 guidelines advocated post-exposure prophylaxis for healthcare workers and this is now widely available. Although its use in the occupational setting is based on limited evidence, there is overwhelming evidence of the efficacy of antiretroviral treatment in reducing the risk of vertical transmission. HIV is transmitted to 15-20% of babies born to HIV positive mothers in Europe and America. A randomized trial of zidovudine in pregnant women reduced vertical transmission rate at age 18 months to 8% compared with 25.5% with placebo.

New techniques for measuring HIV RNA concentrations may be able to provide earlier evidence of infection following exposure at a time when the healthcare worker is viraemic but not yet producing detectable antibody. Even in the case of negative PCR tests there would still have to be an appropriate length of follow-up, as a negative PCR test at 3 months does not mean that seroconversion will not be detected at a later stage up to 6 months after the exposure.

HEPATITIS C

We have learnt much more about the hepatitis C virus (HCV) since its discovery in 1989. Its prevalence in the general population of the UK is low, at below 1%. The risk of occupational transmission following a needlestick injury has been estimated at 1.8%, with the presence of viraemia as measured by PCR being a major risk factor.

Until recently the only two reported episodes of transmission of HCV from surgeon to patients were in 1995 and 1996. However, it was reported in April 2000 that six patients who might have been infected by two doctors carrying HCV had been identified. Neither the UK nor any other country has yet issued guidelines on preventing HCV infected healthcare workers from carrying out exposure prone procedures unless they have been associated with transmission to patients.

Unlike HIV there is no effective post-exposure prophylaxis for HCV and unlike HBV there is no effective vaccine. However, α-interferon, especially in combination with ribavirin, is proving an effective treatment for chronic HCV infection.

RESISTANCE TO ANTIBIOTICS

The increasing problem of resistance to antibiotics and, to a lesser extent, antiviral agents threatens to limit their use in the control of biological hazards. The prevalence of methicillin-resistant Staphylococcus aureus (MRSA) continues to rise in the UK and healthcare workers can become colonized and so spread infection to patients. MRSA has not so far been responsible for significant staff morbidity but staff with wounds or dermatitis may have to be excluded from work until their lesions have resolved.

There are now only about 6000 notifications of tuberculosis a year in the UK (compared to 117,139 in 1913). However, the disease is spreading in many other parts of the world, including central and eastern Europe. Multidrug resistant tuberculosis (MDRTB) is also on the increase and the World Health Organization is advocating implementation of the directly observed treatment short course (DOTS plus) programme. MDRTB is still uncommon in the UK but tuberculosis is still a hazard in the health service and healthcare workers are potentially at greater risk from MDRTB. Those whose immunity to tuberculosis is unknown require particular protection in the workplace.

IDENTIFICATION OF INFECTED HEALTHCARE WORKERS

When infected healthcare workers have not been identified through normal screening procedures and have continued to practice, costly and time consuming lookback exercises have been necessary. Because two HCV positive doctors who may have infected six patients had worked in 20 different hospitals in England during the past 22 years a lookback exercise involving about 4500 patients had to be conducted. Similar exercises have recently been necessary after hospital staff have been diagnosed with tuberculosis. Although uncommon, the costs involved in these exercises underline the need to maintain high standards of occupational health and infection control in the health services.

REFERENCES

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