Could Poliovirus be Lurking in Your Laboratory?

Introduction

The global eradication scheme for polio is now entering its final phase and polio will almost certainly join smallpox as an historical disease within the next few years. There is evidence that one subtype of wild poliovirus (type 2) has already been eradicated and just a few pockets of endemic infection remain in parts of Asia and Africa.

Thanks to the successful polio vaccination campaign the last known indigenous case in Ireland was recorded in 1982, with one further imported case in 1984. The only remaining potential sources of wild poliovirus are the country's laboratories. Laboratories may store specimens from known poliomyelitis cases, research materials containing wild poliovirus or other materials that are potentially infected with wild poliovirus.

The risk of wild poliovirus escaping from laboratories into the community is remote, though laboratory-acquired infections have been described. Once poliovirus has been eradicated globally there will no longer be a need for polio vaccination. The resulting decrease in polio immunity in the population will mean that if poliovirus were to escape from a laboratory the public health impact would be enormous.

What sort of materials might contain poliovirus?

There is a wide range of biological materials that could contain poliovirus. The World Health Organisation (WHO) has divided biological materials that may pose a threat into poliovirus *infectious materials* and *potentially infectious materials*.

Infectious materials

- Any clinical and investigative materials from confirmed or suspected cases of poliomyelitis are classed as infectious clinical materials.
- Infectious research materials include stocks of wild poliovirus (control strains, clinical or environmental isolates, proficiency test panels, seeds for inactivated vaccines etc.) and materials with wild poliovirus capsid sequences (poliovirus derivates, full-length poliovirus RNA or cDNA and infected cells). Vaccine-derived poliovirus strains are also considered infectious.
- Infectious animals include any experimental animal infected with a poliovirus strain containing capsid sequences derived from wild poliovirus, especially CD 155 transgenic mice. Specimens from laboratory animals infected with wild virus are also considered infectious. Infectious environmental materials include sewage or water samples known or suspected to contain wild polioviruses.

The likelihood is that few, if any, laboratories in Ireland possess poliovirus infectious materials.

Potentially infectious materials

Potentially infectious materials represent a far greater challenge, as more laboratories are likely to possess them compared to infectious materials. In addition, while most laboratories possessing infectious materials are likely to have these well documented, laboratories may not be aware that they possess potentially infectious materials.

- Potentially infectious materials include clinical materials (particularly faeces and throat swabs), unfixed autopsy specimens (such as faeces, intestinal contents, lymph nodes, brain tissue, spinal cord tissue) and environmental samples (sewage and untreated water samples) collected at a time and in a geographic area where wild poliovirus was circulating.
- Laboratory products, such as untyped enterovirus-like cell culture isolates and undifferentiated poliovirus isolates, are also potentially infectious.

The way in which materials are stored will affect their potential infectivity. Clinical materials stored without refrigeration for more than three months, or refrigerated for more than one year are not considered infectious. Frozen materials, however, are potentially infectious.

What type of laboratories may possess infectious or potentially infectious materials?

It is important to note that any type of laboratory could possess infectious or potentially infectious material. The most likely laboratories to possess such material would be microbiology, pathology, haematology, neurology, gastroenterology, nutrition and environmental laboratories. Industrial laboratories may possess infectious quality control or research material, as may a wide variety of research laboratories.

How will laboratory containment of poliovirus be achieved in Ireland?

Each collection of biological materials must be assessed to determine the likelihood of the presence of wild polioviruses, based on treatment and storage history, the area of origin, the year collected, the time of the last indigenous wild poliovirus isolates in the area, and the type of specimen. Clearly, attempting to carry out such a detailed inventory in every laboratory in the country would be a monumental task. Thus the containment process in Ireland will be divided into three phases:

Phase 1: *National Laboratory Survey (April-December 2001)*

The first task was to identify all of the institutions in the country that may have laboratories. A comprehensive list of medical, educational, research and industrial institutions was compiled and these institutions were contacted as part of the National Laboratory Survey. Each institution was asked whether they have any laboratories and, if so, to compile a list with the contact details of each laboratory. In particular they were

asked to note whether or not each laboratory stores any biological materials for more than four weeks.

Larger institutions with multiple departments and laboratories, such as universities, colleges and teaching hospitals, were asked to nominate a local coordinator for the survey. This person was responsible for contacting the individual departments, compiling the list of laboratories and returning the relevant forms to NDSC.

The main purpose of this phase of the containment process was to exclude as many institutions and individual laboratories from the second phase of the process.

Survey forms were sent to 491 biomedical, educational, research and commercial institutions in April 2001 and this phase of the project is nearing completion.

Phase 2: *Targeted Laboratory Survey (December 2001-February 2002)*

The laboratories that store biological materials for more than four weeks, identified in Phase 1, will be included in this phase. Laboratories having a low risk of possessing poliovirus infectious/potentially infectious materials will be contacted by telephone. Laboratories having a higher risk of possessing such materials, along with those not excluded on the telephone survey, will be asked to complete a more detailed survey. Each laboratory director will be asked to complete a one-page survey questionnaire to identify whether or not they possess poliovirus infectious or potentially infectious materials. This will require a brief search of all storage areas within the laboratory, with particular attention to freezers that may contain research materials.

Phase 3: *Detailed Inventory and Containment of Infectious/Potentially Infectious Materials (February 2002-May 2002)*

Laboratories identified as possessing suspect materials in Phase 2 will be contacted individually to determine if the materials are truly poliovirus infectious or potentially infectious. Where the materials are confirmed as poliovirus infectious or potentially infectious options for storage or destruction of these materials will be discussed with the individual laboratory directors.

Laboratories that possess poliovirus infectious materials will be asked to complete a detailed inventory of these materials and certify that they are stored under enhanced bio-safety level (BSL-2/polio) conditions. In addition to the standard BSL-2 requirements laboratories will have to ensure that persons entering the laboratory are fully immunised against polio, internal controls are implemented for any wild poliovirus stocks, poliovirus stocks are stored in separate, secure areas and appropriate sterilisation and/or incineration is used for disposing of infectious or potentially infectious materials. Once global eradication of polio is achieved laboratories possessing such materials will be required to store them under BSL-3/polio conditions. Once routine polio vaccination is suspended this requirement will increase again to BSL-4.

For potentially infectious materials that will not undergo viral culture the containment requirements will not be as strict. Most potentially infectious materials stored in routine diagnostic laboratories will fall within this category. This will include faecal specimens, throat swabs and sewage specimens collected at a time and from a geographical area where wild poliovirus was circulating. Laboratories possessing such materials will be asked to maintain an inventory of these materials and ensure that they are stored under appropriate conditions.

In practice few laboratories in Ireland are likely to possess poliovirus infectious or potentially infectious materials. Those that do may opt to disinfect or destroy such materials, rather than going through the cumbersome process of meeting BSL-2/polio requirements. Where materials are considered too valuable to destroy or disinfect some of these could be transferred to another secure laboratory facility. Alternatively laboratories may opt to have such materials tested for the presence of poliovirus and, if certified as negative, store them under standard conditions.

Conclusion

The likelihood is that few, if any, Irish laboratories will possess poliovirus infectious or potentially infectious materials. None the less it is vital that all laboratories are contacted to ensure that no laboratory is unwittingly storing poliovirus infectious/potentially infectious materials.

A deadline of June 2002 has been set for all European countries to complete this process so that Europe can be certified as polio-free.

We would like to thank all of the institutions that have taken the time to complete the initial survey. With the ongoing cooperation of all institutions possessing laboratories, and the cooperation of laboratory directors and staff, will we be able to complete this task and certify Ireland as polio-free.