

Guidelines for investigating single cases of legionnaires' disease

JV Lee, C Joseph, on behalf of the PHLS Atypical Pneumonia Working Group

Summary: *These guidelines for the investigation of single cases of legionnaires' disease have been updated from those produced in 1994¹ to take account of developments in microbiological and environmental diagnostic capabilities and the recognition that infection may be acquired from the patient's domestic water system. The new guidelines recommend that when a case of legionnaires' disease has been diagnosed, it should be investigated to determine whether it is part of an outbreak or cluster, work related, suspected to be a hospital acquired infection or is travel associated. If information concerning the patient's movements during the incubation period shows it to be none of these, then appropriate environmental investigations should be considered which might include the patient's domestic water system as a potential source of infection. The guidelines are designed to provide advice and information to all public health personnel involved in the control and prevention of legionnaires' disease.*

Key words:
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Status of guidelines

These guidelines have been produced by the PHLS Atypical Pneumonia Working Group on behalf of the PHLS Advisory Committee on Systemic and Respiratory Infections and the PHLS Advisory Committee on Water and the Environment. These guidelines take account of new developments in microbiological and environmental diagnostic capabilities and the recognition that infection may be acquired from the patient's domestic water system; hence they update guidance produced in 1994¹. They have been produced for consultants in communicable disease control (CsCDC), microbiologists, clinicians, environmental health officers (EHOs) and other public health specialists involved in the control and prevention of legionnaires' disease. These guidelines

do not cover the investigation of clusters of two or more cases of legionnaires' disease. This will be published separately by the PHLS. After publication each set of guidelines will be available on the PHLS website (www.phls.co.uk) as a general resource.

Introduction

Legionellosis, infection caused by *Legionella* spp., is commonly divided into the pneumonic form (legionnaires' disease) and the non-pneumonic form (Pontiac fever). These guidelines deal solely with advice on investigating the pneumonic cases of legionnaires' disease which for purposes of surveillance are classified as:

- i) sporadic* - a single case not associated with any other cases;
- ii) cluster/outbreak* - two or more cases associated with a single source with dates of onset within six months of each other;
- iii) linked* - two or more cases associated with a single source with dates of onset more than six months apart.

Between 1980 and 2000, 3,844 cases of legionnaires' disease were reported to the PHLS Communicable Disease Surveillance Centre's National Surveillance Scheme for Legionnaires' disease in residents of England and Wales; an average of 183 cases a year. One thousand six hundred and forty-seven (43%) of the cases were acquired because of travel abroad, 1,773 (46%) cases were community acquired infections, 169 (4%) were associated with travel in the UK and the remaining 265 (7%) were linked to hospital acquired infection. Diagnosis of the cases was made

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either by culture of the organism from a respiratory specimen, detection of urinary antigen, or evidence of an antibody response in a serological specimen. The microbiological case definitions for national surveillance and reporting of cases were revised in January 1996 and again in March 2000. The updated definitions are given in appendix 1.

Local management of the investigation

Past experience has highlighted some areas of confusion in relation to roles and responsibilities of the different agencies that might be involved in the investigation of legionnaires' disease. This can potentially hinder the investigation but is prevented if a local Memorandum of Understanding (MoU) has been agreed in advance between the relevant agencies, for example, the Health and Safety Executive (HSE), Environmental Health Departments (EHDs), CCDCs and microbiology laboratories (PHLS or NHS).

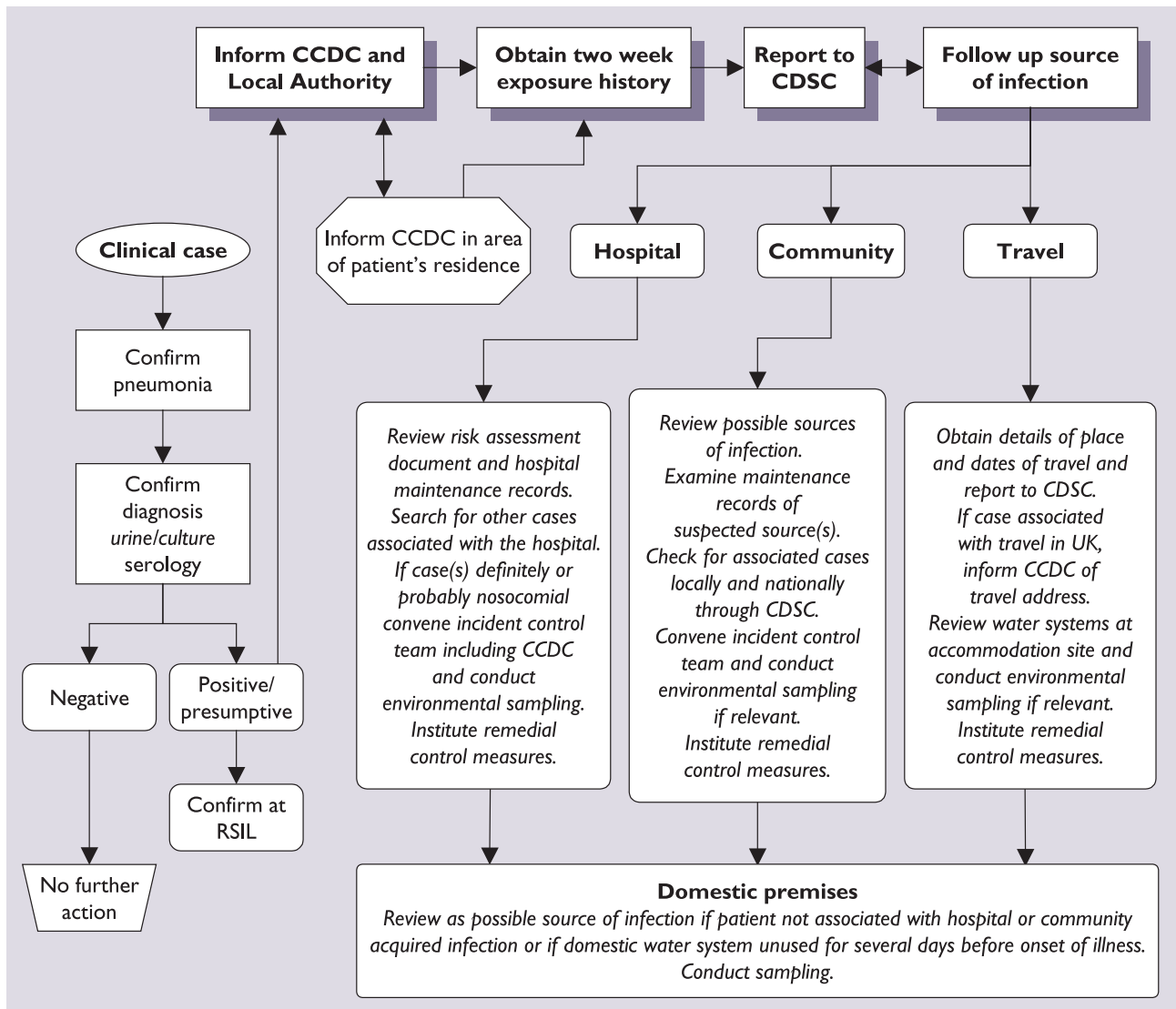
Investigation of single cases of legionnaires' disease

Four steps should be taken (figure 1).

Confirm the diagnosis

For surveillance and public/environmental health action, a clinical diagnosis of legionnaires' disease must be supported by confirmed or presumptive microbiological evidence of recent legionella infection, using the nationally agreed case definitions. The Respiratory and Systemic Infection Laboratory (RSIL) of the PHLS Central Public Health Laboratory at Colindale provides a reference service for advice and testing of legionella specimens from patients and environmental sources, as well as advice on the management of cases with legionella infection. The PHLS Communicable Disease Surveillance Centre provides advice and information on epidemiological risk factors and follow-up of cases. The PHLS Water and Environmental Microbiology Reference Unit (WEMRU) advises on the investigation of suspected environmental sources of infection. Clinical isolates from cases diagnosed by culture of the organism should be submitted to the RSIL for epidemiological typing, and positive urinary antigen detection results should be submitted for confirmation by the RSIL. Serological specimens with evidence of legionella infection should

FIGURE 1 Investigating a single case of legionnaires' disease



also be submitted to the RSIL for testing of cross-reaction with other organisms such as *Campylobacter*.

Inform the local CCDC and deputy

As soon as the laboratory diagnosis has been made, the microbiologist should report the case to the local CCDC and the local authority infectious diseases clerk. Investigations should then be initiated according to the previously agreed MoU. However, the clinical or microbiological investigations for legionella infection may take place at a hospital or laboratory outside the residential area of the patient. In this situation, a suspected or confirmed diagnostic result should be forwarded as quickly as possible to the public health department in whose area the patient resides, so that the local CCDC can begin the follow-up procedures.

Obtain two week history of patient's movements before illness

The incubation period for legionnaires' disease is normally two to ten days. However, some patients with underlying disease may take up to two weeks to develop signs of infection, or the exact date of onset may not be known. It is therefore essential that the CCDC or his/her agent obtain details of the patient's movements for the two weeks prior to onset of illness, in order to determine a possible source of infection or an association with other cases. The full address and postcode of place of residence, place of work and details of travel (with overnight stays) should be obtained. In addition, details of visits to, or overnight stays in, hospital should be ascertained, as well as information on other potential common sites and exposures to legionella. These include exposure to industrial or commercial wet cooling systems, whirlpool spas in domestic, leisure, retail or commercial settings, and showers and respiratory equipment in hospital or domestic settings. Recognised sources of legionella infection are listed in appendix 2.

Report the case to CDSC

Cases should be reported to CDSC in confidence, either by telephone or through an encrypted fax to a named person. The standard CDSC reporting form should be completed once details of clinical, microbiological and exposure histories have been obtained for the case. The form can be completed by telephone or submitted by fax or post. However, cases with incomplete histories should still be reported if they are suspected to be associated with other cases or are linked to travel. In these circumstances, early reporting may be crucial to the management of an outbreak.

Follow up of sources of infection

Methods for sampling and analysis

The Health and Safety Commission Approved Code of Practice and Guidance (L8) on the control of legionella bacteria in water systems has recently been published². This document now includes recommendations for the regular sampling for

legionellas in cooling systems and certain other water systems where control is by methods other than the heat regime². The methods used should be capable of detecting 100 or less legionellas in a litre of water. The laboratory should be UKAS accredited for the test and should participate in an external quality assessment scheme for the detection of legionellas in water samples, such as the PHLS Scheme (see website www.phls.co.uk). The Standing Committee of Analysts is in the process of producing a booklet of recommended methods for the sampling for and isolation of *Legionella* species from water and other environmental samples³. This supplements and updates the advice in BS7592⁴. Wherever sampling is undertaken, it should be carried out by a competent and trained person following the methods in the SCA document or in BS7592⁴. Procedures for sampling are given in an associated document available on the PHLS website.

Community acquired cases

The recognition that wet cooling systems (cooling towers) were responsible for many outbreaks and cases of legionnaires' disease led to legislation in 1992 that required all cooling towers to be registered with the local authority⁵. Legionellas are widespread in the environment, and aerosols containing the organism can be dispersed into the atmosphere and travel distances of up to 500 metres from their source⁶. Thus, examination of cooling towers in the area where the patient lives, works or has visited should be considered, if appropriate, in consultation with the environmental health officer and Health and Safety Executive. The risk assessment of the patient's workplace should be reviewed by the relevant enforcement authority.

If appropriate and at local discretion, and through the local enforcing authority, the CCDC should ask the management or occupational health department of the patient's place of work, about recent levels of sick leave and respiratory symptoms in the workforce, to determine if other cases are occurring. If the patient lives in a nursing home, residential home or sheltered housing, enquiries should be made about respiratory symptoms in other residents and the maintenance of the water systems. In the absence of associated cases and subject to the water system being satisfactory, further investigation is not warranted but local surveillance should be maintained.

Spa pools, commonly known as 'Jacuzzis', are an increasingly recognised source of outbreaks of legionnaires' disease and large outbreaks have been associated with pools on display as well as in use⁷. If the patient reports contact with a spa pool the control measures for the pool should be reviewed to see if they comply with the HSE requirements² and PHLS guidance⁸. The pool should be sampled, particularly if there are deficiencies in its maintenance, and enquiries made about respiratory symptoms in other users. Water samples should be collected from the pool, balance tank and back washings from the filter.

Investigation of the domestic water system in a patient's home

A recent collaborative case-control study carried out by the PHLS and the Building Research Establishment showed that cases included in the study were more likely than controls to have legionella in their domestic water system and that it was their probable source of infection⁹. This source of infection for single cases should be considered alongside other possible sources, especially if the domestic water system is not used for long periods, or problems relating to maintenance or temperature control are identified. The risk factors for a household water system are much the same as for other larger water systems.

Hospital acquired cases

Hospital patients, particularly those who are immunosuppressed, are particularly susceptible to legionnaires' disease and the hospital environment provides many of the factors necessary for the transmission of legionellas. Consequently, hospitals have a special responsibility for the prevention of legionnaires' disease. All hospitals are required under Health and Safety legislation² to have carried out regularly reviewed risk assessment for the control of legionella on their premises, and to have defined and implemented a system of controls. In the absence of problems, risk assessments should be repeated every two years. In general, following the current technical advice from NHS Estates HTM 2040¹⁰ will ensure compliance with the Health and Safety legislation.

The following classifications of nosocomial legionnaires' disease are used for surveillance purposes:

- i) definite nosocomial* - legionnaires' disease in a person who was in hospital for all ten days before the onset of symptoms;
- ii) probable nosocomial* - legionnaires' disease in a person who was in hospital for between one and nine of the ten days before the onset of symptoms and either became ill in a hospital associated with one or more previous cases of legionnaires' disease, or yielded an isolate that was indistinguishable (by monoclonal antibody [mAb] subgrouping or by molecular typing methods) from isolates obtained from the hospital water system at about the same time.
- iii) possible nosocomial* - legionnaires' disease in a person who was in hospital for between one and nine of the ten days before the onset of symptoms in a hospital not previously known to be associated with any case of legionnaires' disease and where no microbiological link has been established between the infection and the hospital.

Investigation is essential for any case of legionnaires' disease that cannot be excluded as having been acquired in hospital. The hospital's infection control doctor will generally lead the investigation into a single case in a hospital, but it is essential that the local CCDC should be alerted as soon as possible. The CCDC may need to alert the local authority and HSE if relevant. After discussion and if

appropriate, an incident control team may be convened.

The risk assessment for control of legionella in the hospital, and maintenance records, must be reviewed by the incident control team in conjunction with the nominated person responsible for legionella control, the appropriate hospital engineer if this is not the nominated person, and the infection control doctor for legionella. The aim of this review is to ensure that the preventative procedures laid out in the risk assessment, required by the HSE, and recommended in HTM 2040¹⁰, are being followed. Any deficiencies in the controls should be remedied as soon as possible. If precautionary disinfection of parts of the water systems is considered justified, this must only be undertaken *after* any sampling. Environmental sampling at the hospital under the direction of the incident control team should be carried out in accordance with BS7592⁴. Guidance on disinfection and cleaning potential sources of infection is given in HTM 2040¹⁰.

A case search should also be conducted for other confirmed or presumptive cases of legionnaires' disease associated with the hospital or community, unexplained cases of nosocomial pneumonia in patients (especially those with impaired immunity), and pneumonia in hospital staff.

Investigation of the homes of nosocomial cases

If the patient did not spend all of the incubation period in hospital, and no other cases are linked to the hospital, the possibility remains that either the home or the hospital may be the source of infection. Therefore, both should be investigated at the same time. In accordance with the local MoU, the CCDC should arrange for sampling of the patient's home to be carried out following BS7592⁴. (Note: the Standing Committee of Analysts document will provide more information and probably supersede or supplement the BS document.) Detection of indistinguishable strains of legionella in the patient and the patient's domestic water system is evidence of infection in the home. Isolation of *L. pneumophila* from the patient's home in the absence of isolates from the patient and the hospital water system indicates that the patient's home may be the place of infection rather than the hospital and may prevent unnecessary expenditure on preventative measures in the hospital.

Travel associated cases

A case is defined as travel associated if the patient spent one or more nights away from home in accommodation used for commercial or leisure purposes, e.g. hotels, holiday apartments, ships, campsites, etc. Many travel associated cases are linked to travel abroad. When these are reported to CDSC, their details are forwarded to the European Surveillance Scheme for Travel Associated Legionnaires' Disease. The European database is then searched for any other cases linked to the same accommodation. If none are

detected, the collaborator in the country of infection is informed immediately and the accommodation at which the patient stayed is sent a checklist, which reminds them of good practice for minimising the risk of legionella infection, and lists the procedures that should be in place for control and prevention. These procedures also pertain to cases associated with accommodation in the UK. The CCDC in whose health authority the UK hotel is based should be informed about the case and a risk assessment of the hotel's water systems carried out according to the locally agreed MoU.

Investigation of the homes of possible travel associated cases

Legionnaires' disease can occur up to ten days after the patient returns to their own home thus infection could be linked either to a patient's home or the accommodation at which they stayed before the onset of illness. The greatest risk of infection will occur on returning to a property after it has been empty for several days or longer, such as returning from holiday. Isolation of legionellas from the patient's home, particularly of the same type as that isolated from the patient, suggests infection at home rather than in the hotel or other accommodation site. Increased risk from a household water system can also be associated with carrying out maintenance work on the plumbing system. Other potential sources of infection in the home, such as spa pools or garden sprays, should not be overlooked. If the home is examined, samples should be collected according to the SCA guidance³ or BS7592.

APPENDIX I Case definitions used by the National Surveillance Scheme for Legionnaires' Disease

Confirmed case:

A clinical diagnosis of pneumonia with laboratory evidence of one or more of the following:

- Isolation (culture) of legionella species from clinical specimens.
- Seroconversion (a four-fold or greater increase in titre) determined using a validated indirect immunofluorescent antibody test (IFAT) incorporating a monovalent *L. pneumophila* serogroup 1 antigen.
- The presence of *L. pneumophila* urinary antigen determined using validated reagents/kits.

Presumptive case:

A clinical diagnosis of pneumonia with laboratory evidence of one or more of the following:

- A single high titre of 128 using IFAT as above (or a single titre of 64 in an outbreak).
- A positive direct fluorescence (DFA) on a clinical specimen using validated monoclonal antibodies (also referred to as a positive result by Direct Immunofluorescence [DIF]).

Conclusions

The investigation of single cases of legionnaires' disease should always become carried out in a systematic way. Single cases may become the first reported case in an outbreak. Examination of the potential environmental sources of infection for these single cases, which will normally be carried out according to local arrangements, are likely to highlight problems that might otherwise remain undetected and could contribute to the occurrence of further cases of legionnaires' disease.

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APPENDIX II Proven and potential sources of infection for legionnaires' disease

Proven and frequent sources

- Domestic hot and cold water systems, including taps, showers, and water closets, in hospitals, hotels and other buildings.
- Wet cooling systems (cooling towers and evaporative condensers).
- Plastics factories (see HSC L8)².
- Whirlpool spas (spa pools).
- Natural spas.
- Humidifiers.
- Respiratory therapy equipment.
- Fountains/sprinkler systems.
- Humidified display cabinets for meat and vegetables.
- Compost.

Other potential sources

- Spray washing equipment.
- Whirlpool baths or therapy pools.
- Sprinklers and other water features.

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