



OFFICE OF THE STATE CORONER

NON-INQUEST FINDINGS OF THE INVESTIGATION INTO THE DEATH OF A PATIENT

CITATION: Investigation into the death of a Patient
from hospital acquired legionella
pneumonia

TITLE OF COURT: Coroners Court

JURISDICTION: Brisbane

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FINDINGS OF: John Lock, Deputy State Coroner

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Contents

Introduction	2
Autopsy results	3
Review by Clinical Forensic Medicine Unit (CFMU).....	4
Molecular epidemiology analysis and testing	5
Legionella pneumophila SG 1	6
Chief Health Officer's Report into a review of the prevention and control of legionella pneumophila infection in Queensland.....	6
Conclusions	8

Introduction

The Patient was aged 66.

He had a background history of recent diagnosis of multiple myeloma. He also had a known history of coronary artery disease.

Various investigations were being carried out in relation to the multiple myelomas when he presented following a possible non-ST elevation myocardial infarction. He was transferred from the Sunshine Coast Private Hospital to the Wesley Hospital Coronary Care Unit on 12 April 2013.

The Patient remained in hospital where he received treatment for both his cardiac condition and multiple myelomas. On 26 May 2013, he developed a fever and in combination with other symptoms a likely diagnosis was considered to be pneumonia due to immuno-suppression following chemotherapy. Antibiotics were prescribed.

A test result on urine reported on 27 May 2013 indicated the presence of legionella. A blood test collected indicated he may also have a current infection by cytomegalovirus (CMV). Despite treatment, the Patient's condition deteriorated.

On 2 June 2013, a decision was made with family and doctors that given his continued decline in health, palliative care should be provided and he died later that day.

A cause of death certificate was signed by the treating clinician giving the cause of death as *due to respiratory failure due to legionella pneumonia due to neutropenia due to multiple myeloma*.

Subsequently Wesley Hospital confirmed that pathology testing had found the type of legionella that had infected the Patient was the same type of legionella found in water within the water systems of the hospital.

Pathology laboratories are required to immediately notify Queensland Health of laboratory results, which provide definitive or suggestive evidence of legionellosis. In the case of the Patient the required notification had not occurred until Queensland Health contacted the pathology laboratory (Sullivan Nicolades Pathology).

Wesley Hospital also advised that another patient was diagnosed with legionella pneumonia in 2011. That infection was notified to Queensland Health. That death was not reported to the Office of the State Coroner at the time.

The death of the Patient was reported to the Chief Health Officer and public health authorities.

The matter was reported to the after-hours coroner in the evening of 5 June 2013 and subsequently to the Office of the State Coroner on 6 June 2013. It

was at this time that a link was made by the Wesley Hospital that the Legionella bacterium may have come from the hospital water system.

A limited autopsy was able to be arranged with the consent of family and a review of the hospital records was completed by the Clinical Forensic Medicine Unit on 7 June.

From a coronial perspective (as distinct from any issues of a public health nature and notification to public health authorities) the Deputy State Coroner holds no concerns with respect to any perceived delay in reporting the matter to the Office of the State Coroner.

The Wesley Hospital ceased admission of further patients and closed its Emergency Department until the source of legionella had been identified and controlled.

Autopsy results

After consultation with the Chief Forensic Pathologist a decision was made for a limited internal examination sufficient to take samples of lung tissue and other fluids for testing. Dr Samarasinghe conducted the analysis and autopsy.

Histology has confirmed severe bilateral pneumonia in keeping with the clinical diagnosis of legionella pneumonia.

Microbiology tests isolated legionella pneumophila serotype 1 bacteria from the lung tissue confirming the diagnosis of legionella pneumonia.

Various other samples from the Wesley Hospital were tested for this organism including molecular testing. The results indicated that all samples, including reticulated water samples from the hospital, were positive for the same serotype (legionella pneumophila serotype 1).

The cause of death as given after the autopsy was legionella pneumophila with other significant conditions being multiple myeloma and ischaemic heart disease.

The pathologist noted that legionnaire's disease is a severe atypical form of pneumonia caused by the gram negative bacterium, legionella pneumophila.

Legionella pneumophila serogroups 1–16 cause pneumonia in humans but serogroup 1 is most commonly associated with the disease. Legionella pneumophila bacterium is able to cause outbreaks related to contaminated water supplies, such as cooling towers or water pipes.

The pathologist also noted the complex medical history detailed in the report by the Clinical Forensic Medicine Unit, which had been requested by the coroner. This indicated the Patient had a background medical history of ischaemic heart disease, cytomegalovirus co-infection and multiple myeloma. He suffered complications of multiple myeloma despite having been treated with chemotherapy and other agents.

Multiple myeloma is a malignant neoplasm of bone marrow producing an abnormal population of plasma cells. The disease and its treatment (chemotherapy and corticosteroids) are known to impair normal immune response to infections. The pathologist stated the Patient was therefore at high risk of having atypical infections due to his immuno-compromised state.

Review by Clinical Forensic Medicine Unit (CFMU)

The Director of the CFMU, Dr Adam Griffin was requested by the coroner to review the Patient's medical record and provided a report.

The Patient had a known history of coronary artery disease with previous angiogram and stenting performed in 2007 and 2010.

The Patient also had a significant background history of a recent diagnosis of multiple myeloma.

Multiple myeloma is a cancer of a specific group of cells found in the bone marrow called plasma cells. These cells have a normal function of producing antibodies to help fight infection. The abnormal cells also produce proteins, but a large amount of one kind of antibody. Complications that arise are either due to the overgrowth of these cells in the bone marrow affecting other blood cell development or the impairment of one's normal immune response.

The Patient was diagnosed with multiple myeloma after presenting with a recurrent pleural effusion (collection of fluid in the chest) in November 2012. This was managed with a pleurdesis. A biopsy identified the deposition of amyloid. Amyloid is a collection of protein within the tissue and multiple myeloma is one cause of this condition.

Subsequent investigations diagnosed the multiple myeloma. Further amyloid deposition was suspected in his heart muscle and bowel wall. He was booked in to discuss management options of this condition when he presented following the non-ST elevation myocardial infarction.

On initial assessment his presentation was considered either due to amyloid deposition in the heart muscle or a primary cardiac ischaemic event.

Dr Griffin noted the history of assessments by a cardiologist and the subsequent initiation of chemotherapy to treat his multiple myeloma. On a number of occasions pleural effusions were required to be drained. There were periods when he improved symptomatically and was managing well with his activities of daily living. However, there were also periods of gradual deterioration.

On 26 May 2013, the Patient appeared breathless and a right pleural effusion was drained. Later that day he developed a fever and blood cultures and urine were collected. An antibiotic was prescribed and given intravenously. The differential diagnosis at this stage included bleeding in the chest due to the amyloid. He was reviewed by the oncologist who considered a likely diagnosis

was pneumonia due to immuno-suppression following chemotherapy. An infectious diseases consultant reviewed him and antibiotics were again prescribed.

The test result on the urine was reported on 27 May notifying of the presence of legionella. An appropriate antibiotic had already been prescribed.

There was increasing shortness of breath. The results of a further blood test indicated a current infection by cytomegalovirus. On 29 May the Patient appeared to be somewhat improved.

On 30 May a medical emergency response was called. There was a marked increase in respiratory rate and a diagnosis of acute pulmonary oedema was made and he was transferred to the intensive care unit.

His breathing was assisted but he remained unwell. A further pleural drain was performed.

A referral was made for palliative care and on 2 June family discussed the deterioration with the doctors and a decision was made that he be kept comfortable and he died later that day.

Dr Griffin opined that the assessment and management by the various doctors and nurses involved in the Patient's care was clearly documented. Diagnosis and intervention was timely on all occasions. Appropriate specialists were consulted and interviewed in a timely manner. Dr Griffin had no concerns about health care delivery identified in the review. He stated that the Patient was very unwell and appeared unlikely to recover from his multiple myeloma, given the difficulty he was experiencing during chemotherapy and his complications relating to his heart.

Co-infection with cytomegalovirus was a complicating factor. However, pneumonia from one agent (i.e. legionella) was sufficient to explain his decline.

Molecular epidemiology analysis and testing

Molecular epidemiology testing was performed by Queensland Health Forensic and Scientific Services. Tests were conducted from samples collected from the Wesley Hospital reticulated water samples collected in June 2013, legionella isolates from the patient collected in 2011 and legionella isolates collected from the Patient.

The result was that the isolates from both patients and the isolates from the water samples all shared the same virulence gene profile and all belonged to sequence type I.

Although this might have suggested a unique tightly clustered outbreak at the Wesley Hospital, the Public Health Microbiology laboratory noted that testing conducted over many years demonstrated that they were dealing with a

dominant and highly clonal strain of legionella pneumophila SG 1 that is present in water sources across South-East Queensland.

Legionella pneumophila SG 1

This particular strain of legionella is common in water supplies across South-East Queensland. The organism itself is not a particular threat until it is given an opportunity to form biofilms and proliferate. This can occur in water systems and the practice of using warm water systems increases the risk of legionella proliferation.

Provided appropriate risk factors for Legionella are controlled, the organism does not grow to hazardous levels. The point at which Legionella reaches 'hazardous levels' depends on the vulnerability of the individual.

Chief Health Officer's report into a review of the prevention and control of legionella pneumophila infection in Queensland

The Chief Health Officer conducted a review.

There had previously been no recorded hospital outbreak of legionella in Queensland and only two or three cases involving very small outbreaks in community settings in Queensland.

Legionella is widespread in the environment, especially in water and wet areas. Human exposure to legionella is a common occurrence with most experiencing none or only mild symptoms. It is not possible to totally eliminate legionella from the environment.

Control measures are therefore aimed at limiting growth of the bacteria in manufactured water systems and controlling the risk of legionella exposures in those people who are particularly vulnerable (people who are immunocompromised, those with chronic disease and especially those in oncology and transplant units). This vulnerable group of people includes many who are cared for in large hospitals.

Legionnaire's disease is an uncommon disease in Australia and more so in Queensland.

Queensland Health requested all public and private healthcare facilities across Queensland undertake testing of their water supply systems. A significant number of these facilities tested positive for legionella contamination to varying degrees.

Guidelines to health facilities were issued to assist with understanding the nature of the issue, extent of risk and recommended responses to water quality sample results.

The resulting Guidelines contained a number of recommendations for actions required to implement improvements in a number of areas. It is not intended to consider the measures in any detail as they are within the province of the

public health authorities. The full report was published and is available online at <http://www.health.qld.gov.au/legionnaires> .

The Chief Health Officer made a number of findings and conclusions.

With respect to the Wesley Hospital it was found that:

- with regard to compliance by the hospital with the *Private Health Facilities Act 1999*, and in light of the absence of a requirement to test for legionella in hospital water systems, although some administrative breaches of legislation were detected, none would warrant punitive action under the Act based on information received at the time of the investigation
- there was no evidence indicating negligence or intent on the part of the hospital resulting in harm to visitors, patients, hospital staff and/or the greater community that would warrant punitive action based on information received at the time of the investigation
- the majority of issues identified during the investigation were system and process type lapses related to the administrative aspects of the hospital's management of, and response to, the outbreak of legionnaires disease - these mostly related to the fact that timely reporting of an unexpected death of an inpatient to the Chief Health Officer and to the Coroner did not occur
- the failure by the pathology company Sullivan Nicolaides Pathology (SNP) to notify the first positive legionella test result was due to deficiencies in the laboratory information system and supporting procedure document - in this case, this failure had no impact on future risks to patients given the prompt action undertaken by the Wesley Hospital.

Further it was the view of the Chief Health Officer that:

- The Wesley Hospital responded promptly and comprehensively to the notification of positive results in two of its patients, including extensive investigatory work and enhancements to its water infrastructure to help further reduce any future risks to patients, and active case finding to determine if any other patients had developed the infection.
- SNP responded promptly on being advised by Queensland Health that the notification of the first case had not been received, identifying how and why the failure had occurred, and making the necessary modifications to its information system and supporting benchtop procedures.
- Public and private hospitals have responded to the detection of legionella in water samples from within their facilities following a statewide water testing program, informed by guidelines issued by the Department - action is continuing where required.
- There is no evidence that current and past government climate change and energy efficiency policies and programs have promoted unsafe

practices or contributed to any increase in risk of contracting legionellosis.

The review identified a number of areas for improvement that would make for a more robust system-wide approach to prevention and control of legionella. A number of recommendations were made, summarised as follows:

- In the short term, public and private hospitals and public and private residential aged care facilities develop water quality risk management plans, which include periodic testing of their water supplies.
- In the medium term, legislation be strengthened relating to the design, commissioning, installation, operation and maintenance of cooling water systems and water delivery systems in hospitals and residential aged care facilities.
- A memorandum of understanding be developed by relevant regulatory agencies to clearly articulate the roles of each agency and coordination arrangements with respect to legionella risks in hospitals and residential aged care facilities.
- National collaboration be sought with regard to a number of issues including strengthening and finalising of Australian standards, guidelines for the operation and maintenance of drinking water systems and reviewing accreditation processes for both hospital and residential aged care facilities to determine if aspects relating to the physical environment should be strengthened.
- An immediate upgrade of the Notifiable Conditions System be progressed.
- A review of information for the community be undertaken in collaboration with other agencies to ensure opportunities are maximised to increase awareness of the generally low, but potential risks of legionella and how to minimise them.

Conclusions

The Patient was suffering from a number of medical conditions. In particular, he was being treated for multiple myelomas. The treatment included chemotherapy. As a result he was a person who was immuno-compromised and more susceptible to infective processes.

He became infected with legionella bacteria. This developed into pneumonia from which he died.

He came into contact with legionella bacteria from the water systems within the Wesley Hospital and most likely the shower head.

Legionella itself is a common organism found in water but is known to proliferate in warm water systems. The same serogroup of legionella had been previously identified in another patient who died in 2011. The connection to the water infrastructure within the hospital had not been made until the Patient died.

The Patient was an unwell man, but he would not have died from legionella pneumonia at the time he did, without having been exposed to the organism in the first place. Once this occurred, his particular health issues and his immuno-compromised state made him particularly vulnerable.

Legionella proliferation can be minimised by taking control measures.

Since this case the Wesley Hospital has made enhancements to its water infrastructure to minimise future risks to patients.

The Chief Health Officer's investigation identified similar infiltration of legionella in numerous other health facilities and a comprehensive program of similar risk minimisation has been commenced. Other longer term solutions and enhancements have also been identified.

Taking into account the comprehensive investigations already completed, it is considered that any further investigation will not advance the state of knowledge of how the Patient died, and any recommendations that would be considered have already been identified and implemented.

After consultation with the family, and given the findings from this investigation have significant public interest, a decision has been made to publish these findings de-identifying the name of the Patient.

John Lock
Deputy State Coroner
Brisbane
3 September 2014