Legionnaires' disease: thematic review and hospital case studies

Joana Lemos, Alexandra Vaz, Eduardo Melo, António Marques, Ana Albuquerque, Inês Barros, Miguel Sequeira, José Pedro Saraiva

Abstract

Identified since 1976, *Legionella* is a microorganism that is increasingly acknowledged as a cause of pneumonia, particularly the most severe forms. Diagnostic methods have improved and their availability is increasing. Antibiotic treatment, if begun early, is usually effective, but some severe cases continue to evolve with respiratory distress and failure or even multiorgan dysfunction. Since 1999, Legionnaires' disease has been subject to Compulsory Notification in Portugal.

In this work, the authors begin with a thematic review of this entity, before presenting their Hospital case studies. They have identified all Legionella cases in the Hospital, from January 2000 to September 2007, giving demographic and epidemiologic data, risk factors, clinical aspects, complementary exams, specific laboratory diagnosis, the therapy chosen, complications and results; and comparing the data with the adaptation of the disease coding in the final diagnoses and notification statistics.

Key words: Key words: *Legionella*, Legionnaires' disease, diagnosis, notification, statistics.

INTRODUCTION

Legionnaires' disease was first identified after an outbreak of pneumonia among delegates of the American Legion National Convention, who were meeting in a hotel in Philadelphia in 1976.[1] The bacterium found to be responsible for this infection received its name, *Legionella* because of the event. It is also known as "Traveler's Disease" due to outbreaks in hotels. However, diagnostic methods have evolved, as well as epidemiological knowledge of the reservoirs, and it has been discovered that this is a fairly common etiology for CAP (**C**ommunity **A**cquired **P**neumonia) or HCAP (**H**ealthcare **A**ssociated **P**neumonia, previously known as nosocomial).[2-4] Early antibiotic treatment is usually effective, but there are still severe cases with respiratory or multiple organ failure.[1,5] Since 1999 this has been a Notifiable Disease in our country.[6]

PATHOGENESIS

The bacteria of the genus *Legionella* are coccobacilli with polar flagella, intracellular binding and poor staining (or no staining at all) by Gram's Method. These are ubiquitous to natural freshwater ecosystems, at optimum temperatures of between 40°C and 50°C, but tolerate temperatures between 0°C and 63°C and pH from 5.0 to 8.5. They form a biofilm on existing organic or inorganic surfaces in still waters, infecting and replicating in various species of protozoa of the water and soil, including amoebas.[1,7] There are over 48 species of *Legionella,* but less than twenty of these cause human disease. *Legionella pneumophila* is the most pathogenic (responsible for more than 90% of cases of the disease), followed by *Legionella micdadei*. Virulence is also different among the various strains of *Legionella pneumophila*: many colonize water systems, but only some are capable of causing disease in those exposed to contaminated water. The virulence and the possibility of intracellular infection are facilitated by the presence of flagellum, some loci, and surface antigens. Although there are more than 70 *Legionella pneumophila* serogroups, serogroup 1 has been identified in more than 80% of legionellosis.[2,7] However, these data may be biased because the antigenuria technique is only available for serogroup 1.

When fighting infection, cellular immunity (activated leukocytes that ingest and destroy bacteria) is more important than humoral immunity. The *Legionella* inhaled or breathed in are capable of adhering to the respiratory tract activating neutrophils and macrophages alveolus which phagocyte them. The-

Polyvalent Intensive Care Unit
Internal Medicine Service 1
Hospital de São Teotónio E.P.E. – Viseu

Received for publication on the 22nd February 2008
Accepted for publication on the 5th August 2009

se either eliminate them or become the growth and intracellular replication medium of the *Legionella,* which are released upon macrophages lysis and perpetuate infection. Antibody production remains useful for diagnosis and may confer immunity, since there are no records for repeated infections caused by *Legionella.*[7,8]

EPIDEMIOLOGY

Typically, CAP Legionellosis occurs in outbreaks in hotels, cruise ships, offices, etc. However, there has been an increase in the number of isolated sporadic cases diagnosed, usually among the severe cases of CAP. The incidence varies among different authors: between 2% and 15% of CAP requiring hospitalization. Some even argue that if it were investigated in every case, *Legionella* would be among the top 3 or 4 microorganisms involved. However, it is estimated that only 3% of sporadic Legionellosis are correctly diagnosed.[1,2, 9,10]

Legionellosis as an agent of HCAP was first described in the 1980s, during outbreaks in tertiary health care units. In the 1990s, sporadic cases were reported in community hospitals. Its incidence has been increasing, no doubt a reflection of the increased availability of diagnostic methods. The increase in these cases may be related to ecological factors, but also to greater epidemiological surveillance of infections associated with healthcare provision.[1,3,4,10]

Legionnaires' disease has a peak incidence in Summer and early Fall. Men are affected twice as frequently as women. The incubation period ranges from 2 to 10 days. The risk factors are identified as smoking, chronic lung disease (especially structural), advanced age, immunosuppression (by steroid therapy, organ transplantation, terminal renal disease, congenital or acquired immunodeficiency, malignancy, diabetes ...) and recent major surgery. Incidence of Legionellosis in patients with AIDS is low, but in these cases, it is particularly severe.[1,2,7] Legionellosis is not spread from person to person, so respiratory or contact isolation is not necessary. The transmission takes place by Legionella contaminated aerosol inhalation, e.g. from air conditioning systems, instrumentation equipment, and respiratory therapy, spa facilities, showers ... Infection by micro-aspiration of contaminated water from water distribution systems in buildings has been increasingly recognized, e.g. via naso/orogastric intubation equipment, with a higher incidence of cases in postoperative infection for surgery of the head and neck, in which there is a greater risk of aspiration.[1,3,8,9] Mortality rates range from 5% to 80% and are directly related to age, the presence and severity of comorbidities, whether or not it is an HCAP, and delay in starting specific treatment.[1,11]

DIAGNOSIS

Traditionally, Legionnaires' disease has been related to severe pneumonia, but increasingly less severe forms are identified, probably because we now have earlier diagnosis and treatment. Initially, nonspecific symptoms may arise, including general malaise, myalgia, anorexia, fatigue and headache. The typical clinical syndrome is that of pneumonia, with dry or unproductive cough, fever (low or even over 40°C), pleuritic chest pain, sometimes intense, and sometimes dyspnea and respiratory distress. Gastrointestinal symptoms may be prominent and even dominate the symptoms, eluding diagnosis (watery diarrhea without blood, nausea, vomiting, abdominal cramps) as well as neurological symptoms (headache, lethargy, confusion, cerebellar ataxia, excitement or stupor, in more severe cases). Physical examination is suggestive of pneumonia (fever, crackles and rhonchi during lung auscultation), whereas hypotension and relative bradycardia are sometimes highlighted (dissociation from temperature/pulse, which is not very distinctive of Legionellosis, but rather, suggests severe disease/pneumonia, especially in elderly patients).[1,2,8,10,12] It may also reach outside the lung, related to infection of other organs. Extra-pulmonary Legionellosis is rare and as a rule, it has a dramatic manifestation, resulting in advanced illness. The spread occurs by the hematogenous route. The most common site is the heart; and sinusitis, cellulitis, pancreatitis, peritonitis, pyelonephritis, adenitis, hepatitis may also occur. It may also reach the bone marrow or central nervous system. With regard to Cardiac Legionellosis, the most common form is myocarditis, followed by pericarditis, post-cardiotomy syndrome (often without pneumonia, thought it is thought to be related to surgery wound/placement of drains with contaminated colonized water), and finally, endocarditis, as described in prosthetic valves.[1,8,12]

Chest x-ray usually identifies nonspecific pneumonic condensation, which is usually unilateral but may also be bilateral, sometimes with nodular opacities that increase in size and cavitate, particularly in im-

munocompromised patients. Infiltrates usually progress despite antibiotic therapy; their improvement takes several days longer than the clinical improvement, and normalization in the imaging exams can take one to four months. Histologically this infection is characterized by bronchitis and alveolitis processes (alveolar inflammation with polymorph nuclear, macrophages and necrotic debris) that can develop microabscesses and in cases of advanced, drawn out disease, fibrosis.[1,7,8,11]

In laboratory tests, leukocytosis (sometimes leukopenia) is found with neutrophilia, thrombocytosis, disseminated intravascular coagulation (severe cases), elevated speed of erythrocyte sedimentation and C-reactive protein, transaminases and creatine kinase, hypophosphatemia, proteinuria, hematuria, hyponatremia (particularly suggestive if less than 130 mEq / L).[1,10-12]

Differential diagnosis with other etiologic microorganisms of pneumonias with "atypical agents": *Chlamydia pneumoniae, Mycoplasma pneumoniae, Pneumocystis carinii,* fungi, viruses ... The diagnosis requires a high degree of suspicion in order to carry out investigation, which is not done routinely.[2,4,8,9,11]

The final diagnosis can be based on different methods. The "gold standard" is the culture test (in solid agar special medium with L-cysteine and iron), which is not done in all microbiology laboratories and gives many false negative results. Sputum cultures should be performed for all suspected cases, even when the sample is of poor quality. The use of direct fluorescent antibodies is a quick method but with lower sensitivity (20-80%) than the culture test, since it requires a higher number of bacteria to be identified. Monoclonal reagents are better than polyclonal ones, as they lead to less base fluorescence and do not generate false positive results (there are no cross-reactions with antigens from other bacteria). Detection of antigen in the urine (or pleural fluid) is a convenient, fast and cheap method, with sensitivity of about 70% (or higher if the urine is concentrated by ultrafiltration) and specificity of almost 100%. It has the advantage that it is easy to obtain an adequate sample of urine (unlike samples of sputum or bronchial secretions) and the test remains positive for weeks (cases reported up to one year), despite effective antibiotic therapy. However, it only detects antigens of serogroup 1 for *Legionella pneumophila*. Serologies have greater epidemiological utility than clinical individual decision, but remain among the most used methods. IgG and IgM antibodies must be investigated, since some patients only respond with IgM, and serum determinations are required during the acute and convalescent phases. The antibodies may remain negative until one to three months after the onset of the disease. The diagnosis is defined by an increase in antibody titer of at least four times, up to at least 1/128, with gap of four to eight weeks between the two determinations (minimum of ten days). The diagnosis established by a single titer greater than or equal to 1/256 in the convalescent phase of pneumonia is not consensual. Finally, the detection of *Legionella pneumophila* DNA by *polymerase chain reaction* (PCR) is rapid and feasible in urine samples, bronchoalveolar lavage or serum. It is highly specific, but not more sensitive than the culture test; it has the limitation that there may be PCR inhibitors in the sputum or serum. It should be noted that the sensitivity of culture tests and the direct fluorescent antibody test on expectorated samples is similar to samples taken by bronchoscopy, and that this sensitivity is higher for samples collected by lavage *versus* protected specimen brush. The pleural fluid, when existing in significant or sufficient quantity, must be cultivated and the subject of specific antigen analysis by radioimmunoassay.[7,8,10,13-15]

Pontiac Fever is not a Legionellosis. It consists of a flu-like clinical syndrome with sudden onset, after 24 to 48 hours of incubation, which occurs in bursts after contact (without infection) with *Legionella pneumophila* and is self-limiting in about a week.[1,12]

TREATMENT

A delay in starting specific therapy significantly increases mortality rates for the disease. Currently, the guidelines for empirical treatment of community pneumonia include antibiotics with coverage for *Legionella.* Historically, erythromycin was the first line drug for this infection, but it was sidelined due to its gastrointestinal intolerance, ototoxicity, and the fact that it requires a high volume in intravenous administration. The new macrolides (preferably azithromycin, but also clarithromycin, phosphomycin and roxithromycin) have better activity *in vitro* and better intracellular and lung penetration. Quinolones (ciprofloxacin, levofloxacin, moxifloxacin) have better activity *in vitro* and better intracellular penetration than macrolides and are preferred, for example, in

transplanted patients, because macrolides (and rifampicin) interact with immunosuppressive drugs. Rifampicin is highly active *in vivo* and *in vitro,* and is a valid alternative for severe cases patients resistant to other treatments, in combination with a macrolide or a quinolone. Tetracyclines (doxycycline, minocycline) are also active against *Legionella.* Some studies also show some efficacy for imipenem, cotrimoxazole, ofloxacin and clindamycin. The recommended doses are the same as those used in other pneumonias *(Table I)*. The hospital treatment is administered parenterally until a clinical response is obtained, with the majority of patients having no fever after 72 hours, and after that, orally. The duration of antibiotic treatment is from ten to fourteen days for most cases, while twenty-one day treatment is recommended for immunosuppressed patients or those with extensive disease, and five to ten days when azithromycin is used.[1,2,5,12,16]

Supportive organ failure therapy is added to targeted antibiotic therapy.[1,11,12]

Individuals with no severe disease, and who are able to follow the appropriate therapy and monitoring can be treated as outpatients.[1,12]

Pontiac fever requires only symptomatic treatment.

TABLE I

Recommended doses of antibiotics

Antibiotic	Doses
Azithromycin	500 mg q24h, iv or *per os*
Clarithromycin	500 mg q24h, iv or *per os*
Roxithromycin	300 mg q24h *per os*
Erythromycin	1 g q6h iv or 500 mg q6h *per os*
Levofloxacin	500 mg q24h, iv or *per os*
Ciprofloxacin	400 mg q8h iv or 750 mg q12h *per os*
Ofloxacin	400 mg q12h, iv or *per os*
Doxycycline	100 mg q12h, iv or *per os*
Minocycline	100 mg q12h, iv or *per os*
Tetracycline	500 mg q6h, or *per os* iv
Cotrimoxazole	960 mg q8h iv or 960 mg q12h *per os*
Rifampicin	300 to 600 mg q12h, iv or *per os*

Key to figure - iv: intravenous; q24h (example) every 24 hours.

PREVENTION

In order to prevent Legionnaires' disease, it is crucial to identify the environmental source and eradicate the microorganism. Currently, in relation to prevention of HCAP, routine cultures of the hospital water supply systems are recommended (hot water tanks, pipes, showers ...) and when there are positive cultures, Legionellosis in HCAPs should always be suspected, and patients should be tested for diagnosis. Disinfection of the water should also be considered, either routinely or at least according to the culture findings. Disinfection of water systems to eliminate *Legionella pneumophila spp* is done by heating the water to 70ºC to 80ºC, with *flushing* of the terminals (fast and available, but costly); the installation of ionization units of copper or silver (better in the long term but very costly), or hyperchlorination of the water (more economic but complicated in the long run, as it damages the equipment).[1,3,4,9,12] Regarding prevention of Legionellosis in hotels, buildings or public offices, it is possible to reduce the risk by carrying out proper maintenance of aerosol manufacturing equipment, with regular cleaning and disinfection, application of biocides, and temperature control. Regular microbiological analyses are also part of the preventative measures.

COMPLICATIONS AND PROGNOSIS

The disease may progress over weeks or even months. In the lungs, it can be complicated by empyema, cavitations or bullous emphysema, in addition to respiratory failure. Compared to other organ systems, besides extra-pulmonary infection, the development of SIRS (systemic inflammatory response syndrome) can lead to multiple organ failure (renal, cardiovascular, hepatic, hematological ...). Even after healing of the infection by *Legionella*, memory loss, fatigue or other nonspecific neurologic disorders may still occur. Death is also a possible outcome.[1,7,11]

With early and adequate therapy, most patients improve within days. Poor prognosis factors are advanced age, the presence of underlying disease, and the development of respiratory failure or organ dysfunction. The occurrence of subsequent episodes is not described, therefore it is supposed that some form of immunity to the microorganism develops.[7,12]

NOTIFICATION

Since 1999, Legionnaires ' disease has been a Noti-

fiable Disease in Portugal. However, notification by this means was clearly ineffective, so in April 2004 the Health General Directorate (HGD) established the Program for Integrated Surveillance of Legionnaires' Disease, coordinated by the National Institute of Health Dr. Ricardo Jorge (INSA) in collaboration with the Hospital of Santa Cruz and the School of Medical Sciences of Universidade Nova de Lisboa (Microbiology Laboratories and Departments). This program aims to promote timely and effective clinical and laboratory notification, involving and addressing all Physicians, Health Authorities and the Clinical Pathology Services of Health Services, whether public or private.[6, 17]

This program defines a confirmed case as: isolation of *Legionella pneumophila* in sputum culture, BAL, pleural fluid, lung or blood biopsy, or an increase ≥ 4 times in antibody titer for *Legionella pneumophila* serogroup 1 in 2 blood samples taken with a minimum of 10 days, with a second titer ≥1/128, or antigen detection of *Legionella pneumophila* serogroup 1 in the urine. A probable case is defined as: A ≥ 4 increase in antibody titer for *Legionella spp* in two blood samples collected with a minimum interval of 10 days, with a second titer ≥ 1/128, or a single titer of antibodies for *Legionella spp* ≥1/256; or antigen detection of *Legionella spp* or staining with monoclonal antibodies by direct fluorescence; or PCR detection of *Legionella spp* DNA by PCR.[17]

The doctor assessing the patient is responsible, primarily and where appropriate, for suspecting the diagnosis. For all suspected cases, the following should be requested: specific culture (sputum, bronchial secretions, BAL and/or pleural fluid), research of antigen in urine (or pleural fluid) and serum antibodies by indirect immunofluorescence (IIF). Where at least one of these tests is positive, the laboratory that conducted the test shall notify the INSA, which notifies the Municipal Health Officer (DSC) and Santa Cruz Hospital. Meanwhile, the doctor who made the diagnosis must make the DDO notification (be it a probable or confirmed case) which is delivered to the DSC – cross-referencing the data and thereby avoiding loss of information. The DSC then establishes the *epidemiological investigation,* initially with *the case study* (which may ask for direct collaboration of the physician who diagnosed the case, to establish and provide information) and then with the *environmental study* (seeking to identify sources of contamination, especially the suspected sources identified in the *case study)*. The Hospital of Santa Cruz sends the data to the Collaborating Centre of the European Health Surveillance Network for Legionnaires' Disease (EWGLI, European Working Group for *Legionella* Infections), an international database.[17]

PATIENTS AT ST. TEOTÓNIO HOSPITAL, VISEU

INTRODUCTION

According to data from the DGS [Health Department], of the 317 cases of Legionnaires' Disease reported in Portugal between 2000 and 2006, only two were in the region of Viseu.[6]

We wanted to find out the reality of our Hospital, and to what extent these figures correspond to the reality.

MATERIAL AND METHODS

We conducted a retrospective investigation of cases of Legionellosis in our Hospital from January 2000 to September 2007. For this, we cross examined data provided by the Coding Office (patients whose hospital discharge report included diagnosis of Legionellosis) with the Department of Microbiology (whose records contained all the results of serology and research required for *Legionella* antigen in the Hospital). Once the number of cases was determined (and coding and diagnosis errors were excluded), we categorized them according to the demographic data and epidemiological risk factors, clinical features, laboratory tests, specific laboratory diagnosis, treatment, complications and results. Finally we cross-referenced these cases with DDO notifications found in the DGS. We also analyzed what preventive measures are adopted among us for the prevention of Legionellosis associated with health care.

RESULTS AND DISCUSSION

We found that of 11,630 patients hospitalized with a final diagnosis of pneumonia (all types of pneumonia included), there were only eight (0.007%) cases of Legionnaires' disease, three of them in 2007. There were no cases diagnosed in 2000, 2001 and 2006. Of the five cases that occurred between 2000 and 2006, only two were reported. The three 2007 cases were reported but this information is not available on the DGS website.

The characterization of the eight cases is summa-

rized in *Tables II to X*.

The following considerations have the limitations inherent to a small sample size. In our experience, the percentage of Legionnaires' disease among patients with pneumonia was 0.007%, clearly lower than predicted by the estimates of prevalence and incidence published. The number of affected males was equal to that of women, and at younger ages than are usually reported in the literature. The epidemiological context was either not clear or was inconclusive. All cases were of CAP; no cases of HCAP were found. Only 25% of smokers and 12.5% of diabetic patients were reported as risk factors. Nonspecific respiratory complaints were predominant, followed by abdominal complaints (12.5% in isolation) and finally, changes in states of consciousness (restlessness and mental cloudiness). All patients had increased analytical inflammation markers, but only 12.5% had hyponatremia at <130 mEq/L. 87.5% had a chest x-ray suggestive of pneumonia and 62.5%, significant hypoxemia. All the cases were caused by *Legionella pneumophila* serogroup 1. In 87.5% (6 cases) the diagnosis was based on serology, in 12.5% (1) by identifying specific antigen in the urine and in 12.5% (1) by both methods. No culture or detection of DNA per *Legionella* PCR was requested. 62.5% of the diagnoses were already completed after discharge of the patient. No cases of extra-pulmonary infection were detected. 87.5% of patients received appropriate antibiotics therapy from the time of admission; in the remainder, it was adjusted after diagnosis. Half of the patients required mechanical ventilation and were admitted to the Intensive Care Unit; the same

TABLE II

Demographic and epidemiological data

	Sex ♂	Sex ♀	Age	Epidemiological context	CAP	HCAP
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	1	-	41 y	?	1	-
2003	-	1	41 y	?	1	-
2004	1	-	25 y	?	1	-
2005	-	2	72 y, 63 y	?	2	-
2006	-	-	-	-	-	-
2007	2	1	55y, 35y, 50y	?	3	-
Total	4	4	mean: 47.75y	?	8	0

Key to figure - y: years of age; CAP: community acquired pneumonia; HCAP: Healthcare Associated pneumonia.

TABLE III

Risk Factors

	Smoker	Pulmonary disease	Diabetes mellitus	Immune depression	Transplant Patient
2002	0	0	0	0	0
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	1	0	0
2007	2	0	0	0	0
Total	2	0	1	0	0

TABLE IV

Clinical aspects

	Respiratory clinic predominant	Abdominal complaints	Altered state of consciousness	Nonspecific complaints
2002	1	0	0	1
2003	1	1	1	0
2004	0	1	0	1
2005	2	0	0	1
2007	1	1	1	1
Total	5	3	2	5

TABLE V

Auxiliary diagnostic tests

	Leukocytosis, neutrophilia, ↑ ESR and/or PCR	Hyponatremia <130 mEq / L	Pneumonic condensation	GSA with hypoxemia
2002	1	0	1	?
2003	1	0	1	1
2004	1	0	0	?
2005	2	0	2	2
2007	3 (1 with leukopenia)	1	3	2
Total	8	1	7	5

Key to figure - GSA: arterial blood gases, PCR: C reactive protein; ESR: Erythrocyte Sedimentation rate.

TABLE VI

Etiologic diagnosis

	L. pneumophila serogroup 1 vs Legionella spp	Serological (↑≥ 4x antibody titer)	Detection of specific antigen	Cultural isolation	DNA detection by PCR
2002	1	1	0	0	0
2003	1	1	0	0	0
2004	1	1	0	0	0
2005	2	1 + 1conv	0	0	0
2007	3	2	2	0	0
Total	8	7	2	0	0

Key to figure - conv: convalesce in the convalescent phase, DNA: deoxyribonucleic acid, PCR: polymerase chain reaction.

TABLE VII

Treatment

	Macrolide	Quinolone	Tetracycline	ABtx appropriate *ab initium*	Duration of ABtx
2002	Clarithromycin	0	0	1	2d
2003	Erythro-clarithromycin	0	0	1	20d
2004	Azithromycin	0	Doxycycline	1	14d
2005	Clarithromycin Azithromycin	0	0	1	11d, 7d
2007	Azithromycin (2)	0	Doxycycline	3	5d, 5d, 11d
Total	7	0	2	7	Mean: 9,4 d

Key to figure - ABtx: Antibiotics therapy, d: Days of hospital treatment.

patients also had failure of other organs. The average length of hospital stay was significantly higher than for pneumonias in general. The mortality rate was 12.5%.

Regarding the prevention of hospital Legionellosis in our Hospital, the study of specific cultural *Legionella* (two random points in the ventilation systems and hot water network) has been carried out twice a year since 1998, under a protocol with the ARS (Regional Health Administration); the results have always been negative to date. Disinfection of water and screens is done with sodium hypochlorite.

CONCLUSION

We conclude that Legionnaires' disease has been under diagnosed in our hospital. With the introduction of rapid diagnostic tests in hospital laboratories (such as the urinary antigen test) we now have the conditions to change this reality. Flaws in coding and notification prevent proper statistics and break with the guidelines created and the modes of action aimed at controlling this type of infection.

As a recommendation, we should remember that all patients hospitalized with CAP should undergo diagnostic evaluation for Legionnaires' disease, especially if extra-pulmonary symptoms are prevalent, there is hyponatraemia, or the patient fails to respond to treatment with β-lactamics or aminoglycosides.

Direct examination with Gram stain of sputum may suggest "atypical" pneumonia, (many leukocytes with few microorganisms – because they do not stain) and the research of the urinary

TABLE VIII

Complications

	Lung (empyema, abscess ...)	Respiratory failure (requiring MV)	Renal failure	CNS dysfunction	Multiorgan failure
2002	0	0	0	0	0
2003	0	1	1	0	1 CV
2004	0	0	0	0	0
2005	0	1	0	1	1 CV
2007	1 over-infection	2	2 (1 HD)	0	2 CV + liver + hematological
Total	1	4	3	1	4

Key to figure - CV: cardiovascular; HD: hemodialysis; CNS: central nervous system; MV: mechanical ventilation.

TABLE IX

Results

	PICU on admission	Length of stay	Discharged	Deceased
2002	0	5d	1	0
2003	1	26d	1	0
2004	0	58d	1	0
2005	1	31d, 7d	2	0
2007	2	6d, 6d, 54d	2	1
Total	4	Mean: 24 days	7	1

Key to figure - d: days; PICU: Polyvalent intensive care unit.

TABLE X

Table X: Coding and Reporting

	Coding on discharge	Notification to DDO
2002	1	1
2003	1	1
2004	0	0
2005	1	0
2007	3	2
Total	6	4

Key to figure - DDO: Notifiable disease.

antigen quickly guides the diagnosis. Culture tests for *Legionella* must be requested, to support the diagnosis and any epidemiological investigation. The newer macrolides are part of the treatment of choice for CAP in immunocompetent, as they cover typical pathogens (*Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Staphylococcus aureus*) and atypical pathogens (*Chlamydia pneumoniae, Mycoplasma pneumoniae, Legionella pneumophila*). Any pneumonia without a known etiologic agent that is sufficiently severe to require intensive care should be treated empirically for *Legionella*.

Finally, we argue that the correct coding of the final diagnoses of each patient in the hospital discharge reports, and reporting of notifiable diseases, are medical procedures that are valid, necessary and good professional practice, as much as correct diagnosis and treatment of the patient. ■

References

1. Stout JE, Yu VL. Legionellosis. N Eng J Med Sept 1997; 337: 682-687.

2. Marrie TJ, Peeling RW, Fine MJ, Singer DE, Coley CM, Kapoor WN. Ambulatory patients with community-acquired pneumonia: the frequency of atypical agents and clinical course. Am J Med 1996;101:508-515.

3. Hugo JP, Anderson KAJ, Wiebe T et al. Nosocomial transmission of Legionella pneumophila in cold water supply. Scand J Infect Dis. November 2006; 38: 1023-1027.

4. Seenivasan MH, Yu VL, Muder RR. Legionnaires' disease in long-term care facilities: overview and proposed solutions.

J Am Geriatr Soc May 2005; 3(5): 75-80.

5. Amsden GW. Treatment of Legionnaires' disease. Drugs. 2005; 5(5): 605-614.

6. www.dgs.pt. Estatísticas. Doenças de Declaração Obrigatória.

7. Fields BS, Benson RF, Besser RE. Legionella and Legionnaires' Disease: 25 years of investigation. Clin Microb Reviews 2002; 15: 506-526.

8. Den Boer JW, Yzerman EP. Diagnosis of Legionella infection in Legionnaires' isease. Eur J Clin Microbiol Infect Dis Dec 2004; 23(12): 871-878.

9. Nguyen TM, Ilef D, Jarraud S, Rouil L, Campese C, Che D. A community-wide outbreak of Legionnaires disease linked to industrial cooling towers--how far can contaminated aerosols spread?. J Infect Dis Jan 2006; 193(1): 102-111.

10. Cunha BA. Legionella pneumonia: The value of clinical and laboratory findings. J Respir Dis 2005; 26: 469-460.

11. Cunha BA. The atypical pneumonias: clinical diagnosis and importance. Clin Microbiol Infect May 2006; 12 Suppl 3: 12-24.

12. Rathore MH. Legionella infection. emedicine Aug 2007.

13. Blazquez RM, Espinosa FJ, Martinez-Toldos CM et al. Sensitivity of urinary antigen test in relation to clinical severity in a large outbreak of Legionella pneumonia in Spain. Eur J Clin Microbiol Infect Dis 2005; 24: 488.

14. Kashuba AD, Ballow CH. Legionella urinary antigen testing: potential impact on diagnosis and antibiotic therapy. Diagn Microbiol Infect Dis Mar 1996; 24(3): 129-139.

15. Helbig JH, Engelstadter T, Maiwald M et al. Diagnostic relevance of the detection of Legionella DNA in urine samples by the polymerase chain reaction. Eur J Clin Microbiol Infect Dis Oct 1999; 18(10): 716-722.

16. Blasquez GRM, Espinosa PFJ, Alemany FL et al. Antimicrobial chemotherapy for Legionella: levofloxacin versus macrolides. Clin Infect Dis Mar 2005; 40(6): 800-806.

17. Programa de vigilância epidemiológica integrada da Doença dos Legionários: notificação clínica e laboratorial de casos e investigação epidemiológica. DGS, Circulares Normativas 05/DT e 06/DT. Abril 2004.