



Pneumocystis jiroveci

Pneumocystis jiroveci (formerly known as *P. carinii*) is an atypical fungus that causes a severe and often fatal pneumonia (pneumocystis pneumonia, PCP) in immunocompromised patients¹.

Diagnosis by conventional methods

P. jiroveci cannot be cultured *in vitro*, therefore laboratory diagnosis has relied upon cytological staining or immunofluorescent assay. Generally however, few organisms are present within the upper respiratory tract and thus lower respiratory tract specimens such as BAL and induced sputa (in conjunction with other clinical indicators) are usually required for the definitive diagnosis of pneumocystis pneumonia.

Diagnosis by molecular methods

Recent advances in molecular methods have allowed the development of more sensitive tests for the detection of *P. jiroveci* DNA in a range of clinical samples.

1. Blood

Several studies have demonstrated that *P. jiroveci* can be detected in serum and blood product derivatives^{3,4,5,6} however, due to the conflicting results obtained, the usefulness of such samples in detecting the presence of *P. jiroveci* remains to be established.

Its detection in peripheral blood may represent transient dissemination of *P. jiroveci* due to an alteration of the endothelial architecture of the lung, possibly due to prolonged treatment. Alternatively it may represent the presence of damaged organisms / DNA complexes released from phagocytic cells transiently passing through the bloodstream^{3,6}.

Extrapulmonary pneumocystosis, affecting organs such as the spleen, kidney and also the foetus, is a rare condition but demonstrates that the organism can be spread systemically via the bloodstream (Bazaz G *et al.*, 1970, Boldorini R *et al.* 1995).

2. Oral wash

Oral washes may be useful when invasive sampling procedures are not feasible^{1,9,10}. Several studies have compared paired oral washes and BAL samples for the detection of *P. jiroveci* and although the results are mixed¹², most have demonstrated similar specificity and sensitivity between the two sample types^{9,10,11}. Antibiotic treatment prior to oral wash sampling negatively affects the detection of *P. jiroveci* DNA¹¹. Systematically collected oral wash samples may be useful in monitoring the effectiveness of treatment⁹.

3. Respiratory samples

P. jiroveci has been detected using molecular methods in respiratory samples including BAL, induced sputum, oral washes and tracheal aspirates¹³. A study by Gupta *et al.*,¹³ investigated the detection of *P. jiroveci* in respiratory samples by PCR when compared to standard microscopy techniques. BAL and sputum were demonstrated to be the most useful clinical samples. None of the nasopharyngeal aspirates tested were positive for the presence of *P. jiroveci* DNA¹³.

Asymptomatic colonisation

Asymptomatic colonisation of *P. jiroveci* has been described in immunocompromised patients with primary acute and chronic respiratory disorders including bacterial pneumonia, lung fibrosis, transplant patients and lung edema^{14,15,16}. The detection of *P. jiroveci* in these groups of patients suggests that lung tissue damage may favour colonisation of this organism¹⁴. Consequently, colonisation may represent a reservoir for person-to-person transmission in these patients^{14,16}.

Recommended Sample types (for the detection of *P. jiroveci* DNA)

BAL and sputum samples are best for the detection of *P. jiroveci* to aid in the diagnosis of PCP. Where these samples cannot be obtained, there may be some value in testing oral washes, as long as PCP treatment has not already been started.

We would always advise that a diagnosis of PCP is made only after consideration of the full clinical picture.

Please contact Dr John Thomas (j.thomas@micropathology.com) or Dr Mark Collery (m.collery@micropathology.com) to discuss any aspect of the *Pneumocystis jiroveci* detection service.

References

1. Wakefield AE. 2002. *Pneumocystis carinii*. Br Med Bull. Vol 61:175-88.
2. Helweg-Larsen Jannik. 2004. *Pneumocystis jiroveci*. App mol. micro, epid, diag. Vol 51. 251-273.
- 3 Tamburrini E *et al.*, 1996. Detection of *Pneumocystis carinii* DNA in blood by PCR Is Not of value for diagnosis of P. carinii pneumonia. J Clin microbiol. Vol 34. No 6. p1586 –88.
4. Rabodonirina M, *et al.*, 1999. Detection of *Pneumocystis carinii* DNA in blood specimens from Human Immunodeficiency Virus-infected Patients by nested PCR. J Clin Micro. Vol 37 No 1. p127-131.
5. Evans R *et al.* 1995. The use of a nested polymerase chain reaction for detecting *Pneumocystis carinii* from lung and blood in rat and human infection. J Med Microbiol. Vol 42(3):209-13.
6. Schluger N *et al.* 1992. Application of DNA amplification to pneumocystosis: presence of serum *Pneumocystis carinii* DNA during human and experimentally induced *Pneumocystis carinii* pneumonia. J Exp Med. Vol 176(5):1327-33.
7. Bazaz G *et al.*, 1970. *Pneumocystis carinii* pneumonia in three full-term siblings. Vol 76(5):767-9.
8. Boldorini R *et al.* 1995. Acute hepatic and renal failure caused by *Pneumocystis carinii* in patients with AIDS. J Clin Pathol. Vol 48(10):975-8.
9. Helweg-Larsen J *et al.* 1998. Diagnostic use of PCR for detection of *Pneumocystis carinii* in oral wash samples. J Clin Microbiol. Vol 36(7):2068-72.
10. Fischer S *et al.* 2001. The use of oral washes to diagnose *Pneumocystis carinii* pneumonia: a blinded prospective study using a polymerase chain reaction-based detection system. J Infect Dis. Vol 184(11):1485-8. Epub 2001 Nov 13.
11. Larsen H, *et al.* 2004. A prospective, blinded study of quantitative touch-down polymerase chain reaction using oral-wash samples for diagnosis of *Pneumocystis* pneumonia in HIV-infected patients. Vol 189(9):1679-83. Epub 2004 Apr 16.
12. Nyamande K. *et al.*, 2005. Low sensitivity of a nested PCR in oropharyngeal washings for the diagnosis of *Pneumocystis* Pneumonia in HIV-infected patients. Chest. Vol 128. p167-171.
13. Gupta R *et al.*, 2009. Diagnostic significance of nested PCR for sensitive detection of *Pneumocystis jiroveci* in respiratory clinical specimens. Diag. Micro. Infect. Dis. Vol 64. p 381-88.
14. Sing A *et al.*, 1999. *Pneumocystis carinii* carriage in immunocompetent patients with primary pulmonary disorders as detected by single or nested PCR. J Clin. Micro. Vol 37. p3409 –10.
15. Sing A *et al.*, 2000. Evaluation of diagnostic value and epidemiological implications of PCR for *Pneumocystis carinii* in different immunosuppressed and immunocompetent patient groups. J Clin Microbiol. Vol 38 (4). P 1461-7.
16. Jarboui M. 2010. Molecular diagnosis of *Pneumocystis jiroveci* pneumonia in immunocompromised patients. Mycoses. Vol 53 (4). P 329-33.