A case of infection caused by the basidiomycete *Phellinus undulatus*

Deborah Williamson,¹ Sushil Pandey,¹ Susan Taylor,²,³ Karen Rogers,¹ Louanne Storey,²,³ Mark R. Marshall⁴ and David Holland²,³

¹Department of Microbiology, LabPlus, Auckland City Hospital, Auckland, New Zealand
²Department of Infectious Diseases, Middlemore Hospital, Auckland, New Zealand
³Department of Microbiology, Middlemore Hospital, Auckland, New Zealand
⁴Department of Renal Medicine, Middlemore Hospital, Auckland, New Zealand

We present a case of soft tissue infection caused by the basidiomycete *Phellinus undulatus*. To our knowledge, this is the first reported case of human infection caused by this fungus. Definitive identification was only possible through molecular analysis as the isolate failed to produce any distinct morphological features in vitro.

Introduction

Infections caused by filamentous basidiomycetes are rare, with most reports citing *Schizophyllum commune* or *Coprinus* species as the most common aetiological agents (Gené et al., 1996; Sigler & Abbott, 1997; González et al., 2001). The clinical spectrum of infections can include allergic bronchopulmonary disease (Kamei et al., 1994), fungal ball of the lung (Sigler et al., 1995), sinusitis (Rosenthal et al., 1992; Sigler et al., 1999), endocarditis (Speller & MacIver, 1971), brain abscess (Rihs et al., 1996) and fatal pneumonia (Verweij et al., 1997). We report a case of cutaneous infection caused by the basidiomycete *Phellinus undulatus*.

Case report

A 57-year-old type 2 diabetic female presented to the renal outpatient clinic (Middlemore Hospital, Auckland, New Zealand) in September 2008, with a gradually expanding mass on the medial aspect of her right knee. There was no history of recent trauma to the knee. Six years previously, she had been diagnosed with end-stage kidney failure secondary to diabetic nephropathy, and had commenced haemodialysis at that time. Her dialysis regimen consisted of three-times-weekly treatments through a left brachiocephalic fistula. Her other active medical co-morbidity included treated hypertension and ischaemic heart disease. She had a history of a previous central venous catheter-related blood stream infection secondary to *Staphylococcus aureus* in 2002.

On examination, the mass was non-tender and fluctuant, and was initially thought to be a lipoma. Magnetic resonance imaging examination of the knee revealed a well-circumscribed round mass within the subcutaneous tissue at the medial aspect of the right knee, measuring approximately 5 × 5 × 4 cm, with no involvement of deep structures or the knee joint. Further examination of the mass by ultrasound showed it to be compressible and hypoechoic, with no internal vascularity. Referral was made to the orthopaedic team (Middlemore Hospital) for surgical excision, which was undertaken in December 2008. The operative findings were of a large pus-filled cyst, which was completely excised.

Histological examination revealed a pseudocyst, containing thick creamy material. Microscopy showed chronic inflammatory changes, and staining with periodic acid-Schiff stain revealed the presence of non-branching, septate fungal hyphae within the wall of the pseudocyst. No organisms were seen on Gram staining, and there was no evidence of malignancy. Routine bacteriological cultures taken from the lesion perioperatively did not show growth; however, after incubation at 37 °C for 4 days, a few pure colonies of a fungus were seen on a horse blood agar plate. This was subcultured onto plain Sabouraud dextrose agar, and incubated at 25 and 37 °C. After 7 days at 25 °C, a yellow/cream-coloured, fluffy thallus with a yellow/brown reverse were seen (Fig. 1). The isolate did not grow on media containing cycloheximide (0.05 %), but was tolerant of benomyl (2 μg ml⁻¹). Microscopic examination revealed hyaline, septate hyphae without any particular features.

The isolate remained sterile in culture, so definitive identification was carried out by molecular analysis. Fungal chromosomal DNA was extracted from fungal culture using the PrepMan Ultra sample preparation reagent, as per the manufacturer’s instructions. The D1, D2 and D3 region of the 25–28S (large subunit rRNA) was amplified with primers LROR and LR16 (Chen et al., 2002). Amplification was performed in a 0.2 ml PCR tube with a total reaction volume of 50 μl using a GeneAmp PCR System 9700 thermocycler (Applied Biosystems). Each reaction tube contained 2.5 U Taq DNA polymerase,
Discussion

The filamentous basidiomycetes are ubiquitous fungi that are commonly isolated from clinical specimens. However, their pathogenic role is often unclear, and cases of actual infection caused by basidiomycetes remain relatively rare (González et al., 2001). Furthermore, identification is difficult, as many isolates do not sporulate and remain sterile in culture. In this patient, however, there was significant corroborative evidence that *P. undulatus* was the true cause of her infection (pure growth in culture, absence of any other bacterial or mycobacterial agents and, most importantly, demonstration of fungal hyphae in histopathology specimens). Antifungal susceptibility testing of this isolate was not performed, as clinically it was felt that surgical excision of the lesion would be curative, and this has proved correct to October 2010. However, in one of the few past reports of an infection with *Phellinus* spp., it was necessary to utilize triple antifungal therapy with intravenous liposomal amphotericin B, intravenous caspofungin and oral voriconazole (Davis et al., 2007).

Filamentous fungi are often agents of opportunistic infection in immunodeficient patients (Richardson & Lass-Flör, 2008). Although our patient was not frankly immunocompromised, uraemia does result in a variable degree of impairment to host defences, and can be expected to increase susceptibility to novel and opportunistic pathogens (Meier et al., 2002). The portal of entry for infection in our patient was not obvious, although the circumscribed nature of her infection is suggestive of local traumatic inoculation. However, the patient had no recollection of any notable trauma at that site.

The genus *Phellinus* belongs to the family *Hymenochaetaceae*, as does the closely related genus *Inonotus*. Most filamentous basidiomycetes such as these are obligate phytopathogens or wood-decaying fungi, and are ubiquitous in the environment. Approximately 220 species of *Phellinus* are recognized to date, many of which are known to occur throughout New Zealand on a variety of tree hosts (http://nzfungi.landcareresearch.co.nz).

*Phellinus* spp. produce numerous potential medicinal metabolites – the bioactivity of these is the subject of ongoing research (Dai et al., 2010). However, to our knowledge there have been few documented infections with *Phellinus* spp. and none citing *P. undulatus* as the aetiological agent (Sutton et al., 2005; Davis et al., 2007).

The failure of many basidiomycetes to yield diagnostic characteristics means that identification is possible only by molecular analysis, as for our isolate. It is likely that the future increased use of molecular identification tools will expand the identification of basidiomycetes as agents of infection.

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References


