INTRODUCTION

Penicillium species are common and generally non-pathogenic laboratory contaminants that are widely found in nature [1]. Among Penicillium species, *Penicillium marneffei* (*P. marneffei*) is the only dimorphic and pathogenic species. This pathogen can cause infections in both healthy individuals and immunosuppressed patients, particularly in those infected with HIV in Southeast Asia [2]. This species was recently transferred to the *Talaromyces* genus along with other *Penicillium* species belonging to the *Biverticillium* sub-genus [3]. Aside from *Talaromyces marneffei* (previously named *P. marneffei*), rare cases of infections related to species such as *Penicillium chrysogenum*, *Penicillium oxalicum*, *Penicillium piceum* and *Penicillium* 

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**SUMMARY**

A 66-year-old female patient with multiple myeloma (MM) was admitted to the emergency service on 29.09.2014 with an inability to walk, and urinary and faecal incontinence. She had previously undergone autologous bone marrow transplantation (ABMT) twice. The patient was hospitalized at the Department of Haematology. Further investigations showed findings suggestive of a spinal mass at the T5-T6-T7 level, and a mass lesion in the iliac fossa. The mass lesion was resected and needle biopsy was performed during a colonoscopy. Examination of the specimens revealed plasmacytoma. The patient also had chronic obstructive pulmonary disease (COPD) and was suffering from respiratory distress. After consultation with an infectious diseases specialist the patient was placed on an intravenous antibiotherapy with piperacillin/tazobactam (4.5 g x 3) on 17.10.2014. During piperacillin/tazobactam treatment, the patient suffered from drowsiness, her general condition deteriorated, and she had rales on auscultation of the lungs. The patient underwent thoracic computerized tomography (CT) which showed areas of focal consolidation in the lower lobes of the two lungs (more prominent on the left), and increased medullary density. The radiology report suggested that fungal infection could not be ruled out based on the CT images. The sputum sample was sent to the mycology laboratory and direct microscopic examination performed with Gram and Giemsa’s staining showed the presence of septate hyphae; therefore voriconazole was added to the treatment. Slow growing (at day 10), grey-greenish colonies and red pigment formation were observed in all culture media except cycloheximide-containing Sabouraud dextrose agar (SDA) medium. The isolate was initially considered to be *Talaromyces marneffei*. However, it was subsequently identified by DNA sequencing analysis as *Talaromyces purpurogenus*. The patient was discharged at her own wish, as she was willing to continue treatment in her hometown. Unfortunately, the patient died on December 8, 2014. In conclusion, apart from *T. marneffei*, less common strains such as *T. purpurogenus* should be considered when clinical samples obtained from patients with haematologic/oncologic disorders show fungal colonies that form red pigments on the culture media and when microscopic examination suggests a morphological appearance similar to *Penicillium* species.

**Keywords**: multiple myeloma, *Penicillium*, *Talaromyces purpurogenus*.
purpurogenum have also been reported [4-7]. According to current taxonomic approaches, the last two Penicillium species have also been transferred to the Talaromyces genus, with their names being changed to Talaromyces piceus and Talaromyces purpurogenus [3].

In this case report, we discuss the diagnosis and clinical significance of a T. purpurogenus strain isolated from the sputum culture of a patient with multiple myeloma (MM) who previously underwent autologous bone marrow transplantation (ABMT) twice and later developed plasmocytoma. The strain in question was initially presumed to be T. marneffei due to red pigments scattered in the sputum culture, but it was later identified correctly as T. purpurogenus using DNA sequencing analysis.

**CASE REPORT**

A 66-year-old female patient, who was diagnosed with MM at another healthcare center in 2010, had previously received vincristine, adriamycin and dexamethasone (VAD) chemotherapy. The patient subsequently underwent ABMT at the Hematology Unit of our hospital in 2011 and 2013. Then the patient was followed at 3-monthly intervals in remission. However, the patient was admitted to the emergency service of our hospital on September 29, 2014, with the complaints of urinary and fecal incontinence and inability to walk. The patient was hospitalized at the department of hematology and further investigations showed findings suggestive of a spinal mass at the T5-T6-T7 level and a mass lesion in the iliac fossa. The mass lesion was resected and needle biopsy was performed during a colonoscopy. The examination of the two specimens revealed plasmocytoma. The patient also had chronic obstructive pulmonary disease (COPD) and she was suffering from respiratory distress. A consultation with an infectious diseases specialist was performed after which the patient was placed on an intravenous antibiotic therapy with piperacillin/tazobactam (4.5 g x 3) on 17.10.2014. During piperacillin/tazobactam therapy, the patient developed suffered from drowsiness, her general condition deteriorated, and there were rales on auscultation of the lungs. Thoracic computerized tomography (CT) scan was then performed. Lymph nodes with short axes smaller than 1 cm were observed in the mediastinum, and there was minimal free fluid in the left hemithorax. Focal consolidated areas and increases in medullary density were observed bilaterally in the lower lobes of the lungs that were more prominent in the left lung. It was noted that these findings could not rule out a possible fungal infection (Figure 1). In laboratory tests, white blood cell count was 7.63 x 10³/µL (68.9% neutrophils), hemoglobin was 9.0 g/dL, and platelets was 208 x 10³ µL. The sputum culture sent to the bacteriology laboratory on October 30, 2014, showed growth of Acinetobacter baumannii, and the patient was placed on a therapy with colistin and sulbactam based on the antibiotic susceptibility tests. Direct microscopic examination was performed on the sputum culture sent to the mycology laboratory in the same day, and the samples were inoculated onto Sabouraud dextrose

**Figure 1** - Computerized tomography scan shows pulmonary fungal lesions.
agar (SDA; Oxoid, United Kingdom) with and without antibiotics (containing cycloheximide and chloramphenicol) after Gram and Giemsa’s staining, and then incubated at 37°C and 25°C. Direct microscopic examination performed with Gram and Giemsa’s staining showed presence of septate hyphae. The voriconazole (4 mg/kg x 2) was added to the treatment. Slow growing (at day 10), gray-greenish colonies were observed at both 37°C and 25°C in all culture media except cycloheximide-containing SDA and red pigment was diffusely scattered on the culture medium (Figure 2). The isolate was initially considered to be *T. marneffei*; however, this possibility was ruled out when it was observed that the isolate did not form circular white colonies similar to those of yeast on sheep blood agar at the suitable temperature. In corn meal-Tween 80 agar slide culture; non-specific septate, hyaline hyphae, conidiophores, and bottle shaped phyllitis on some metulae branching from conidiophores, and circular conidium chains branching from each phyllitis were observed (Figure 3). DNA analysis of the clinical species was performed at a private laboratory (RefGen) by using PCR products and primers and the ABI 3100 Genetic Analyzer device. The data of sequence analysis was analyzed using the “National Center for Biotechnology Information (Bethesda, ABD)” BLAST system (http://www.ncbi.nlm.nih.gov/BLAST/), and DNA of the isolate was found to be 100% consistent with *Talaromyces purpurogenus*. Antifungal susceptibility test was not performed routinely. The isolated strain could not be reproduced when an antifungal susceptibility test was attempted for the purpose of this case report. There was no bacterial or fungal growth in blood and subsequent sputum cultures. The patient tested negative for human immunodeficiency virus antibodies (anti-HIV) and galactomannan antigen. The patient was administered IVIG due to low IgG levels. Blood gas analysis was performed as the patient had persistent tachypnea and tachycardia. The results of blood gas analysis were found to be consistent with respiratory alkalosis; a repeat thoracic CT was then performed on November 16, 2014, which revealed healing and newly formed nodules, and a newly formed consolidation in the left upper lobe. The

![Figure 2 - Colony of *Talaromyces purpurogenus* and red pigment formation.](image1)

![Figure 3 - *Talaromyces purpurogenus* in slide culture.](image2)
patient was then placed on meropenem therapy. The patient was discharged from the hospital on her own wish, willing to continue treatment in her hometown. We were soon informed that the patient died on December 8, 2014.

**DISCUSSION**

*P. marneffei* has been reported as the fourth most common infectious agent among opportunistic infections observed in patients with AIDS in endemic regions [2]. Although *P. marneffei* is the best known primary pathogen in humans and animals among *Penicillium* species, invasive fungal infections caused by species such as *P. capsulatum*, *P. chrysogenum*, *P. citrinum*, *P. decumbens*, *P. piceum*, *P. commune* and *P. purpurogenum* have also been reported on rare occasions [8-13]. Recently, species such as *P. piceum*, *P. purpurogenum* and *P. marneffei* have been transferred to *Talaromyces* genus, and renamed as *Talaromyces marneffei*, *T. piceus* and *T. purpurogenus*, respectively [3]. *T. purpurogenus* is a soil and herbal pathogen that can grow at 37ºC [14]. According to the new taxonomy; *T. purpurogenus*, *T. ruber* and two new species of *T. amestolkiae* and *T. stolii* are included into the *T. purpurogenus* complex [15]. *T. purpurogenus* can be distinguished from other species in the *T. purpurogenus* complex by its slow growth, inability to grow under 18ºC, and production of red pigment [15]. *Talaromyces* species such as *T. marneffei*, *T. purpurogenus*, *T. albobiverticillius* and *T. minioluteus*, as well as *Penicillium* species such as *P. citrinum*, *P. fanninellum* and *P. rubrum* can produce red pigments that spread in the medium [2,16]. Due to red pigment that spread on the surface of the medium, we initially assumed that the slowly-growing clinical isolate was *T. marneffei*, before realizing that it was 100% consistent with *T. purpurogenus* based on the DNA sequence analysis method.

To date, *T. purpurogenus* has been reported as the causative agent of pulmonary infection only in three cases [the underlying disorder was chronic granulomatous disease (CGD) in one patient, and acute myeloid leukemia (AML) in the other patient; the data on the third patient was obtained from reference number 14, and the underlying disease of this patient could not be identified]. It was also the suspected etiologic agent in a newborn with pulmonary hemorrhage and reported as the causative agent of disseminated mycosis in one German shepherd [8,14,17,18]. On the other hand, it is still questionable whether the isolates reported in these cases were accurately identified according to the new taxonomy. Amphotericin B was used in the two patients with underlying CGD and AML. The first patient fully recovered as evidenced by radiological and clinical assessment; however, the second patient remained stable for one month after achieving recovery but died of septic shock after two months. The present patient died approximately one month after initiation of voriconazole therapy.

In conclusion, it is important to bear in mind that in case fungal colonies that produce red pigments on the surface of the medium are observed, and in case the microscopy findings of clinical samples indicate *Penicillium*-like morphology, there is a possibility that the infection might be caused by rarely encountered species other than *T. marneffei*, such as *T. purpurogenus*.

**Conflict of interest:** The authors have no conflicts of interest. They alone are responsible for the content and composition of the manuscript.

**REFERENCES**


Pulmonary infection caused by *Talaromyces purpurogenus* in a patient with multiple myeloma


