DISSEMINATED TRICHOSPORONOSIS IN A BURN PATIENT: MENINGITIS AND CEREBRAL ABSCESS DUE TO TRICHOSPORON ASAHII

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A 44-year-old diabetic female presented to hospital in Jamaica with thermal burns. *Trichosporon asahii* was isolated from facial wounds, sputum and meningeal swab. Dissemination of the fungus was demonstrated in stained histological sections of the meninges and a brain abscess at autopsy. Pure growth of the fungus from patient samples submitted and an environmental isolate obtained from a wash basin in the hospital supported the diagnosis.

CASE REPORT

A 44-year-old hypertensive, diabetic woman presented with partial and full-thickness thermal burns involving 50% of her total body surface area including the face and neck, torso, upper limbs and proximal portion of lower limbs. She was admitted to the ICU for ventilatory support for suspected inhalational injury. Her initial haemoglobin was 5.2 g/dl, white cell count 6.4 x 10^9/l and platelet count 239 x 10^9/l, while blood urea nitrogen (BUN) and creatinine levels were 2 mmol/l and 54 µmol/l respectively. Management included fluid resuscitation, topical and systemic antibiotic therapy, surgical intervention for control of wound sepsis, and limb perfusion. She also received ceftriaxone for empiric antibiotic coverage, tetracycline ointment for facial burn wounds and twice-daily dressings using flumazine to the wounds on the body. Nursing and dietary supportive measures were also instituted.

The patient was clinically stable on admission when primary culture of sputum yielded a light growth of yeast reported as ‘Yeast not *Candida albicans*’. However, despite broad-spectrum...
antibiotic coverage, signs of sepsis manifested within 5 d of admission. She developed multi-
organism infection of the burn wounds, which were culture-positive for *Pseudomonas*
aeruginosa, *Streptococcus* Group D, *Bacteroides*, *Alcaligenes* sp. and *Stenotrophomonas*
maltophilia. Blood culture and culture of a femoral central venous catheter tip were also positive
for *Streptococcus* Group D and *Acinetobacter* sp. Sputum and urine cultures were negative at
this time. Appropriate antibiotic intervention following antibiotic susceptibility testing on
isolates were commenced and 0.25% acetic acid was included in the dressings to wounds that
were positive for *Pseudomonas*. Despite the continued usage of antibiotics, she persistently
showed clinical, biochemical and haematological signs of sepsis. The patient’s clinical status
continued to deteriorate and she developed multi-organ dysfunction.

Over the period of hospitalization, gradual increasing levels in BUN (Mean: 20.9 mmol/l, range:
9.1-32.1 mmol/l) and creatinine (Mean: 287.2 µmol/l, range: 54-353 µmol/l) were recorded.
Levels remained relatively high throughout the remainder of the patient’s hospital stay, and were
consistent with renal failure.

Subsequent sputum culture (23 d after admission) again demonstrated moderate growth of a
fungus reported as “Yeast not *Candida albicans*”. Repeat blood cultures were negative following
specific antibiotic therapy after antibiotic susceptibility testing on the cultured isolates. However,
facial wound culture repeated one day before death was positive for multi-drug resistant
*Acinetobacter* sp, *Streptococcus* Group D and ‘coagulase negative’ *Staphylococcus*. The blood
culture grew multi-drug resistant ‘coagulase-negative’ *Staphylococcus* and *Acinetobacter* sp. In
addition, a rapidly growing fungus was isolated from facial wounds and sputum. Characteristic
microscopic features, growth at various temperatures, and assimilation of specific carbohydrates
identified the fungus as *Trichosporon asahii*. The patient's clinical status continued to deteriorate
and she died on day 32, post-admission to hospital.

Autopsy revealed infected thermal burns involving all anatomical locations noted clinically. On
dissection, significant findings included hyperaemia of the tracheobronchial tree and markedly
overweight lungs, with marked pulmonary congestion and consolidation consistent with adult
respiratory distress syndrome. Other significant autopsy findings included perivascular opacity in
the parasagittal region of the meninges suggestive of inflammation. Subsequent microbiological
examination identified *Trichosporon asahii*. Dissection of the brain revealed an abscess in the
right temporoparietal region. Histological examination of sections obtained from the meninges
and brain abscess, using haematoxylin & eosin and periodic acid Schiff, showed numerous yeast
cells and arthroconidia scattered within the acute inflamed tissue (Fig. 1). No fungal elements
were seen in histological-stained sections in any other post mortem tissues.

Standard microbiological procedures including Gram stain microscopy on sputum, facial wound
swab and meningeal swab, revealed Gram positive budding yeast cells, pseudohyphae and
arthroconidia, while overnight cultures at 37°C on blood agar and MacConkey agar produced a
rapidly growing fungus with chalky white, pin point colonies. Colonies on both agar media
became wrinkled and heaped up at the centers with characteristic radiating furors following 7 d
incubation at 37°C (Fig. 2). All specimens except blood cultures and urine grew the fungus with
detectable pure growth of the organism.

Mycological investigation including culturing on Sabouraud dextrose agar (SDA), cornmeal agar
(CMA) and Mycobiotic agar (MYC) incubated at 25°C, 28°C, and 37°C produced
morphologically similar colonies to those seen on blood agar and MacConkey agar. Pellicles
formed in broth cultures and growth after 48 hours incubation at 42°C was demonstrated by the
fungus.

Lactophenol Cotton Blue stains from pure cultures demonstrated microscopic morphology
characteristic of *Trichosporon* species. Arthroconidia, hyphae and pseudohyphae were more
pronounced in older (7 d) cultures on cornmeal agar (Figs. 3, 4). The barrel-shaped arthroconidia
of *T. asahii* are diagnostic for this species (Fig. 4).

The API 20C (BioMérieux) system was employed for yeast identification, and the assimilation
profiles readily identified all three isolates as *T. asahii* (API 20 C code – 2744734). Positive
assimilation was demonstrated for arabinose, cellobiose, galactose, lactose, maltose and xylose,
while negative reactions were documented for adonitol, inositol and sorbitol. All isolates were
urease positive, a diagnostic feature of *Trichosporon* species aiding differentiation from urease.
negative species of *Geotrichum*. Differential species characteristic of *T. asahii* include assimilation of arabinose, inability to assimilate melibiose, and growth at 37°C (7, 9).

Several attempts to identify the source of infection including sampling health care workers and the immediate environment were mostly unsuccessful, but the fungus was later recovered from one of thirteen wash-basins designated for patients use. This isolate also produced identical carbohydrate assimilation reactions as the clinical isolates (API 20C code- 2744734). One representative isolates of *T. asahii* from the patient and one from the environmental source (basin) are deposited in the University of Alberta Microfungus Collection (UAMH; Edmonton, Alberta, Canada).

*Trichosporon asahii* and other members of the Genus *Trichosporon* are basidiomycetous yeasts characterized by the production of true hyphae and pseudohyphae, arthroconidia and blastoconidia (8, 9). These fungi are rarely seen in human infections, and to-date, just over 100 disseminated cases caused by *T. asahii* have been reported in the literature worldwide (21). The vast majority of these cases have been reported in leukemia or lymphoma patients who developed severe depletion in neutrophils (11, 21). Our report describes the first case fatality of disseminated *T. asahii* infection seen at the University Hospital of the West Indies (UHWI), Jamaica. The disseminated case presented was not typical of those usually reported in the literature in which neutropenia is the major risk factor in invasive diseases (17).

For many years, invasive trichosporonosis not due to *T. cutaneum* were reported as *T. beigelli* infection. However, significant taxonomic revision in the early 1990s divided *T. beigelli* into several strains including *T. asahii* and presumably a significant number of those cases prior to the revision may have been due to *T. asahii* infection (7, 13, 9). Since the first case report of invasive disease in 1970, disseminated infections have been increasingly recognized in systemic illnesses of immune compromised patients (4, 21, 23).

*Trichosporon* species have been isolated from the soil and other environmental sources (7), and from surfaces in indoor environments (19). They can also be a part of the normal flora of the human gastrointestinal tract, skin and respiratory tract (22). Our isolation of *T. asahii* from a
hospital wash-basin in this study demonstrates the potential for environmentally acquired and nosocomial infections.

Dissemination of the fungus is rarely encountered and only a few case reports of associated invasive trichosporonosis in patients with extensive burns have been documented (2). It is noteworthy to mention that neutropenia is the primary predisposing risk factor in disseminated cases of trichosporonosis but a notable absence in the present case. Despite the infrequency of invasive trichosporonosis, *T. asahii* is increasingly recognized as an important emerging opportunistic pathogen in the immunocompromised host and generally patients with critical underlying conditions (6) including diabetes (3). Several documented cases of trichosporonosis in aged and critically ill patients have been linked with ICU patients in different hospitals (5, 24). Invasive disease is not limited to elderly patients, affecting a wide age range including neonates (1). Several prior reports of *Trichosporon* causing chronic meningitis and brain abscess may be attributable to *T. asahii* (23, 9).

Patients with invasive trichosporonosis often present with an acute febrile illness that is unresponsive to empiric antibacterial agents. Skin lesions occur in about one-third of patients while other clinical manifestations may include pulmonary infiltrates, azotemia, and renal dysfunction (16). This 44-year-old female who was admitted to the ICU with thermal burns also developed complications of renal failure. Renal failure is a frequent feature of invasive trichosporonosis (22) but the notably absence of the fungus from repeated urine cultures indicated that *T. asahii* was not a contributing factor to this clinical outcome. The pathogenesis of the fungus is not fully understood and has only been described using the findings of laboratory animal models. In one experimental study using cortisone treated mice inoculated with several yeast-like fungi, macroscopic and microscopic observations revealed lesions in their brain, heart, kidney, liver, lung, and spleen due to *T. cutaneum* with a 38% mortality (12). A similar experimental study to determine the invasive properties of *T. asahii* would be a useful exercise to compare possible similarities between the two species. Presumably, similar findings would help to explain *T. asahii* involvement of the meninges in the current case of trichosporonosis.

The use of corticosteroid and anticancer drugs may influence neutropenic levels in haematologic cancer patients thereby predisposing such cases to *T. asahii* infection (17). The absence of these
predisposing factors in this current case of trichosporonosis did not prevent the dissemination of the fungus. While not conclusive, it would appear that the invasive properties demonstrated by the fungus were facilitated by predisposing risk factors of widespread burns, prolonged mechanical ventilation, and diabetes together with the invasive properties of capsular antigen glucuronoxylomannan (GXM). These risk factors were likely, the main contributors to dissemination of the fungus (10, 3, 15). In our case, the only evidence of T. asahii invasion from pathological investigation was the meninges, suggesting the propensity of the fungus to gain access to several organ systems once the body’s defense mechanisms have been breached. Failure to invade other organ tissues may have been reflective of the blood cultures being repeatedly negative. A positive blood culture and presence of characteristic fungal elements typical of Trichosporon species in internal organ tissues frequently support the diagnosis of disseminated infection (20, 21). In the present case, a diagnosis of invasive disease was based on typical fungal elements of T. asahii in stained histologic sections of the meninges. These findings may suggest a predilection of the organism for the meninges and respiratory tract and its apparent ability to easily invade a breached blood brain barrier. Karashima et al. (10) demonstrated that passage of T. asahii in vivo (laboratory mice) is associated with increased release of glucuronoxylomannan antigen (GXM). This antigen enables the fungus to evade phagocytosis by polymorphonuclear leucocytes and monocytes in vivo (10). Consequently, persistent infection by the fungus may establish infection in various organ tissues and has been reported in brain abscess and other sterile areas due to the persistent infection of the fungus (10, 23).

Positive urine cultures are frequently another important indicator of dissemination of the organism (21). In the present case, however, these cultures were repeatedly negative for T. asahii. Other body sites including the alimentary tract, respiratory tract, broken skin and mucosal barriers have been viewed as possible routes for Trichosporon species (21, 24). In our case, the respiratory tract and damaged skin were the most likely portals of entry. Early cultures of sputum samples that grew a yeast-like fungus were not identified, but T. asahii was subsequently isolated and identified from sputum specimens that were later submitted for mycological investigation. All isolates including those from the meninges and facial wounds yielded pure growth of T. asahii in cultures suggesting a single infecting agent.
T asahii in invasive disease closely resembles systemic candidiasis in its clinical presentations and is difficult to differentiate histologically (14). Fungal infections of this nature are likely to be missed by clinicians who are encountering such cases for the first time. This may result in delays of diagnosis, antifungal intervention and subsequently the choice of the appropriate antifungal drugs where resistance is of major concern. In vitro resistance has been demonstrated in both amphotericin B and, to a lesser extent, the azoles (24). However, the newer triazoles (eg. voriconazole, posaconazole, ravuconazole) have shown excellent in vitro activity against *trichosporon* species and are recommended for treatment (1, 5, 21). A review of the patient’s record revealed that no antifungal drugs were used in management of this patient, a decision apparently made in the face of negative blood cultures and given that the dissemination of the fungus at the time was not indicated from early investigations. Importantly, when there is clear evidence of fungal dissemination, a considered approach to antifungal intervention is paramount. Bearing in mind, the effectiveness of early treatment and resistance to many antifungals by *trichosporon* species have been encountered and remains a major challenge to patient management (5, 18).

The challenge of determining the source of infection together with several predisposing factors may further compound the problem of eradication of *trichosporon* species and the management of affected patients. Identifying these unusual fungal infections is even more difficult when signs and symptoms mimic other diseases with similar clinical manifestations. It is therefore incumbent on health care professionals, especially those involved in direct patient care, to be aware of: 1) the risk factors that facilitate the spread of infection and the necessary steps towards prevention. This will require the ability to differentiate natural colonization of skin and mucosal surfaces by the fungus as opposed to symptomatic and invasive cases of trichosporonosis. Correspondingly, the progress of affected patients should be carefully monitored with regular laboratory investigations; 2) the importance of sampling healthcare workers, hospital commodes and other potential environmental sources to stem the chain of transmission; and 3) the real challenges of antifungal drug resistance and the appropriate choices to guide treatment policy. Nevertheless, early antifungal intervention in patient management is paramount to reducing dissemination of the fungus. New approaches to treatment may translate into improved prognosis and subsequently reduced hospital stay. Tantamount to this, is the application of several infection
control measures including the need for regular disinfection with 1-5% sodium hypochlorite (bleach) of the immediate environs and, in particular, cubicles where affected patients are housed. The recent fatal case of invasive trichosporonosis will undoubtedly serve to alert the medical fraternity that this and other rare and emerging infections are on the increase and are likely to pose similar problems.
REFERENCES


Fig. 1. Photomicrograph of brain adjacent to abscess cavity showing fungal elements of T. asahii (PAS x 300).

Fig. 2. Blood agar with T. asahii colonies showing radiating furrows and umbonate centres after 7 d incubation at 37°C.

Fig. 3. Photomicrograph (x 400) of T. asahii (unstained) showing arthroconidia, some with terminal and oval conidia produced on CMA after 7 d incubation at 25°C.

Fig. 4. Photomicrograph (x 400) of T. asahii showing cubical to barrel-shaped arthroconidia, produced on CMA after 7 d incubation at 30°C.