Results. A total of 61 patients with proven mucormycosis were analyzed. The primary site of infection was as follows: lung (n = 38, 62.3%), rhino-sinus (n = 21, 34.4%), and otorhinobronchial (n = 15, 24.6%). Based on sterile culture results, 4 patients (6.6%) had the evidence of co-infection with other fungi including Candida species (from 3 cases; C. albicans from 1, C. glabrata from 1 and C. kruisii from 1), A. fumigatus (1), and 23 patients (37.7%) had the evidence of co-infection with bacteria including E. faecium (VRE) (8), P. aeruginosa (5), coagulase-negative staphylococci (5), methicillin-resistant S. aureus (4) and others. Based on non-sterile culture results, 10 patients (16.4%) had the evidence of co-infection with fungi other than mucormycosis including Aspergillus species (5), Geotrichum spp. from 1, Aspergillus fumigatus from 1 and A. oryzae from 1, Candida species (5, C. albicans from 2, C. tropicalis from 2 and C. glabrata from 1), Penicillium species (1), S. cerevisiae (1) and P. jirovecii (1), and 24 patients (39.3%) had evidence of bacterial co-infection including S. maltophilia (5), methicillin-resistant S. aureus (5), E. faecium (VRE) (3), E. coli, P. aeruginosa, and others.

Conclusion. Bacterial or fungal co-infections appear to frequently occur as appreciated before in patients with mucormycosis. These data provide us important information to select empirical antifungal and antibacterial agents.

Table 1. Clinical Characteristics and Culture Positivity in Proven Mucormycosis Patients

| Variable | Total (n = 61) |
|----------|---------------|
| Age, years ± SD | 35 ± 12.8 |
| Male sex | 33 (54.1) |
| Positive galactomannan assay | 22 (35.8) |
| Dead/alive at Day 30 | 18 (29.5) |
| Underlying conditions | 80 (20.6) |
| DM | 17 (27.9) |
| S/A organ transplantation | 11 (18.0) |
| Hemophagocytic-stem cell transplantation | 10 (16.4) |
| Hematologic malignancy | 7 (11.5) |
| S/A skin | 8 (13.1) |
| Liver cirrhosis | 6 (9.8) |
| Neutropenia | 5 (8.3) |
| Chronic kidney disease | 5 (8.3) |
| EOS on blood smear | 9 (9.8) |
| Autologous-HSCT with immunosuppressors agents | 4 (6.6) |
| Infection site | 80 (20.6) |
| Pulmonary | 58 (95.0) |
| Brain abscess | 21 (34.4) |
| Other-suspected organs | 15 (24.6) |
| Gastrointestinal | 8 (13.3) |
| Skin | 2 (3.3) |
| E. coli, E. faecalis, diapezus, etc. | 5 (8.2) |
| Positive culture results for non-mucormycosis | 70 (114.7) |
| Respiratory species | 5 (8.3) |
| Moser species | 3 |
| Alicyclic species | 1 |
| Cryptococcus species | 1 |
| Non-mucormycosis | 68 (111.9) |
| Respiratory species | 2 |
| Moser species | 1 |
| Alicyclic species | 1 |
| Cryptococcus species | 1 |

Patient with other pathogens confined from sterile site

| Fungi other than mucormycosis | 40 (66.0) |
| Non-fungi other than mucormycosis | 23 (37.7) |
| Fungi other than mucormycosis | 10 (16.4) |
| Bacteria and others | 24 (39.3) |

Data are given as mean ± SEM or as number (percentage).

*Includes blood (plasma, sera), CMF species obtained by a sterile procedure and pleural fluid.

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1704. Geotrichum spp. Invasive Infection: Experience From a Third-Level Referral Center in Mexico

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Background. Geotrichum spp has been recognized as an emergent pathogen that causes invasive infection in immunosuppressed hosts. There is no data in Latin America about invasive Geotrichum spp. infections. Our objective was to describe the epidemiology, clinical characteristics, and outcomes of patients with this infection.

Methods. We conducted a retrospective survey from 2001 to 2018, of all the Geotrichum spp. isolated from clinical samples at our institution. Data on demographic, clinical, laboratory findings, and imaging studies were obtained from medical records. All cases classified as proven or probable invasive fungal infections (IFI) according to the EORTC/MSG criteria were included. Isolates with unavailable clinical information were excluded. Descriptive analysis was made.

Results. We found 18 patients with a proven/probable Geotrichum spp. IFI. The mean age was 48.5 years and 55.5% were male. The most common predisposing condition was hematological malignancy (55.5%), autoimmune diseases (22.2%) and HIV, chronic granulomatous disease, and solid-organ malignancy in 1 case, respectively. Fifteen (83.3%) received immunosuppressors (cancer chemotherapy or steroids); 27.7% had neutropenia at the time of diagnosis. The most common clinical syndromes were lower respiratory tract infection and pneumonia (83.3%). Chest X-rays abnormalities were present in 15/16 CT scans, pulmonary nodules were the most common finding (62.5%). Geotrichum spp was isolated from bronchoalveolar lavage, 77.7% blood culture, 22.2%; and peritoneal dialysis fluid, 5.6%. Seven patients were coincubated with other pathogens: 4 Aspergillus spp, 1 P. aeruginosa, 1 P. aeruginosa, and 1 E. coli. Fifteen patients received antifungal treatment: 7 amphotericin B, 8 voriconazole, and 1 itraconazole. Among survivors (1), 72.7% received antifungal therapy at discharge: 95.6% cases if CSF cultures were positive, whereas serum Ag was positive in only 85.1% count, protein, or glucose was noted in 85.3%; India ink was positive in 61.3% and CSF was positive in 44.4% cases. Mortality was seen in 48.6% (17/35) of patients with cirrhosis/chronic liver disease, compared with 21.5% (17/79) of non-cirrhosis/chronic liver disease (P = 0.016).

Conclusion. Eighteen cases of Geotrichum spp. were found. The majority had lower respiratory tract infection. Despite antifungal therapy 38.8% died. Geotrichum spp. should be recognized as an emerging pathogen in immunosuppressed hosts.

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1705. Clinical Characteristics and Outcomes of Cryptococcosis in a Tertiary Care Center in Kentucky, 2005 to 2017

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Background. Cryptococcosis is an invasive fungal infection that causes pneumonia and extrapulmonary infection. This study explores its presentations, diagnostic tests, and outcome in different groups over a 12-year period at an academic medical center.

Methods. This was a retrospective study of the patients treated at University of Kentucky HealthCare from October 16, 2005 to October 15, 2017. Inclusion criteria were positive cryptococcal antigen (Ag), positive culture, or presence of yeast morphologically consistent with Cryptococcus on cyto- or histopathology. Patients were divided into HIV-infected, solid-organ transplant (SOT) recipients, and non-HIV/non-transplant groups. Cryptococcal meningitis comprised of either positive CSF Ag, culture, cytology or histopathology.

Results. A total of 114 patients were identified; 23 HIV-infected, 11 SOT recipients and 80 non-HIV/non-transplant patients (Table 1). Cryptococcus neoformans was the most common yeast isolated (91.8%). Cryptococcal meningitis was seen in 56% of total patients whereas 27% had isolated cryptococcal pneumonia (P < 0.01). Blood cultures and serum Ag were positive in 34% and 70%, respectively. Only 8.7% of HIV-infected patients had isolated pulmonary cryptococcosis compared with 36.4% in SOT recipients (P < 0.01). In patients with cryptococcal meningitis, abnormal CSF cell count, protein, or glucose was noted in 85.3%; India ink was positive in 61.3% and CSF culture was positive in 73.4% (Table 2, Figure 1). CSF cryptococcal Ag was detected in 95.6% cases if CSF cultures were positive, whereas serum Ag was positive in only 85.1% of meningitis cases. Mortality was seen in 48.6% (17/35) of patients with cirrhosis/liver disease, compared with 21.5% (17/79) of non-cirrhosis/liver disease (P = 0.003). Transplant group had 54.5% mortality compared with 26.1% in HIV group (P = 0.016).

Conclusion. Cryptococcal meningitis was the most common presentation for cryptococcosis disease in all three groups. Isolated pulmonary disease was least common in the HIV-infected group. Inpatient mortality rate was higher in patients with cirrhosis/liver disease and transplant group compared with those without cirrhosis/liver disease and HIV group, respectively. It is imperative to rule out meningitis in immunosuppressed patients with cryptococcal pneumonia.

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Table 1: Cryptococcal presentation and infectious disease testing by patient risk groups

| Risk Category | IVF-infected patients | Solid organ Transplant recipients | Non-IVF/non-Transplant patients | Total | p-value |
|---------------|-----------------------|-----------------------------------|---------------------------------|-------|---------|
| Meningitis (%)| 17/23 (73.9)          | 7/11 (63.6)                       | 40/60 (66.7)                    | 6/114 (56.1) | 0.11    |
| Isolated pulmonary disease (%) | 2/23 (8.7)          | 4/11 (36.4)                       | 15/30 (50.0)                    | 3/67 (4.5) | < 0.01 |
| Asymptomatic or fungemia without meningitis or pneumonia (%) | 4/25 (16.4)          | 0/11 (0)                          | 15/100 (15.0)                   | 19/114 (16.7) | 0.37  |
| Cirrhosis/liver disease (%) | 4/23 (17.4)          | 4/11 (36.4)                       | 27/32 (84.4)                    | 35/134 (26.2) | 0.33  |
| Positive blood culture (%) | 12/11 (54.5)        | 3/11 (27.3)                       | 22/74 (30.1)                    | 36/106 (34.0) | 0.15  |
| Positive serum Ag (%) | 16/20 (80)           | 7/11 (63.6)                       | 40/61 (65.6)                    | 63/90 (70.0) | 0.46  |
| Inpatient mortality (%) | 6/26 (23.1)          | 6/11 (54.5)                       | 22/80 (27.5)                    | 34/114 (29.8) | 0.17  |

28-day mortality (4.7% vs. 19.7%, odds ratio 0.19, 95% confidence interval 0.05–0.63). However, compliance did not affect clinical success (92.2% vs. 82.0%, odds ratio 2.13, 95% CI 0.77–5.86). Non-Candida albicans, disseminated candidiasis, and total parenteral nutrition were independent factors for poor clinical success. Severe severity and total parenteral nutrition were independent factors for 28-day mortality.

Conclusion. With prospective use of bundles as a checklist in patients with candidemia, compliance of bundles has a beneficial effect on clinical outcomes. This research was supported by AMED (IP18fk0108045).

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1707. Invasive Pulmonary Aspergillosis in Patients with Severe Fever with Thrombocytopenia Syndrome

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Background. Severe fever with thrombocytopenia syndrome (SFTS) is an emerging tick-borne disease often accompanied by immune catastrophic course and subsequent fatal outcome. More than 90% of patients with SFTS had leukopenia and about one-third of those need the admission of intensive care unit (ICU) during the hospital course. So, there has been growing concern about the complications such as invasive pulmonary aspergillosis (IPA) in critical SFTS patients. We thus investigate the incidence and clinical characteristics of IPA in patients with SFTS.

Methods. All patients who were confirmed as SFTS in a tertiary care hospital, Seoul, South Korea, between January 2013 and October 2018 were enrolled. The modified AspICU algorithm was used to identify cases of putative invasive pulmonary aspergillosis (PIPA) and discriminate these invasive diseases from colonization.

Results. Of the 45 PCR-confirmed SFTS patients, 16 (36%) received ICU care. Of these 16 patients, 9 (56%) developed PIPA during hospitalization. The median duration from admission to the first evidence of PIPA was 8 days (range, 2–11 days). None of the PIPA cases met the revised EORTC/MSG criteria. Septic shock and corticosteroid administration preceded more frequently in PIPA group than non-PIPA group (100% vs. 19%, P < 0.0001 and 67% vs. 14%, P = 0.003, respectively). Patients complicated by PIPA showed significantly higher mortality than non-PIPA patients (44% vs. 8%, P = 0.048 by log-rank test). Mortality was lower in patients with PIPA who received antifungal treatment (17% [1/6]) than in those with PIPA who did not [100% [3/3]] (log-rank test, \( P = 0.002 \)).

Conclusion. More than half of patients with SFTS in ICU were complicated by IPA during early hospital course. Cautious scrutiny for IPA in patients with SFTS followed by early appropriate antifungal therapy for IPA is needed.

Table 1. Demographic and clinical characteristics of SFTS patients

| Variable                          | Total (n = 45) | PIPA (n = 16) | Non-PIPA (n = 29) | P value |
|-----------------------------------|---------------|--------------|------------------|---------|
| Age, y, mean ± SD                 | 54.6 ± 18.1   | 52.6 ± 17.9  | 55.6 ± 18.5      | 0.589   |
| Male                              | 27 (60.0%)    | 5 (31.3%)    | 22 (75.9%)       | 1.000   |
| Region                            |               |              |                  |         |
| Seoul and metro                   | 20 (44.4%)    | 11 (68.8%)   | 9 (31.2%)        | 0.030   |
| Others                            | 25 (55.6%)    | 5 (31.3%)    | 20 (68.8%)       | 1.000   |
| Season (months)                   |               |              |                  |         |
| Spring-summer (3-8)              | 21 (46.7%)    | 7 (43.8%)    | 14 (50.0%)       | 0.110   |
| Fall (9-11)                      | 23 (51.1%)    | 4 (25.0%)    | 19 (68.9%)       | 0.048   |
| Winter (12-2)                    | 2 (4.4%)      | 0 (0%)       | 2 (6.9%)         | 1.000   |
| Underlying diseases              |               |              |                  |         |
| Diabetes                          | 11 (24.4%)    | 4 (25.0%)    | 7 (24.1%)        | 0.190   |
| Liver disease                     | 6 (13.3%)     | 2 (12.5%)    | 4 (13.8%)        | 0.733   |
| Cardiovascular disease           | 8 (17.8%)     | 2 (12.5%)    | 6 (20.7%)        | 0.100   |
| Autoimmune disease               | 3 (6.7%)      | 0 (0%)       | 3 (10.3%)        | 0.497   |
| Solid tumor                      | 2 (4.4%)      | 0 (0%)       | 2 (6.9%)         | 1.000   |
| Hematologic malignancy           | 0 (0%)        | 0 (0%)       | 0 (0%)           | NS      |
| Transplantation                   | 0 (0%)        | 0 (0%)       | 0 (0%)           | NS      |
| Human immunodeficiency virus     | 0 (0%)        | 0 (0%)       | 0 (0%)           | NS      |
| Infection and sepsis syndrome     | 0 (0%)        | 0 (0%)       | 0 (0%)           | NS      |
| Symptoms and signs at initial presentation |           |              |                  |         |
| Fever                            | 45 (100%)     | 16 (100%)    | 29 (100%)        | 0.100   |
| Rash                             | 8 (17.8%)     | 5 (31.3%)    | 3 (10.3%)        | 0.526   |
| Bloodig                           | 6 (13.3%)     | 1 (6.3%)     | 5 (17.2%)        | 1.000   |
| Myalgia                          | 23 (51.1%)    | 8 (50.0%)    | 15 (51.7%)       | 0.599   |
| Anemia                           | 30 (66.7%)    | 12 (75.0%)   | 18 (62.1%)       | 0.454   |
| Lupus                            | 10 (22.2%)    | 2 (12.5%)    | 8 (27.6%)        | 0.282   |
| Abdominal pain                   | 9 (20.0%)     | 2 (12.5%)    | 7 (24.1%)        | 1.000   |
| Diarrhea                         | 21 (46.7%)    | 3 (18.8%)    | 18 (62.1%)       | 0.049   |
| Cough/feverformance              | 14 (31.1%)    | 2 (12.5%)    | 12 (41.4%)       | 0.428   |
| Headache                         | 15 (33.3%)    | 3 (18.8%)    | 12 (41.4%)       | 0.454   |
| Aborted mortality types           | 22 (48.9%)    | 5 (31.3%)    | 17 (58.6%)       | 0.061   |
| Eosin                             | 12 (26.7%)    | 3 (18.8%)    | 9 (31.0%)        | 0.682   |

Values are % (except otherwise indicated). Abbreviations: PIPA, putative invasive pulmonary aspergillosis; SD, standard deviation; NS, not significant.

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