

Improving supportive care in cancer with innovative use of AI for invasive fungal diseases

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Background

Invasive fungal diseases (IFD) are rare infections that cause a life-threatening pneumonia in immunocompromised patients. Surveillance and audit is fundamental to antifungal stewardship, outbreak detection and knowledge discovery but is not occurring despite hospitals spending millions on antifungal drugs. Surveillance is difficult because fungi are recovered in less than 50% of sick patients. Chest imaging dominates the diagnostic work-up but detecting a rare disease from thousands of free-text reports is difficult.

Objectives

To leverage artificial intelligence for the detection and diagnosis of IFD from unstructured and structured data in clinical information systems.

Method

Our platform technology is known as fungalAi (<https://www.fungalai.com>) comprising 1. Natural language processing (NLP) of chest computed tomography (CT) reports. 2. Deep learning based image analysis of chest CT for improved radiologist diagnosis 3. An expert system that integrates microbiology and antifungal drug prescriptions to improve fungal prediction.

Results

Using retrospective data from 3 Victorian hospitals, we demonstrated that NLP achieved a sensitivity of 100% for detecting IFD patients; the expert system reduced false notifications by 48%. Image analysis based on a convolutional neural network achieved an AUC of 99.3 for detection of IFD lesions compared to radiologists, with NLP increasing training data acquisition by 3600%. fungalAi, for the first time allowed semi-automated audit of IFD (156 episodes in 144 patients, 2008-16) at Alfred Health revealing gaps relevant to antifungal stewardship.

Conclusions (if applicable)

fungalAi can deliver surveillance and audit of IFD that is important for knowledge discovery; antifungal stewardship and radiologist decision support in real time, to best drive improvements in care.