

New modeling approach for chronic pulmonary aspergillosis (CPA) in the context of pulmonary tuberculosis

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Background

Chronic pulmonary aspergillosis (CPA) may be

- confused with pulmonary tuberculosis (PTB),
- be a co-infection of PTB, or
- Follow successful anti-tuberculous therapy (ATT).

In 2011, we modeled its occurrence after ATT, primarily using data from a UK longitudinal study of 500 patients. "In 2007, 7.7 million cases of PTB occurred globally, and of them, an estimated 372 000 developed CPA..... The global five-year period prevalence was 1,174,000, at a 15% annual attrition rate."

Since then, much additional data has been published allowing more sophisticated modeling.

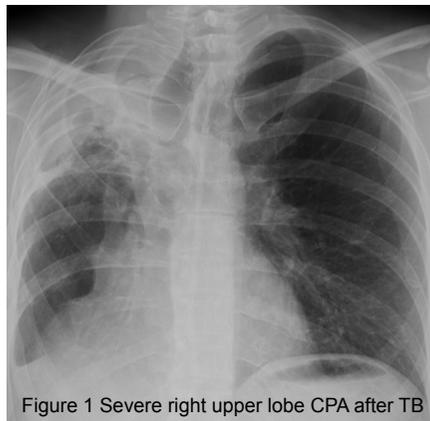


Figure 1 Severe right upper lobe CPA after TB

Aim

- To develop a new CPA incidence and prevalence model, and illustrate it with data from Vietnam.

Methods

Epidemiological literature on CPA has been continuously tracked since 2010, based on weekly automated searches from PubMed and intermittent comprehensive searches on the topic. These data inputs were supplemented with recent comprehensive searches using epidemiology, incidence, prevalence and aspergillosis as combined search terms. Papers with high quality datasets were selected for modeling purposes (Table 1).

Incidence, proportion of pulmonary and laboratory confirmed PTB and mortality data for PTB from 2020 were accessed from the WHO or Vietnam. It was assumed that mortality was proportionately attributable to PTB and non-PTB. The proportion of surviving patients with residual cavitation varied (35% in Vietnam). The 2020 data were used retrospectively for years 2016-2019 inclusive to compute 5 year period prevalence of CPA presenting years after completion of ATT therapy, a conservative estimate.

Table 1

Reference (year)	Design	Population	Relevant measure	Frequencies
Anonymous (1968)	Prospective, 12 months after smear conversion to negative	Post-PTB with pulmonary cavity, UK	<i>Aspergillus</i> precipitins, aspergilloma visible on chest X-ray	14%
Anonymous (1970)	Prospective, 3-4 years after smear conversion to negative	Post-PTB with pulmonary cavity, UK	<i>Aspergillus</i> precipitins, aspergilloma visible on chest X-ray	22%
Oladele (2017)	Cross-sectional	HIV positive and negative on therapy, Nigeria	<i>Aspergillus</i> IgG antibody, symptoms, chest X-ray	6-7% in confirmed PTB 10-19% in unconfirmed PTB
Page (2019)	Cross-sectional and prospective, Post-PTB (2-7 years)	HIV positive and negative, Uganda	<i>Aspergillus</i> IgG antibody, symptoms, chest X-ray and CT scans	6.5% annually if residual cavitation, 0.2% if no cavitation
Setianingrum (2021a)	Cross-sectional, 4-6 months after starting PTB therapy	HIV negative, Indonesia	<i>Aspergillus</i> IgG antibody, symptoms, chest X-ray and some CT scans	13%
Setianingrum (2021b)	Prospective, pulmonary PTB patients at beginning and end of therapy.	HIV negative, Indonesia	<i>Aspergillus</i> IgG antibody, symptoms, chest X-ray and some CT scans	7.9%

Results

In 2020, there were 60,560 cases of PTB in Vietnam, 56,080 in HIV negative people. 74% were laboratory confirmed. 10,400 died.

The new model provides an annual incidence estimate of 9,328, of which 4,510 are misdiagnoses or dual infection cases. An estimated 902 of these CPA patients died within the year of PTB presentation. The 5 year period prevalence is estimated at 36,312 cases, with 4,738 deaths (or cures form surgical resections), a total of 5,640 deaths, 54% of the deaths attributed to PTB.

Conclusions

Beardsley et al in 2015 estimated a 5 year period prevalence of CPA in Vietnam of 55,500 cases, assuming 75% were PTB related.

Our new model finds fewer than this number, primarily because the local data for PTB in Vietnam is ~50% that estimated by WHO. The new model incorporating cases originally misdiagnosed as TB and cases arising early after completion of ATT.

Data from Vietnam found that 54% of TB patients returning to care with symptoms after completion of ATT had CPA (Nguyen, 2021).

