Overrepresentation of Blastomycosis among Canadian Indigenous Populations

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BACKGROUND

Blastomycosis is an uncommon fungal infection caused by the organisms *Blastomyces dermatitidis* and the more recently discovered *Blastomyces gilchritii.*[1] Spores are endemic to the soil surrounding the Ohio and Mississippi River basins and in the regions surrounding the Canadian and American Great Lakes.[2,3] The fungal spores are inhaled and convert to infectious yeast at body temperature.[2] Pulmonary manifestations of the disease can be minor and often go relatively unnoticed, with the infection becoming symptomatic in less than 50% of exposures.[3] The average incubation time between exposure and development of symptoms is 30-45 days.[2,3] Severe symptomatic cases can cause critical respiratory symptoms including acute diffuse pneumonias and acute respiratory distress syndrome (ARDS). Mortality is often caused by respiratory failure.

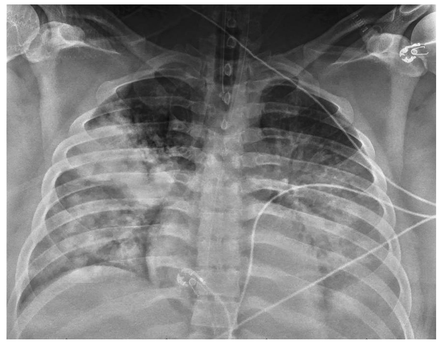

Figure 1: Radiographic imaging of a patient with laboratory confirmed blastomycosis and clinically diagnosed ARDS[5]

Many Canadian studies have examined the demographics among affected patient populations, highlighting the recurring theme of proportional overrepresentation of Indigenous peoples in patient populations.

PURPOSE

While blastomycosis infection is uncharacteristically common in Manitoba and Northwestern Ontario, this investigation sought to explore the potential for proportional overrepresentation of Indigenous peoples among those affected.

METHODS

In all four studies examined here investigators employed the use of a retrospective medical record review, also known as a case series. Each had a predetermined time frame, ranging from 10[1] to 23[3] years, and pre-established medical centre(s) from which records were pulled within a targeted catchment area. Three of the studies[1,3,4] required evidence of clinical specimen growing *Blastomyces* yeast cells in culture or microscopic identification by a pathologist for a diagnosis of blastomycosis. The remaining study[2] included all cases with a discharging diagnosis of blastomycosis, regardless of laboratory correlation. All studies relied on patient self-identification as "Aboriginal", twice defined as "the indigenous inhabitants of Canada including the First Nations and Métis people without regard to their separate origins and political or cultural identities"[2,3] once defined as all Canadians of First Nations, Métis or Inuit ancestory[4] and without further definition in the remaining study.

RESULTS

TABLE 1
Age, sex, Aboriginal heritage and case-fatality rate among 64 patients with blastomycosis

		Patients				
Age, years	Age group total	Male	Female	Aboriginal	Death count, n	Case fatality, %
<20	5 (7.8)	4 (80)	1 (20)	3 (60)	0	0.0
20–29	17 (26.6)	9 (52.9)	8 (47.1)	11 (64.7)	3	17.6
30–39	13 (20.3)	10 (76.9)	3 (23.1)	7 (53.8)	3	23.1
40–49	11 (17.2)	8 (72.7)	3 (27.3)	5 (45.4)	2	18.2
50–59	7 (10.9)	3 (42.9)	4 (57.1)	3 (42.9)	3	42.9
60–69	5 (7.8)	4 (80.0)	1 (20.0)	2 (40.0)	1	20.0
70–79	5 (7.8)	2 (40.0)	3 (60.0)	1 (20.0)	1	20.0
>79	1 (1.6)	1 (100.0)	0 (0.0)	0 (0.0)	0	0.0
Total, n	64	41	23	32	13	20.3

Data presented as n (% of age group) unless otherwise indicated

Figure 2[1]: The outlined box highlights medical records where patients specified Aboriginal status. In the targeted catchment area of Northwestern Ontario, Indigenous populations accounted for only 19.2% of the population but represented 47.6% of patients with blastomycosis. This overrepresentation was theorized to be due to an increase in comorbid status and/or an increased rate of smoking among Indigenous populations .

Table 6 Risk factors of survival for patients with blastomycosis[a]

Risk factors	Univariate analysis			Multivariate analysis	
	Survived	Died	$P \leq$[b]	Adjusted odds ratio (95% confidence interval)	P ≤
Average age (years ± standard deviation)	38 ± 20	60 ± 20	0.0001	1.1 (1.1–1.13)	0.0001
Gender, Number of patients (%)					
Male	174 (90)	19 (10)	NS	–	–
Female	120 (96)	5 (4)		–	–
Ethnicity, Number of patients (%)					
Non-Aboriginal	203 (94)	13 (6)	NS	3.8 (1.3–10.9)	0.01
Aboriginal	91 (89)	11 (11)			

Figure 3[2]: This table indicates an association between Indigenous ethnicity and an increased risk factor for death from blastomycosis, though findings were not statistically significant (P > 0.05). In this study the proportion of Indigenous patients with blastomycosis in Manitoba was 32% compared to 13.6% of the general population, and in Northwestern Ontario 23.3% compared to 14.3% in the general population. Again, this highlights the disproportionate infection rate in Indigenous populations.

Table 2. Distribution according to the race of patients with blastomycosis who were residents of Ontario or Manitoba and the corresponding annual incidence.

Race	Total no. (%) of patients (n = 122)	Ontario residents with blastomycosis (n = 48)		Manitoba residents with blastomycosis (n = 74)	
		No. (%)	Annual incidence[a,b]	No. (%)	Annual incidence[a]
Aboriginal	43 (35.2)	31 (64.6)	7.42	12 (16.2)	0.77
White	72 (59.0)	16 (33.3)	0.68	56 (75.7)	0.53
Other nationality	7 (5.7)	1 (2.1)	—	6 (8.1)	—

[a] Per 100,000 population.
[b] Patients from the Kenora, Rainy River, and Thunder Bay, Ontario census divisions.

Figure 4[3]: Findings indicate a higher rate of blastomycosis infection among Indigenous populations as compared to all other ethnicities. Demographics in this study also indicated Indigenous patients presented with blastomycosis at a much younger age than other ethnicities, though this could simply be a result of the younger age of the population.

Demographics

Age, median, years (IQR)	43 (35–55)
Male	27 (63)
Ethnicity	
Aboriginal	21 (50)
Caucasian	20 (48)
Asian	1 (2)
Chronic medical condition	25 (58)
Diabetes	19 (44)
Partially immunosuppressed	4 (10)*
Chronic lung disease	5 (12)
Chronic heart disease	8 (19)†
Pregnancy	1 (2)‡
Previous blastomycosis	1 (2)

Data presented as number of patients (%) unless otherwise stated.
ARDS = acute respiratory distress syndrome, IQR = interquartile range.

Figure 5[4] : Indigenous patients comprised half of this cohort, while census data at the time reported Indigenous representation to be only 16.7% in Manitoba and 19.7% in Northwestern Ontario. This study also found Indigenous patients to be younger than non-Indigenous patients when presenting with blastomycosis, and found they were more likely to be hospitalized with respiratory complications of the infection.

CONCLUSIONS

- Incidence of blastomycosis is proportionately higher among Indigenous populations when compared to other ethnicities.
- Indigenous populations appear to contract the infection at younger ages and suffer a more severe disease course.
- Increased infection may result from increased comorbid status, increased smoking status[1] or environmental exposures[3].

SIGNIFICANCE

The disproportionate infection rate among Indigenous populations should be highlighted in healthcare education to ensure cases are diagnosed and treated as quickly as possible. Medical professionals, especially in the endemic areas, should hold a higher degree of suspicion for the infection among Indigenous populations so treatment is not delayed. Public health policy in the areas should focus on education surrounding adequate prevention measures for Indigenous persons, such as wearing appropriate masks when working in the soil or reducing smoking.

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