



Hospitalizations associated with coccidioidal meningitis in Arizona, 2008-2014

ARIZONA DEPARTMENT OF HEALTH SERVICES

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BACKGROUND

Meningitis is among the most devastating forms of coccidioidomycosis. Nationwide, an estimated 200 to 300 cases of coccidioidal meningitis occur annually.¹ However, the epidemiology and burden of coccidioidal meningitis in Arizona is poorly described. Risk factors for meningitis are shared with other forms of disseminated disease and include black and Filipino race, male sex, pregnancy (particularly the third trimester), hematologic malignancies, other cancers, HIV infection, and immunosuppressive therapy including chemotherapy.²

We described the demographic and clinical characteristics of patients hospitalized with coccidioidal meningitis in Arizona between 2008 and 2014.

METHODS

Discharge records for hospital admissions between 2008 and 2014 with an ICD-9-CM discharge diagnosis code for coccidioidal meningitis (114.2) were obtained from all non-federal facilities in Arizona via the state hospital discharge database. Underlying conditions were also identified using ICD-9 codes: malignant neoplasm (140-209, 230-239), diabetes (250), HIV/AIDS (042,V08), pregnancy (63-67,V22, V23). Demographic characteristics were defined using the initial hospitalization. We used chi-squared and t-tests to examine bivariate relationships among categorical and continuous variables, respectively. Multivariable logistic regression with backwards elimination was also conducted. Analyses were performed using SAS 9.3.

RESULTS

There were 1,251 hospitalizations with a diagnosis code for coccidioidal meningitis among 623 patients during the study period. The average annual hospitalization rate was 2.74 hospitalizations per 100,000 person-years. An average of 89 patients were admitted per year.

No statistically significant temporal trend or seasonality was observed. Most hospitalizations were among residents of the three largest counties in Arizona: Maricopa (66.9%), Pima (17.0%), and Pinal (9.6%).

In 2014, the hospitalization rate was 2.66 hospitalizations per 100,000 person-years (95% CI: 2.26, 3.05). The hospitalization rate among black persons was 4.85 times higher than that in whites (95% CI: 3.29, 7.13), and the rate among men was 1.78 times higher than that in women (95% CI: 1.31, 2.43).

Table 1. Demographic and clinical characteristics (n=623)

| | n (%) |
|---|-------------|
| Male | 433 (70.0) |
| Race/Ethnicity | |
| White | 300 (48.2) |
| Hispanic | 143 (23.0) |
| Black | 97 (15.6) |
| American Indian or Alaska Native | 36 (5.8) |
| Asian | 17 (2.7) |
| Native Hawaiian or Pacific Islander | 15 (2.3) |
| Mean age, years [IQR] | 47 [34, 60] |
| Expected source of payment (n=1,251 hospitalizations) | |
| Medicaid | 400 (32.0) |
| Medicare | 275 (22.0) |
| HMO | 184 (14.7) |
| Medicare Risk | 113 (9.0) |
| PPO | 107 (8.6) |
| Self Pay | 65 (5.2) |
| Commercial | 28 (2.2) |
| Discharge status (n=1,251 hospitalizations) | |
| Home | 742 (59.3) |
| Skilled Nursing Facility | 145 (11.6) |
| Home Health Service Organization | 115 (9.2) |
| Inpatient Rehabilitation Facility | 62 (5.0) |
| Transferred | 49 (3.9) |
| Hospice | 39 (3.1) |
| Long Term Care Hospital | 37 (3.0) |
| Died | 31 (2.5) |
| Court/Law Enforcement | 10 (0.8) |
| Assisted Living Facility | 6 (0.5) |
| Underlying conditions | |
| Diabetes | 146 (23.5) |
| HIV | 126 (20.2) |
| Malignant Neoplasm | 35 (5.6) |
| Pregnancy | 10 (1.6) |
| ICU stay | 381 (61.2) |
| Readmitted at least once | 216 (34.7) |

Coccidioidal meningitis was the primary discharge diagnosis in 37.2% of hospitalizations. Other primary discharge diagnoses were HIV infection, other specified rehabilitation procedure, mechanical complication of ventricular shunt, hearing loss, obstructive hydrocephalus, disseminated coccidioidomycosis, cerebral artery occlusion with infarction, and ventricular shunt infection.

The top 50% of admitting diagnoses, in order of frequency:

- Headache
- Coccidioidal meningitis
- Altered mental status
- Other specified rehabilitation procedure
- Unspecified meningitis
- Obstructive hydrocephalus
- Fever
- Malaise and fatigue

The median length of stay was six days. Length of stay did not significantly differ by sex, age, or underlying condition diagnosis. Patients were hospitalized for a total of 12,111 patient-days. Charges for all hospitalizations totaled \$112 million dollars.

Mortality

In-hospital mortality was relatively rare: 31 (5%) patients died. In the multivariable model with sex, HIV diagnosis, diabetes diagnosis, ICU stay, and age, only ICU stay (OR: 2.67, 95% CI 1.07, 6.64) and HIV diagnosis (OR: 2.97, 95% CI 1.41, 6.27) were significantly associated with an increased risk of death.

Readmission

Median time to second admission was 83 days. In the multivariable model with sex, race, diabetes diagnosis, age group, and HIV diagnosis, diabetes diagnosis and age > 45 years were significantly associated with an increased risk of readmission.

No significant predictors of ICU stay were found.

DISCUSSION

Hospitalization due to coccidioidal meningitis is uncommon in Arizona. However, the observed average annual hospitalization rate was higher than that of other studies: Sondermeyer et al reported that the rate of coccidioidal meningitis hospitalizations in California was 1 per 100,000 person-years in 2011.³ Rates were substantially higher among men and persons of black race in Arizona. Medicare and Medicaid were the expected source of payment for more than half of patients. Although in-hospital mortality was rare, the burden of severe, chronic disease was substantial: 61% of patients were admitted to the ICU, and more than a third were readmitted during the study period. HIV infection was associated with a three-fold increased risk of death, which may reflect poor underlying health of co-infected patients.

Our analysis has several limitations. We did not assess the sensitivity or specificity of the ICD-9-CM code for coccidioidal meningitis. Some hospitalizations were likely not due to illness associated with coccidioidomycosis. Misclassification of underlying conditions was also not assessed. Finally, our analysis was susceptible to selection bias due to loss to follow-up.

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