

Evaluation of Sōna Lateral Flow Assay for the Rapid Detection of *Coccidioides Immitis*



Deisy A. Contreras¹, Qingyu Li² and Omai B. Garner^{2,3}

¹ Clinical Microbiology Laboratory, Brentwood Annex, University of California Los Angeles, CA 90049, ²David Geffen School of Medicine at UCLA, ³Department of Pathology and Laboratory Medicine, University of California Los Angeles, CA 90049

Abstract

Dimorphic fungal species, *Coccidioides immitis* and *Coccidioides posadasii*, are the etiological cause of Coccidioidomycosis. These fungal pathogens are endemic to hot, arid regions of the southwest United States, Mexico and South America. A total of 60% of all coccidioidal infections are asymptomatic, while the remaining 40% of the population present to clinic with acute respiratory symptoms that mimic community-acquired pneumonia, with symptoms that range from cough, pleuritic chest pain to fever. Culture, microscopy and serology have been the primarily used modalities for diagnosing *Coccidioides* spp. The enzyme-linked immunosorbent assay (EIA) has been widely used and recommended for screening patients with suspected coccidioidomycosis. Even though the EIA has a sensitivity of greater than 90%, there has been controversial reports of high false-positive rates requiring confirmation. The confirmatory methods of immunodiffusion (ID) and complement fixation (CF) are laborious and subject to interpretation but are needed to make a definitive diagnosis. These tests are typically only available at reference laboratories. There is a need for more available testing methods. In this study, remnant serum samples from patients (n=908) that tested positive (n=100) and negative for *Coccidioides* spp. using the Cocci EIA were compared with the new *Coccidioides* Antibody Lateral Flow Assay (Cocci Ab LFA) from IMMY. We analyzed performance parameters such as sensitivity, specificity, negative and positive predictive values of this test compared to EIA, ID and CF as a potential screening method for labs. Cocci Ab LFA testing was carried out per manufacturer's protocol. When compared to the EIA, our data indicates that the Cocci Ab LFA has a sensitivity of 93%, specificity of 99% and an excellent negative predictive value of 99%. The total turnaround time of the assay is 30 minutes. Limitations of the assay include subjective interpretation of results when a faint band is present. Overall, given the high negative predictive value and the faster turnaround time, the Cocci Ab LFA can serve as a rapid accessible screening test for *Coccidioides* spp. for small laboratories that lack the capabilities to perform technically-complexed confirmatory tests.

Background

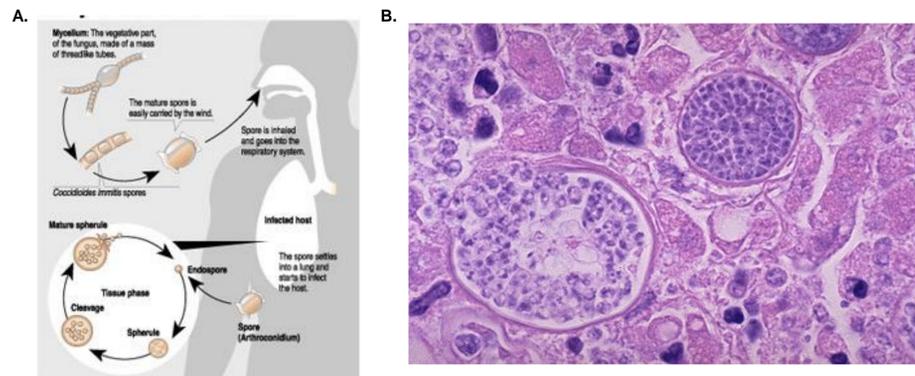


Figure 1. Life cycle of Coccidioidomycosis. (A) Dimorphic life cycle of *Coccidioides*. (B) *Coccidioides* spherules with visible endospores (H&E 400X).

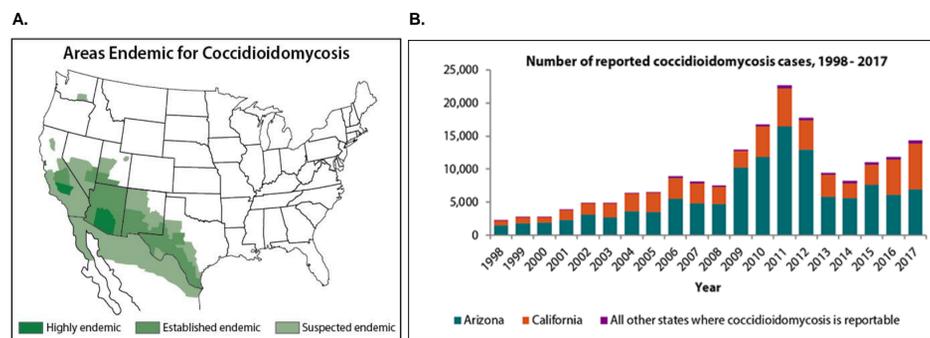


Figure 2. epidemiology of Coccidioidomycosis. (A) Distribution of Coccidioidomycosis according to studies performed in the late 1940s and 1950s. (B) Incidences of Coccidioidomycosis reported to CDC from 1998 to 2016 showing increasing rate especially in states other than Arizona and California.

Materials and Method

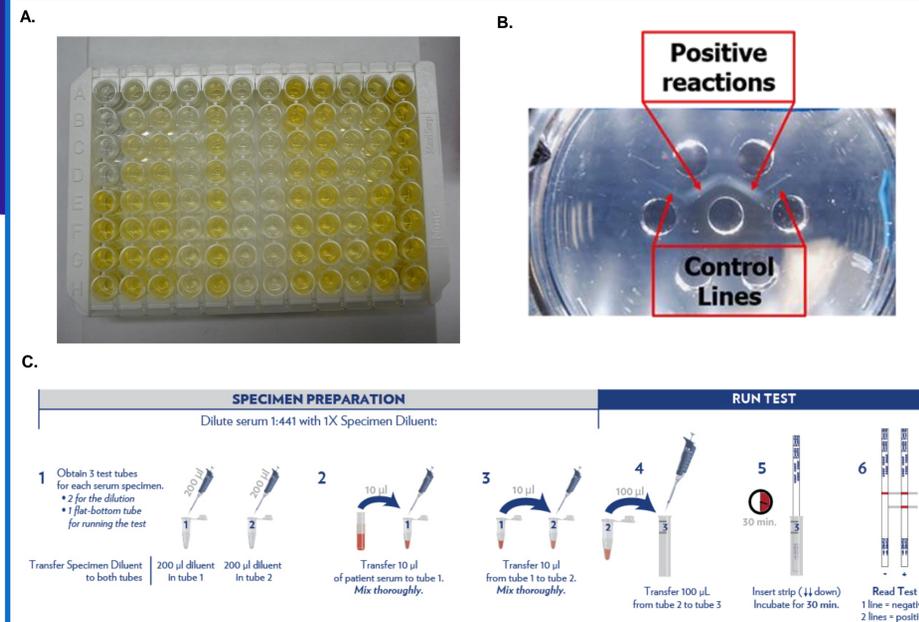


Figure 2. Serological Methods for Diagnosis of Coccidioidomycosis. (A) Enzyme Immunoassay (EIA). (B) Immunodiffusion by the Ouchterlony Method (C) the Sōna *Coccidioides* Antibody Lateral Flow Assay (IMMY Diagnostics).

Patient Demographics

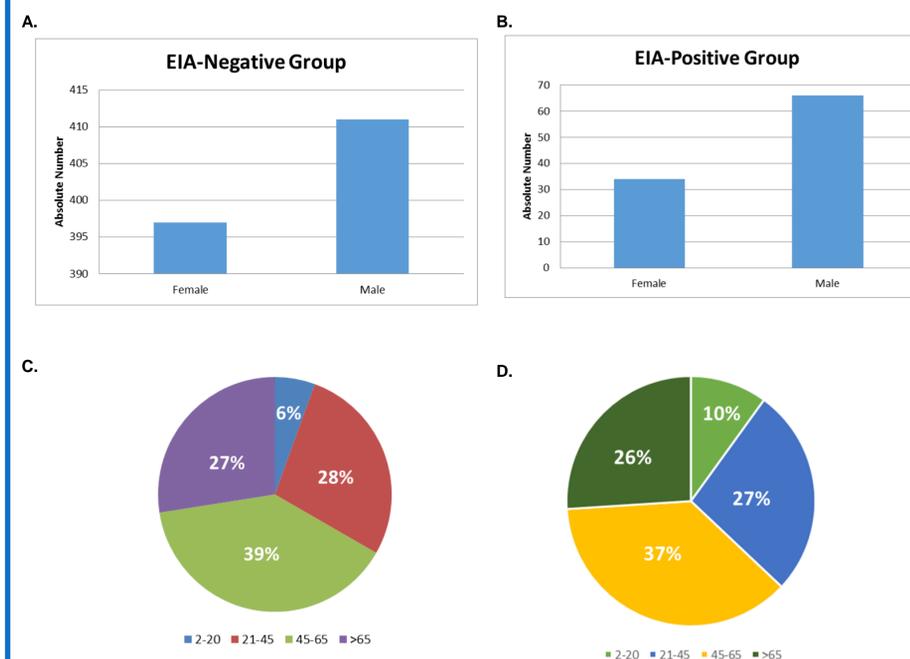


Figure 3. Patient Demographics of Both the EIA-Negative and EIA-Positive Groups. (A) EIA-Negative patient group gender distribution. (B) EIA-Positive patient group gender distribution (C) Age distribution for the EIA-Negative and EIA-positive (D) patient group.

Preliminary Results

Table 3. Comparison of Sōna Cocci Ab LFA and Enzyme Immunoassay (EIA)

		Sōna <i>Coccidioides</i> Antibody Lateral Flow Assay		Sensitivity (%)	95% CI	Specificity (%)	95% CI	PPV (%)	95% CI	NPV (%)	95% CI
		Positive	Negative								
EIA	Positive	93	7	93	86.11-97.14	99.26	98.39-99.73	93.94	87.46-97.18	99.13	98.25-99.57
	Negative	6	802								
EIA + ID	Positive	92	8	92	84.84-96.48	99.26	98.39-99.73	93.88	87.33-97.15	99.01	98.10-99.49
	Negative	6	802								

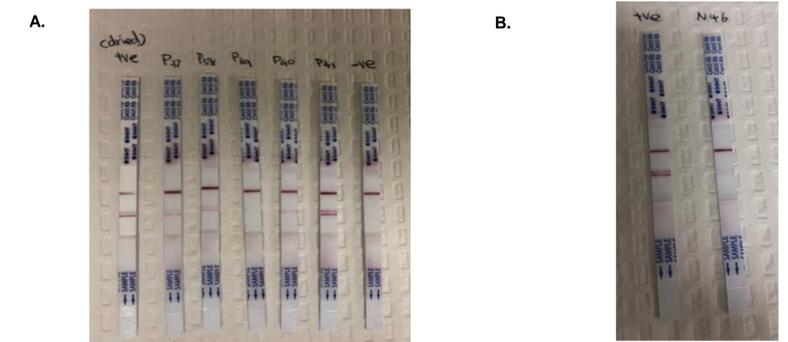


Figure 3. Real Cocci Ab LFA result with various band patterns. (A) EIA positive samples P41 showed very strong T band while P37, P38, P40 showed vague T band, but all were read as LFA positive. P29 was and EIA negative sample (-ve) were read as LFA negative with no T band. (B) In rare cases, EIA negative sample can be LFA positive.

Conclusions

The Sōna *Coccidioides* Lateral Flow Assay is categorized as a rapid immunoassay that detects anti-*Coccidioides* antibodies. When compared to the Enzyme Immunoassay (EIA), the lateral flow assay demonstrated a 93% sensitivity and 99% specificity. The Cocci Ab LFA had similar sensitivity and specificity when compared with EIA, which is currently the standard screening method. With a high negative predictive value of 99%, the lateral flow assay allows for a rapid 30 minute screen to rule out patients that are suspected of having Coccidioidomycosis, which is critical in the clinical management of these patients. The cost of Cocci Ab LFA may be higher since it cannot be done in bulk as with EIA, but if local clinics has low demand of testing, it may still be a more economical choice.

Acknowledgements

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References

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