

Review of Antimicrobial Susceptibility Profiles of Different Nocardia Species: A Tertiary Care Center Experience

Ahmed Hamdi, M.D., Omar Abu Saleh, M.B.B.S., Madiha Fida, M.B.B.S., Alexandra Bryson, PhD., Nancy L. Wengenack, PhD.
 Division of Infectious Diseases, Division of Clinical Microbiology
 Mayo Clinic, Rochester, MN

Abstract

Background: *Nocardia* is a ubiquitous Gram-positive microorganism that can be found in soil and other organic matter that can cause disease in both the immunocompetent and immunocompromised host population.

Objective: Review our data for *Nocardia* including source, frequency of different species, susceptibility patterns and resistance to the different tested antimicrobial agents.

Methods: Retrospective chart review of patient's with positive cultures for *Nocardia* in the period of January 1st 2011 to January 1st 2017 that were diagnosed and managed in our facility.

Results: We reviewed 2070 samples positive for *Nocardia* spp. Most commonly isolated species included *N. cyriacigeorgica* (18.4%), *N. nova* complex (17.8%) and *N. farcinica* complex (16.1%). Susceptibilities of the more common *Nocardia* species are shown in table 2.

Conclusions: Source of the positive cultures was variable with majority (~60%) from pulmonary source (sputum, BAL and lung tissue), blood in 5% and brain in 4%. Identifying *Nocardia* to species level help with the choice of appropriate empiric therapy pending susceptibility testing results.

Method

- We reviewed 2070 samples positive for *Nocardia* species.
- Specimens were cultured on Middlebrook agar biplates and isolated colony growth was identified using MALDI-TOF MS or 16S rDNA gene sequencing.
- We excluded cultures labeled as "*Nocardia* sp." that were not able to be further identified.
- We included *N. beijingensis* isolates in the *N. abscessus* complex.
- We combined *N. abscessus/N. asiatica* with the *N. abscessus* complex

Results

- Source of the positive cultures was variable in our study with majority (~60%) from pulmonary sources (sputum, BAL fluid and lung tissue), blood in 5% and brain in 4%.
- The antimicrobials that continue to show high activity against most *Nocardia* species (>90%) are: amikacin, linezolid and TMP/SMX.
- N. farcinia*, *N. brasiliensis* and *N. transvalensis/N. wallacei* complex demonstrated >90% susceptibility to amoxicillin/clavulanate.
- Clarithromycin was susceptible in >99% of *N. nova* isolates.
- Both ceftriaxone and doxycycline was susceptible in > 85% of *N. abscessus* complex isolates.

Table 1: Nocardia Species

Species (Total 2070)	Number	%
NOCARDIA CYRIACIGEORGICA	382	18.4%
NOCARDIA NOVA	370	17.8%
NOCARDIA FARCINICA	334	16.1%
NOCARDIA BRASILIENSIS	267	12.9%
NOCARDIA ABSCESSUS COMPLEX	185	8.9%
NOCARDIA ASTEROIDES COMPLEX	82	4.0%
NOCARDIA WALLACEI	60	2.9%
NOCARDIA VETERANA	50	2.4%
Others	340	16.4%

*Most common *Nocardia* species and their frequency in our study.

Conclusions

- Considering the ubiquity of *Nocardia* spp., the isolation of these microorganisms from sputum or a skin swab is not always suggestive of invasive infection, as they may reveal laboratory contamination or colonization of the upper respiratory tract or skin.
- The systemic spectrum of nocardiosis is also wide including, pulmonary, central nervous system, eye, bone, and solid organs.
- Treatment is usually challenging and prolonged and combination therapy is usually used pending susceptibilities.
- It is crucial to identify *Nocardia* to species level and obtain susceptibility testing results to help choose the regimen that will enable the best clinical outcome.
- N. pseudobrasiliensis* was noted to have high rates of resistance to TMP/SMX (~90%).

Introduction

- Nocardia* is a ubiquitous weakly acid-fast, Gram-positive, environmental microorganism with the unique "beaded" acid-fast appearance on microscopy.
- Although described as "opportunistic pathogen" with majority of systemic infections observed in immunosuppressed patients (depressed cell-mediated immunity), up to one-third of patients are immunocompetent.
- Pulmonary nocardiosis is the most common clinical presentation of infection while CNS involvement is the most common extrapulmonary site.
- Treatment is usually challenging and prolonged, lacks supportive data and must be individualized. Treatment often requires empiric coverage with two or three agents in patients with severe infection.

Figure 1

Species by site of infection

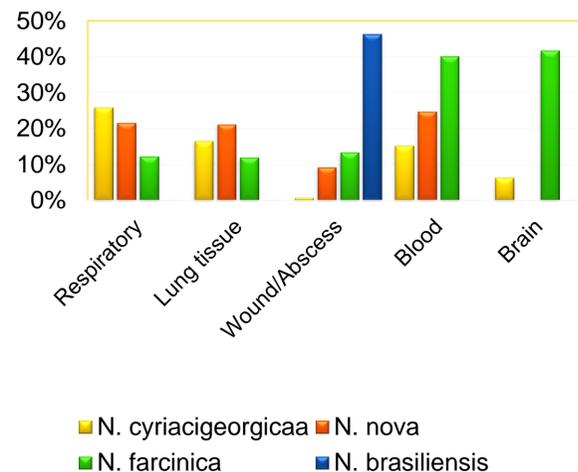


Table 2: Nocardia Susceptibility

ORGANISM	ANTIBIOTIC										
	Amikacin	Amox/Clav	Cefepime	Ceftriaxone	Ciprofloxacin	Clarithromycin	Imipenem	Linezolid	Minocycline	TMP/SMX	Tobramycin
	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
NOCARDIA ABSCESSUS COMPLEX	100.00	60.07	67.54	91.79	4.10	34.70	69.03	100.00	93.66	99.25	99.25
NOCARDIA ASTEROIDES COMPLEX	98.52	28.15	51.85	47.41	24.09	51.11	86.86	100.00	40.00	100.00	54.07
NOCARDIA BRASILIENSIS	100.00	98.92	0.00	2.70	0.00	1.08	4.58	100.00	14.02	99.73	99.46
NOCARDIA CYRIACIGEORGICA	98.91	7.25	23.73	63.22	0.00	0.91	98.91	100.00	13.59	100.00	99.09
NOCARDIA ELEGANS/VETERANA	100.00	18.67	40.00	18.67	0.00	86.67	100.00	100.00	29.33	100.00	10.67
NOCARDIA FARCINICA	99.79	94.94	1.05	2.74	47.47	0.00	83.54	100.00	7.81	99.79	1.05
NOCARDIA NOVA	100.00	0.39	47.38	12.62	0.58	99.61	100.00	100.00	15.15	100.00	0.97

* Most common *Nocardia* species antibiotic susceptibility in our study

References

- Ambrosioni, J., Lew, D., & Garbino, J. (2010). Nocardiosis: Updated Clinical Review and Experience at a Tertiary Center (Vol. 38).
- Conville, P. S., Brown-Elliott, B. A., Smith, T., & Zelazny, A. M. (2018). The Complexities of *Nocardia* Taxonomy and Identification. *J Clin Microbiol*, 56(1). doi:10.1128/jcm.01419-17
- Lebeaux, D., Bergeron, E., Berthet, J., Djadi-Prat, J., Mouniee, D., Boiron, P., Rodriguez-Nava, V. (2018). Antibiotic susceptibility testing and species identification of *Nocardia* isolates: a retrospective analysis of data from a French expert laboratory, 2010-2015. *Clin Microbiol Infect*. doi:10.1016/j.cmi.2018.06.013
- Mazzaferrri, F., Cordoli, M., Segato, E., Adami, I., Maccacaro, L., Sette, P., Azzini, A. M. (2018). *Nocardia* infection over 5 years (2011-2015) in an Italian tertiary care hospital. *New Microbiol*, 41(2), 136-140.
- Wilson, J. W. (2012). Nocardiosis: updates and clinical overview. *Mayo Clin Proc*, 87(4), 403-407. doi:10.1016/j.mayocp.2011.11.016.