

# Causative Organisms in Cardiac Implantable Electronic Device Infections: A Single Quaternary Cardiac Centre's Experience

Dr Michael Fletcher<sup>1,3</sup>, Dr Nethmi Wijesekera<sup>1,3</sup>, Dr Xiang Wen Lee<sup>1,3</sup>, Dr Benjamin Aw-Yeong<sup>2</sup>, Dr Joseph Lee<sup>1,3</sup>, Dr Robert Horvath<sup>1,3,4</sup>, Dr Russel Denman<sup>1,3</sup>, Dr Yong Shen Wee<sup>1,3</sup>

1. The Prince Charles Hospital, Brisbane.
2. Royal Melbourne Hospital, Melbourne.
3. University of Queensland
4. Pathology Queensland

## Introduction:

Cardiac implantable electronic devices (CIEDs) have become a cornerstone in the management of a variety of cardiac conditions. The increasing use of implantable cardiac defibrillators, pacemakers, and cardiac resynchronization therapy devices around the globe have also seen an increase in device-related complications.<sup>1,2</sup> Infection, though uncommon, is a serious and potentially life-threatening complication. Accounting for approximately 10% of all endocardial infections, mortality associated with cardiac device-related infective endocarditis (CDIE) is as high as 23%.<sup>3,4</sup> Making the diagnosis can be difficult, and management is multi-faceted and complex. Though this is a complication with ever increasing prevalence, data on the prevalence of causative organisms in different centres remains relatively scarce.<sup>1,2</sup> The current audit aims to elucidate the microbiology of CDIE encountered in a single quaternary Australian cardiac centre.

## Material and Methods:

The causative organisms isolated from extracted cardiac devices at The Prince Charles Hospital between 2012 and 2022 were audited. Inclusion criteria included all device extractions which had microbiology recorded on the Auslab electronic pathology database.

## Results:

Of a total of 127 extractions, 79 had microbiology recorded; of these, 56 had an organism identified, 36 from the device pocket, 17 from antecedent blood cultures, and 3 from both. The most common organisms were *Staphylococcal* species, including methicillin resistant and methicillin sensitive *Staphylococcus aureus*, and coagulase negative forms. Of the non-*Staphylococcal* organisms, the most prevalent was *Cutibacterium acnes*. *Streptococcus agalactiae*, *Pseudomonas aeruginosa*, *Citrobacter koseri*, *Coxiella burnetti* (confirmed on PCR), *Klebsiella aerogenes*, *Candida albicans*, and *group G Streptococcus* were also isolated. Six subjects had multiple organisms isolated from the same sample; the most common organisms isolated from patients with polymicrobial infections were *Staphylococcus aureus* and *Staphylococcus epidermidis*.

## Conclusion:

This single quaternary cardiac centre experience demonstrated that organisms in cardiac device infections are broadly similar to those in other prosthetic infections, with several atypical organisms identified. Further studies are required to identify potential risk factors for atypical organisms not covered by standard empiric therapy. Investigation of causative organisms at other large centres internationally would also be of value.

Organism	Number	Source
<i>Staphylococcus aureus</i>	20	
- Methicillin sensitive	15	Blood cultures (7), Site (7), Both (1)
- Methicillin resistant	5	Blood cultures (1), Site (3), Both (1)
Coagulase-negative staphylococcus	24	Blood cultures (5), Site (19), Both (0)
Other		
- <i>Klebsiella aerogenes</i>	1	BC
- <i>Streptococcus agalactiae</i>	1	Site
- <i>Group G Streptococcus species</i>	1	BC
- <i>Citrobacter koseri</i>	5	Both
- <i>Cutibacterium acnes</i>	1	Blood cultures (1), Site (4), Both (0)
- <i>Coxiella burnetti</i>	1	PCR (from site) – 1
- <i>Candida albicans</i>	1	BC
- <i>Pseudomonas aeruginosa</i>	1	Site
Polymicrobial	6	
- <i>Methicillin sensitive Staphylococcus aureus</i> and <i>Staphylococcus epidermidis</i>	2	Site
- <i>Methicillin resistant Staphylococcus aureus</i> and <i>coagulase-negative Staphylococcus</i>	1	Site
- <i>Methicillin resistant Staphylococcus aureus</i> and <i>Citrobacter koseri</i>	1	Both
- <i>Staphylococcus aureus</i> and <i>Citrobacter koseri</i>	1	Blood culture
- <i>Staphylococcus epidermidis</i> and <i>Candida albicans</i>	1	Site
- <i>Coxiella burnetti</i> and <i>Cutibacterium acnes</i>		

**Table 1:** The causative organisms identified in CDIE at The Prince Charles Hospital over a 10 year period.

## References:

1. Edelstein S, Yahalom M. Cardiac device-related endocarditis: Epidemiology, pathogenesis, diagnosis and treatment – a review. *Int J Angiol*. 2009 Winter; 18(4): 167–172.
2. Baddour LM, et al. Update on Cardiovascular Implantable Electronic Device Infections and Their Management. *Circulation*. 2010;121:458–477.
3. Kim DH, et al. Cardiac implanted electronic device-related infective endocarditis: clinical features, management, and outcomes of 80 consecutive patients. *Pacing Clin Electrophysiol*. 2014 Aug;37(8):978-85.
4. Arif S, Baddour LM, Sohail MR. Cardiac Device Related Endocarditis. *Infective Endocarditis Epidemiology, Diagnosis, Imaging, Therapy, and Prevention*. 2016 Jul: 187–205.