

# Averting infections when implanting cardiac pacemakers and defibrillators

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Implanting foreign bodies in people carries an inherent risk of infection, increasing morbidity, mortality, and costs to the patient and the health care system.<sup>1</sup> Many Australians have implanted pacemakers and defibrillators (cardiac implantable electronic devices, CIEDs), and the changing demographic characteristics of our population, including substantial rises in the numbers of people in their eighth to tenth decades of life, is increasing the demand. However, the benefits and risks of CIEDs warrant frank discussions prior to their insertion so that people can make informed decisions about whether they wish to proceed. There is no alternative to class 1 implants (when the pacemaker is deemed beneficial and necessary), but for class 2 implants (placement of a pacemaker is indicated, but there is conflicting evidence or divergence of opinion) this discussion is very important.<sup>2</sup> Both early and late complications are possible. Major early complications include pneumothorax, pericardial effusion, lead dislodgement, and infection.<sup>3</sup> One of the most serious and life-threatening late complications is pacemaker-related infection, particularly pacemaker lead endocarditis.<sup>4</sup>

In this issue of the *MJA*, Shawon and colleagues<sup>5</sup> report their retrospective study of infections following 37 675 CIED procedures in New South Wales during 2017–21. They acknowledge that the hospitalisations data they analysed may not have included all CIED-related infections (nor will subclinical infections have been included), and that information about immunosuppression and procedure time were not available.

Shawon and colleagues report that 1.1% of patients had infections that required re-hospitalisation within twelve months of their CIED procedures. Factors that influenced the risk of infection were age (<65 years *v* 65–74 years: adjusted hazard ratio [aHR], 1.71; 95% confidence interval [CI], 1.32–2.23), device type (CRT-D device *v*. pacemaker: aHR, 1.46; 95% CI, 1.02–2.08), previous CIED procedures (two or more *v* none: aHR, 1.51; 95% CI, 1.02–2.25), previous CIED infections (aHR, 11.4; 95% CI, 8.34–15.7), concomitant cardiac surgery (aHR, 1.62; 95% CI, 1.10–2.39), atrial fibrillation (aHR, 1.33; 95% CI, 1.10–1.60), chronic kidney disease (aHR 1.54; 95% CI, 1.27–1.87), chronic obstructive pulmonary disease (aHR, 1.37; 95% CI, 1.10–1.69), and cardiomyopathy (aHR, 1.60; 95% CI, 1.25–2.05).<sup>5</sup>

The overall infection rate was consistent with the internationally accepted standard of about 1%,<sup>6</sup> and the identified risk factors were similar to those of other studies that found increased infection risk following longer and more complex procedures such as cardiac resynchronisation pacemaker and defibrillator implants,<sup>6</sup> chronic kidney disease, previous CIED infection, and being under 65 years of age.<sup>4</sup> The reason for risk being higher for younger patients, as reported by Shawon and colleagues and also by other authors, is unknown.

Further factors reported by other studies to be associated with increased risk of infection<sup>7</sup> include diabetes mellitus, insertion of a temporary pacing lead before implantation, haematoma

after implantation, an additional (revision) pacing procedure during the same admission, long implantation procedures, inexperienced implanters, no antibiotic prophylaxis prior to implantation,<sup>8</sup> no absorbable antibacterial envelope for cardiac implantable electronic devices (World Wide Randomized Antibiotic Envelope Prevention trial, WRAP-IT),<sup>9</sup> procedures undertaken in standard operating theatres rather than cardiac catheter laboratories, skin preparation with chlorhexidine rather than povidone iodine, shaving with electric clippers, and laminar air flow in the operating theatre.<sup>3</sup> Few studies have specifically examined outcomes by antibiotic regimen, but strong evidence suggests that antibiotic prophylaxis is superior to none, but more intensive antibiotic prophylaxis does not achieve greater benefit.<sup>10</sup>

The challenge posed by the findings of Shawon and colleagues is how to reduce the infection risk in patients identified as being at high risk. The standard rules for aseptic procedures are obligatory, and managing the risk factors identified can reduce the risk further, particularly by using antibiotic-impregnated pouches around CIEDs;<sup>9</sup> an alternative is using a leadless pacemaker inserted into the right side of the heart.<sup>11</sup> Apart from this final approach, all treatment options are available in all implanting centres in Australia.

The findings by Shawon and colleagues underscore the importance of having well documented reasons for implanting CIEDs, strict adherence to aseptic technique during the implantation procedure, appropriate antibiotic prophylaxis, and detailed, documented discussions with patients about the risks associated with CIED implantation.

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