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Commentary: A problem well put is half solved

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John Dewey (1859-1952) was an American philosopher, education reformer, and prolific author. His thoughts on the structure of inquiry¹ are useful for understanding the importance of the article from Zhou and colleagues.² In *Logic: The Theory of Inquiry*, Dewey addresses the process of inquiry starting with the aphorism “a problem well put is half solved.”¹ Quantitative understanding of a problem elevates potential solutions from suggestions to ideas (ie, testable hypotheses).¹ Zhou and colleagues² do not solve the problem of infection in patients with left ventricular assist devices (LVADs); however, it is a source for ideas.

Infection, bleeding/thrombosis and device malfunction were recognized as potential problems early in the development of LVADs.³ Zhou and colleagues² analyzed mortality in LVAD patients with a focus on survival after the first documented infection. They grouped infections based on the work of others as non-VAD, VAD-related, and VAD-specific.⁴ The postimplant study intervals (0-90 days, 91-180 days, and >180 days) were chosen based on prior published research and the investigators' own experience. The Society of Thoracic Surgeons Interagency Registry for Mechanically Assisted Circulatory Support provided for analysis 12,957 patients enrolled from 2012 through 2017. First infection in the intermediate postimplant

John Dewey, PhD (1859-1952)

CENTRAL MESSAGE

Infection adversely affects long-term survival of patients with left ventricular assist devices.

interval (91-180 days) showed the largest increase in the hazard of death. VAD-related and VAD-specific infections showed larger increases in the hazard of death than non-VAD infections. The authors made recommendations for targeting specific classes of infection at certain times after LVAD implant to maximize patient survival. A second recommendation is for early detection and treatment of driveline infections.

Prior research based on the cumulative experience of Interagency Registry for Mechanically Assisted Circulatory Support established the potential for device-related infection to limit patient survival and quality of life. Notably, tethering of implanted pumps to external sources of energy (pneumatic earlier and currently electric) provides a pathway for infection. Fully implantable mechanical circulatory support devices have been challenging to design and use, as demonstrated in clinical trials. The present article by Zhou and colleagues² advances our knowledge of infectious complications based on prospectively gathered data using commonly agreed-upon definitions. As noted by the authors, there are limitations to the data. For instance, they cannot identify the infecting organisms nor do they make a distinction between bacterial and fungal infections. Infections of implanted foreign bodies are often recurrent and may worsen over time. Drivelines are an example of this problem. A simple cutaneous exit site infection may eventually tunnel along the driveline to create abscesses or even infect the exterior of the pump body. Information from this article should be considered in light of information regarding healing and immunological effects of implanted biomedical devices⁵ and the behavior of microbes that cause LVAD infections.⁶

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Mechanical circulatory support devices in the current era provide long-term (>5 years) survival of some but not all patients. Infection unfortunately limits survival and diminishes quality of life. Incremental improvements based on analyses of cumulative experience (Dr Dewey's ideas rather than suggestions) provide a path to attain the goal of diminishing infections and improving outcomes for LVAD patients.

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