

Schrödinger's Cat Paradox: *Bartonella* Serology Cannot Be Used to Speciate *Bartonella* Endocarditis

TO THE EDITOR—We read with great interest Ordaya and colleagues' recent article titled "Let the Cat Out of the Heart," describing the clinical characteristics of 16 cases of *Bartonella* endocarditis [1]. We congratulate the authors on an intriguing case series that highlights *Bartonella* endocarditis's association with renal failure, embolization, and PR3-ANCA positivity. Publishing case-level data on *Bartonella* endocarditis is increasingly relevant in light of the 2023 updates to the modified Duke criteria that include *Bartonella* diagnostics as a major endocarditis criterion [2].

However, we have concerns that the article, including the witty title, may mislead readers to consider *Bartonella henselae* as the predominant etiology of *Bartonella* endocarditis without providing species-level evidence to support this claim. The 16 cases described were diagnosed by *Bartonella* serologic positivity, with 7 patients confirmed to *Bartonella* genus level by *Bartonella* polymerase chain reaction (PCR) on explanted cardiac tissue. Species-specific PCR targets such as 16S rRNA, *ribC*, *rpoB*, and *gltA* genes were not performed [3]. While the authors mention *Bartonella* species other than *B henselae* in the introduction, they proceed to focus on *B henselae*, emphasizing cat exposure and *Ctenocephalides* flea vectors. "Cat exposure" was reported in 62.5% of the described cases, but the authors failed to define what this exposure meant. Were all "cat exposures" scratches or simply a recollection of a feline in the vicinity? The authors also failed to include important risk factors for *Bartonella quintana*, such as

homelessness, pediculosis, or immigration from a low-income country [4, 5]. This may reflect heuristic, confirmation, and premature closure biases [6]; the authors imply that any "cat exposure" is a mental shortcut for *B henselae* infection without sufficient information to exclude alternative *Bartonella* species.

The authors appropriately recognize the limitations of serology, recognizing that *Bartonella* endocarditis may cause reactive *Coxiella burnetii* serology. Eight of the 16 patients in this study resulted in false-positive *C burnetii* serology. Analogously, *Bartonella* serology lacks specificity and cross-reacts between *Bartonella* species. *Bartonella quintana* and *B henselae* commonly cause serologic positivity for the other species, with similar titers [7]. In Manitoba, a Canadian province that borders Minnesota (jurisdiction of the authors), *B quintana* was a more common cause of *Bartonella* serologic positivity than *B henselae* [7]. One cannot assume *Bartonella* species based on serology.

In the introduction, Ordaya et al appropriately describe homelessness, human immunodeficiency virus (HIV), and alcohol use as risk factors for *B quintana* infection. However, only HIV and alcohol use were reported in their Table 1; current homelessness, previous homelessness, and shelter exposure were not described. Moreover, it is increasingly recognized that *B quintana* is endemic to many low-income countries [5, 8]. Thus, immigration history is an important and often neglected risk factor for *B quintana* infection that was not described here. Last, *B quintana* has previously been isolated from cats, and human cases of *B quintana* have occurred after a feline bite [9, 10]. Cat exposure alone is not sufficient to confirm

B henselae among endocarditis cases with *Bartonella* serologic positivity.

In quantum mechanics, Schrödinger's cat is a thought experiment to demonstrate quantum superposition [11]. In this parable, a cat, a flask of poison, and a radioactive source are sealed in a box. If radioactivity is detected, the poison is released from the flask, eventually killing the cat. After a period of time, until one looks into the box, the cat can be both dead and alive. Only after opening the box can one identify either an alive or dead cat. Using this analogy, if we do not open the box and use molecular testing to identify the *Bartonella* species, *Bartonella* endocarditis may be caused by either *B henselae* or *B quintana* (or another species) and may or may not be linked to a cat.

Note

Potential conflicts of interest. All authors: No reported conflicts.

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