

# *Staphylococcus hyicus*, a novel pathogen causing destructive infective endocarditis requiring mitral annular reconstruction



Frazer Kirk, MBBS, MSurg,<sup>a</sup> Mary Mashicharan, MD, FRACP,<sup>b</sup> Maxwell Braddick, MBBS,<sup>c</sup> and Pankaj Saxena, FRACS, PhD,<sup>a</sup> Townsville, Australia

From the Departments of <sup>a</sup>Cardiothoracic Surgery, <sup>b</sup>Cardiology, and <sup>c</sup>Infectious Diseases and Microbiology, Townsville University Hospital, Townsville, Queensland, Australia.

Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Virtual poster presentation at the virtual meeting of the Australasian Society for Infectious Diseases Zoonoses Conference, November 3, 2021.

Received for publication Oct 12, 2021; accepted for publication March 30, 2022; available ahead of print April 15, 2022.

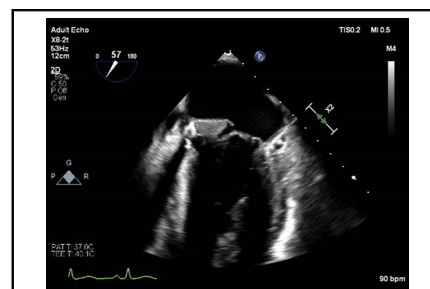
Address for reprints: Pankaj Saxena, FRACS, PhD, Townsville University Hospital, 100 Angus Smith Drive, Douglas, 4811 Queensland, Australia (E-mail: [drpankajsaxena@hotmail.com](mailto:drpankajsaxena@hotmail.com)).

JTCVS Techniques 2022;13:70-3

2666-2507

Copyright © 2022 The Author(s). Published by Elsevier Inc. on behalf of The American Association for Thoracic Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<https://doi.org/10.1016/j.jtc.2022.03.008>



Transesophageal echocardiogram images of *S hyicus* vegetation abutting the mitral valve.

## CENTRAL MESSAGE

*Staphylococcus hyicus* is a novel pathogen with highly atypical features on microbiology and echocardiography. It is extremely destructive and should not be overlooked when identified on culture.

▶ Video clip is available online.

A 52-year-old White male patient, a sheep-shearer without significant medical history, presented to a regional hospital with acute severe fever and back pain. He was treated empirically for septicemia with flucloxacillin and gentamicin. Computed tomography scanning of the spine yielded no explanation. Blood cultures identified penicillin-sensitive *Staphylococcus hyicus* within 12 hours. Intravenous flucloxacillin was continued whilst he was transferred under our care.

Clinical examination revealed a systolic murmur over the mitral area and a nonblanching petechial rash on the dorsum of his hands and feet without other stigmata of infective endocarditis. He developed an acute kidney injury requiring hemodialysis. His antibiotic regimen was changed to benzylpenicillin. *S hyicus* persisted in blood cultures until day 4, and he remained febrile until day 11. Magnetic resonance imaging excluded spinal osteomyelitis/spondylodiscitis.

Transthoracic echocardiogram revealed a mobile structure attached to the atrial base of the posterior mitral valve leaflet (PMVL), suspicious for a large vegetation. Biventricular size and function were normal. Transesophageal

echocardiogram demonstrated a 2.5-cm × 1-cm, ovoid, heterogeneous, mobile mass (stable between studies) with frond-like structures emanating from its surface, attached to the posterior mitral annulus, closely related to the leaflets (Figure 1, Videos 1 and 2). Despite direct contact with the PMVL and the tip of the anterior leaflet, there was no valvular infiltration, tissue destruction, or impedance of leaflet mobility (Video 3). There was trivial-to-mild central mitral regurgitation and extensive posterior mitral annular calcification (MAC) extending into the PMVL, concerning for an abscess of the supravulvar mitral apparatus; however, this was not adequately delineated on the echocardiography.

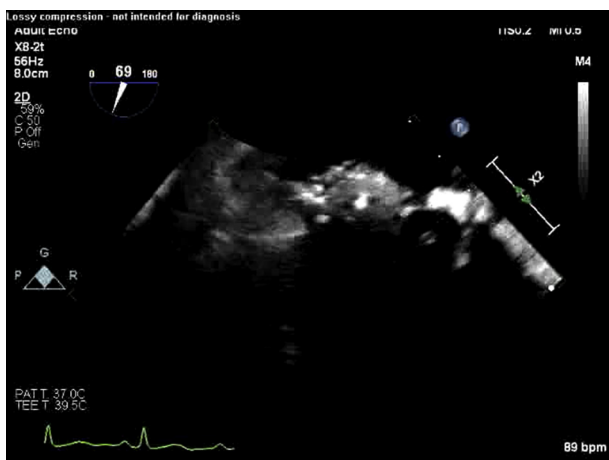
Preoperative angiogram, transesophageal echocardiogram, and computed tomography of the chest showed extensive MAC (Figure 1). Cardiac surgery involved median sternotomy, bicaval cannulation, systemic hypothermia to 34 °C, cold-blood cardioplegia, and exposure of the mitral valve (MV) via a biatrial superior septal



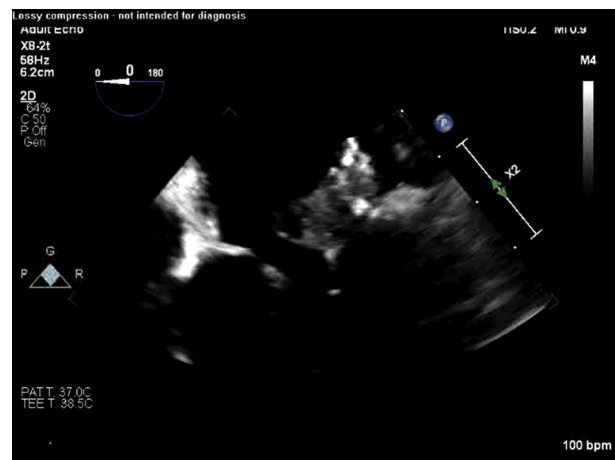
**FIGURE 1.** A and B, *Top left and right* illustrate the echocardiographic appearance of the lesion on transesophageal echocardiogram. C, *Bottom left* illustrates the extensive mitral annular calcification noted on computed tomography.

approach. The PMVL was preserved structurally in the area not affected by the vegetation. A large friable vegetation extended from the annulus on to the P2, 3 areas of the leaflet and infiltrating the posterior wall of the left atrium (Figure 2). The annulus was extremely friable with a large abscess. There was horseshoe-shaped posterior MAC. The anatomical boundary between vegetation, abscess, and

MAC was obliterated (Figure 3, A). This area was extensively debrided. The annulus was reconstructed with a bovine pericardial patch, placed to prevent atrioventricular dissociation, and buttressing the sewing ring of a bio-prosthetic Mosaic 27-mm valve (Medtronic). The patch was secured with a continuous running 4-0 polypropylene



**VIDEO 1.** Transesophageal echocardiogram image demonstrating the frond like projections emanating from the heterogeneous mass. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00203-6/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00203-6/fulltext).



**VIDEO 2.** Transesophageal echocardiogram image demonstrating the large heterogeneous nature of the mass and its mobility. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00203-6/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00203-6/fulltext).

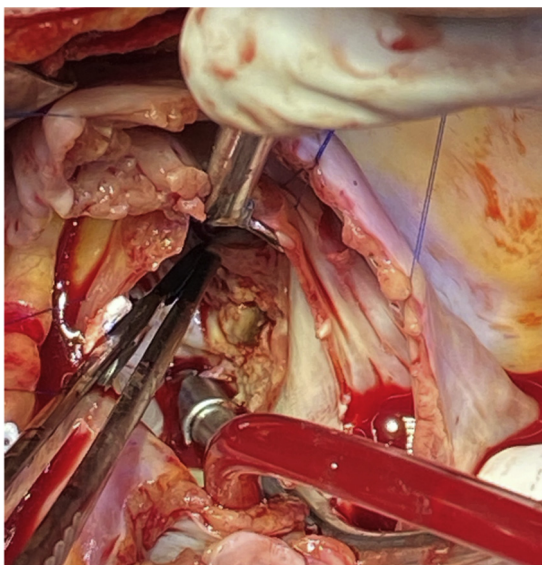


**VIDEO 3.** The video demonstrates the mobile mass adjacent to but moving independently of the mitral leaflets, indicating attachment to the annulus. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00203-6/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00203-6/fulltext).

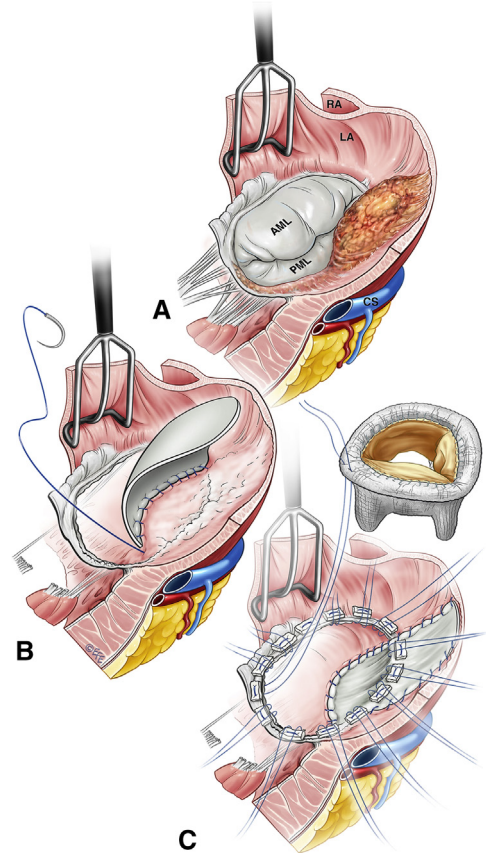
suture starting from the left ventricle, onward towards the left atrium (Figure 3, B and C).

Microscopically, the specimen showed myxoid change, lamellar disorganization, and hyalinization with dense calcification. Superimposed suppurative inflammation and fibrinoid organization suggested subacute infective endocarditis. Tissue cultures and gram staining yielded no organism. *S hyicus* was confirmed using 16s rRNA gene analysis of the MV.

There were no postoperative complications, and the patient’s renal function normalized. Transthoracic echocardiogram at 8 days postoperatively demonstrated normally



**FIGURE 2.** Intraoperative photograph of the necrotic mitral annulus, with the patient’s head shown superiorly. The forceps show the friable fibrinous vegetation, in continuation with the annulus.



**FIGURE 3.** A, Diagram demonstrates exposure of the mitral valve with findings of large vegetation/abscess involving the posterior annulus area; mitral annular calcification is also evident. B, View seen following the excision of posterior leaflet of the mitral valve, debridement of the annulus of the abscess, and mitral annular calcification. The annulus is being reconstructed. The subvalvular apparatus is partially preserved. C, Bioprosthetic mitral valve replacement with sutures placed in the native and neoannulus.

functioning MV prosthesis and left ventricular ejection fraction 55% to 60%. The patient was discharged day 42 postoperatively, after 6 weeks of intravenous cefazolin and rehabilitation, the patient was clinically well at 3 months without evidence of recurrence. The patient provided written consent for publishing. Our ethical review board policy does not require approval for single patient studies with patient consent.

**DISCUSSION**

Before the aforementioned report, *S hyicus* endocarditis has only been recorded in animals. There is a sparsity of information regarding *S hyicus* infection in humans, with only 3 of 5 cases containing sufficient information for comparison, previously causing bacteremia and spondylodiscitis.<sup>1-6</sup>

*S hyicus* are cluster-forming aerobic cocci showing variable coagulase activity.<sup>4</sup> They are commonly mistaken for *Staphylococcus aureus*, *Staphylococcus agnetis*, or

coagulase-negative *Staphylococcal* species. The organism is postulated to be zoonotic. *S hyicus* has similar exotoxin-producing capabilities to *S aureus*, which could explain the acute kidney injury, cutaneous rash, and destructive nature.<sup>3</sup> Matrix-assisted laser desorption ionization-time of flight mass spectrometry was used to identify *S hyicus*. In cases pretreated with antibiotics, 16s rRNA analysis may be required.<sup>7,8</sup>

This case demonstrated endocarditis in an immunocompetent man; underlying MAC may have been instrumental in the pathogenesis.<sup>7</sup> MAC may also explain the anatomical predilection of *S hyicus* to destroy the annulus whilst sparing the valve.<sup>9</sup>

There was a Class I indication for surgery, due to over 5 days of persistent fevers and failure of the vegetation to reduce in size despite appropriate antibiotics.<sup>4</sup> Although no embolic sequelae were noted, the embolic potential of this organism cannot be commented upon in an isolated case report.

## CONCLUSIONS

We herein present clinical management of extremely rare cause of destructive native MV endocarditis related to *S hyicus*. Underlying MAC and animal exposure may be implicated in the development of the condition. It presents with

highly atypical echocardiographic findings, comparative to other *Staphylococcus* species. It is a novel pathogen not to be overlooked on culture.

## References

- Osterlund A, Nordlund E. Wound infection caused by *Staphylococcus hyicus* subspecies *hyicus* after a donkey bite. *Scand J Infect Dis*. 1997;29:95.
- Casanova C, Iselin L, von Steiger N, Droz S, Sendi P. *Staphylococcus hyicus* bacteremia in a farmer. *J Clin Microbiol*. 2011;49:4377-8.
- Foissac M, Lekaditi M, Loutfi B, Ehrhart A, Dauchy FA. Spondylodiscitis and bacteremia due to *Staphylococcus hyicus* in an immunocompetent man. *Gems*. 2016;6:106-10.
- Pettersson GB, Hussain ST. Current AATS guidelines on surgical treatment of infective endocarditis. *Ann Cardiothorac Surg*. 2019;8:630-44.
- Mubashir K, Faiz A, Ashshi A. Clinically significant coagulase negative Staphylococci and their antibiotic resistance pattern in a tertiary care hospital. *J Pak Med Assoc*. 2014;64:1171-4.
- Sato S, Sakuragi T, Dan K. Human skin flora as a potential source of epidural abscess. *Anesthesiology*. 1996;85:1276-82.
- Adkins PRF, Middleton JR, Calcutt MJ, Stewart GC, Fox LK. Species identification and strain typing of *Staphylococcus agnetis* and *Staphylococcus hyicus* isolates from bovine milk by use of a novel multiplex PCR assay and pulsed-field gel electrophoresis. *J Clin Microbiol*. 2017;55:1778-88.
- Becker K, Harmsen D, Mellmann A, Meier C, Schumann P, Peters G, et al. Development and evaluation of a quality-controlled ribosomal sequence database for 16S ribosomal DNA-based identification of *Staphylococcus* species. *J Clin Microbiol*. 2004;42:4988-95.
- Pressman GS, Rodriguez-Ziccardi M, Gartman CH, Obasare E, Melendres E, Arguello V, et al. Mitral annular calcification as a possible nidus for endocarditis: a descriptive series with bacteriological differences noted. *J Am Soc Echocardiogr*. 2017;30:572-8.