

## Case report

# Infective endocarditis caused by *Lactococcus garvieae*: A case report and review of the literature

Izumi Kitagawa<sup>a</sup>, Noriyoshi Ishikawa<sup>b</sup>, Ryohei Ono<sup>c,\*</sup>,<sup>1</sup>

<sup>a</sup> Department of General Internal Medicine, Shonan Fujisawa Tokushukai Hospital, 1-5-1 Tsujido Kandai, Fujisawa, Kanagawa 251-0041, Japan

<sup>b</sup> Department of Pathology, Shonan Fujisawa Tokushukai Hospital, 1-5-1 Tsujido Kandai, Fujisawa, Kanagawa 251-0041, Japan

<sup>c</sup> Department of Cardiovascular Medicine, Chiba University Graduate School of Medicine, 1-8-1 Inohana, Chuo-ku, Chiba 260-8670, Japan

## ARTICLE INFO

## Keywords:

Aortic regurgitation  
*Lactococcus garvieae*  
 Infective endocarditis

## ABSTRACT

*Lactococcus garvieae* is a Gram-positive coccus that can be easily misidentified as *Enterococcus* spp. or streptococci. Infection with *L. garvieae* is associated with the consumption of raw fish and unpasteurized dairy products. Although rare, it can cause infective endocarditis (IE). Herein, we report a case in which aortic valve replacement (AVR) was required for IE caused by *L. garvieae*.

A 79-year-old Japanese man with a history of hypertension, myocardial infarction, gastroesophageal reflux disease (GERD), and abdominal aortic aneurysm presented with loss of appetite, myalgia, and difficulty in moving. Physical examination revealed a diastolic murmur, an Osler's node on the right first toe, dental caries, and a palpable spleen, suggesting IE. Transthoracic echocardiography revealed a large, mobile vegetation on the aortic valve, which was associated with severe aortic regurgitation. Blood cultures revealed *L. garvieae*. The patient received antibiotic therapy, underwent AVR, and recovered without major complications. To date, 30 cases of *L. garvieae*-associated IE have been reported. We reviewed and summarized all cases of *L. garvieae*-associated IE including our case.

## Introduction

*Lactococcus garvieae* is a Gram-positive coccus that was originally considered a part of the genus *Streptococcus* and was reclassified under the genus *Lactococcus* [1]. *L. garvieae* is associated with infected warm water fish, causing hemorrhagic septicemia, which is characterized by the presence of hematomas, dark coloration and desquamation of the skin, abdominal distension, and exophthalmos [1,2]. It has also been isolated from raw cow milk, goat cheese, beef, poultry, and pork [3]. In human, *L. garvieae* can cause infective endocarditis (IE) [4]. However, routine testing of *Lactococcus* spp. remains a challenge in daily practice, and it is difficult to differentiate this organism from other Gram-positive cocci, such as *Enterococcus* spp. and streptococci, due to similar microbiological characteristics they present [5]. The identification of *L. garvieae* is challenging, therefore, only 30 cases of IE caused by *L. garvieae* have been reported to date. Herein, we presented a case of *L. garvieae*-induced IE requiring aortic valve replacement (AVR). We also reviewed and summarized cases of IE caused by *L. garvieae*.

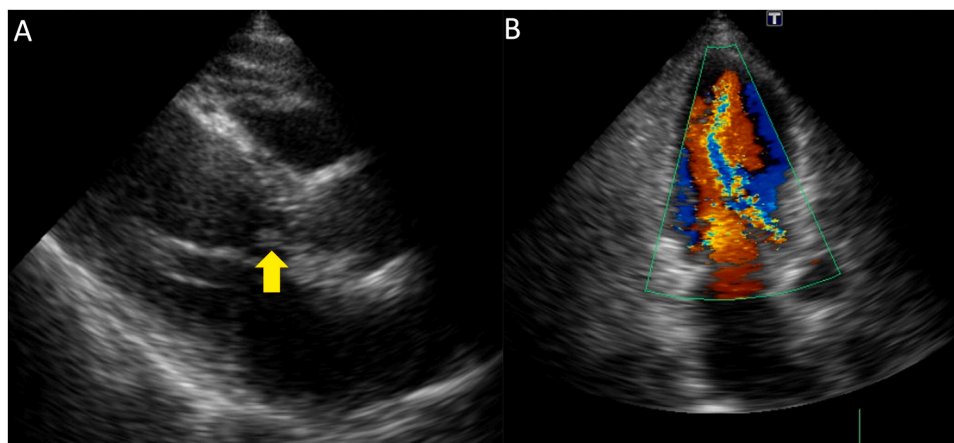
## Case

A 79-year-old Japanese man with a history of hypertension, myocardial infarction, gastroesophageal reflux disease (GERD), and abdominal aortic aneurysm presented to the emergency department with loss of appetite, myalgia, and weakness. Three years prior, he developed acute myocardial infarction and underwent successful percutaneous coronary intervention in the left ascending artery. At that time, he had no valvular abnormalities and was followed up regularly. One month before admission, the patient experienced myalgia and a gradual loss of appetite. He had no history of dental or cardiac surgery, or known allergies, and his family history was unremarkable. His medication included aspirin, lansoprazole, perindopril and azelnidipine. The patient denied any recent history of tooth extraction. On arrival, he was afebrile (36.3 °C), with a heart rate of 74 beats per minute, blood pressure of 97/45 mmHg, and oxygen saturation of 95 % on room air. Physical examination revealed a 3/6 diastolic murmur, an Osler's node on the right first toe, dental caries, a palpable spleen, and bilateral peripheral edema.

\* Corresponding author.

E-mail address: [r.ono.circulation@chiba-u.jp](mailto:r.ono.circulation@chiba-u.jp) (R. Ono).

<sup>1</sup> This author takes responsibility for all aspects of the reliability and freedom from bias of the presented data and their interpretation.



**Fig. 1.** A transthoracic echocardiogram revealing large mobile vegetation on the aortic valve (arrow, 14 mm) (A), associated with severe aortic regurgitation (B).

**Table 1**  
Antimicrobial susceptibility of *Lactococcus garvieae*.

Antimicrobial agent	Interpretation
Penicillin	S
Ampicillin	S
Cefazolin	S
Cefmetazole	S
Imipenem	S
Gentamicin	R
Minocycline	S
Vancomycin	S

R, Resistant; S, susceptible.

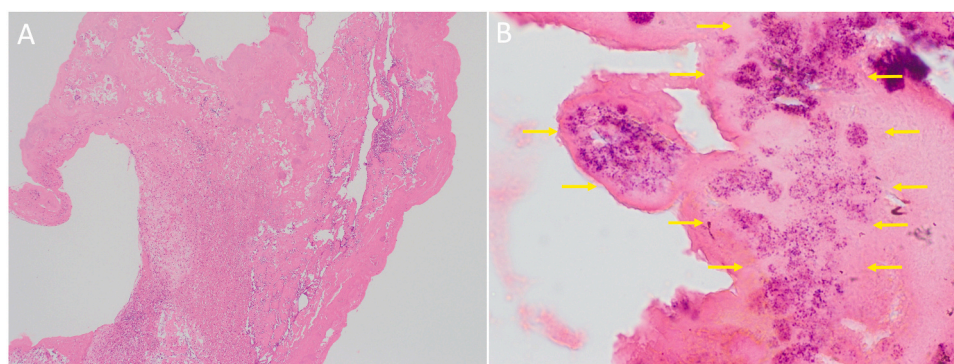
Laboratory tests revealed the following findings: white blood cell count, 12,900/ $\mu$ L (normal range; 4000–9000/ $\mu$ L); C-reactive protein level, 8.16 mg/dL (normal range; 0–0.30 mg/dL); serum creatinine level, 1.41 mg/dL (normal range; 0.64–1.11 mg/dL); and B-type natriuretic peptide level, 428 pg/mL (normal range; 0–18.4 pg/mL). Transthoracic echocardiography revealed a large mobile vegetation on the aortic valve (14 mm) associated with severe aortic regurgitation (AR) (Fig. 1). Contrast-enhanced whole-body computed tomography revealed no systemic embolism. Two sets of two bottles of blood cultures were obtained, the patient was admitted in the hospital, and ampicillin-sulbactam was administered.

All blood cultures tested positive after 12 h of incubation, and Gram staining revealed Gram-positive cocci that was initially diagnosed as *Enterococcus* spp. Therefore, the antimicrobial treatment changed to ampicillin and gentamicin. The patient underwent AVR on day 2 because of severe AR with vegetation. During surgery, leaflet perforations of the noncoronary, right coronary, and left coronary cusps were

noted in the native aortic valve. The patient underwent successful AVR, and a prosthetic valve was implanted to repair the aortic root. *L. garvieae* was identified after 2 weeks using a matrix-assisted laser desorption/ionization time-of-flight analyzer (MALDI-TOF) in an outsourced test. The isolated bacteria were susceptible to penicillin, ampicillin, cefazolin, and fluoroquinolones (Table 1). In addition, pathological examination of the resected aortic valve revealed leaflet perforation with vegetation, neutrophil infiltration, and fibrin on hematoxylin and eosin staining (Fig. 2A), and gram-positive bacterial colonies (Fig. 2B), which were consistent with IE. Additional blood cultures were obtained 3 days later, and the results were negative. In addition, postoperative transthoracic echocardiography revealed no AR, vegetation, or valvular abnormalities. The patient was treated with ampicillin and gentamicin for 2 weeks, followed by cefazolin for 2 weeks after confirmation of susceptibility. The patient was discharged on day 29 without any complications and oral levofloxacin was prescribed for 2 weeks after discharge. The patient was doing well at 1-year follow-up.

## Discussion

*L. garvieae* was first described in 1983 and human infection with *L. garvieae* was first reported in 1991 [6,7]. *L. garvieae* is an anaerobic, catalase-negative, Gram-positive coccus that can be found singly, in pairs, or in chains [8]. The organism phenotypically tends to be pyrrolidonyl arylamidase-positive and leucine aminopeptidase-positive and grows in 6.5 % salt and bile esculin media; however, *Enterococcus* spp. have a similar profile and can be easily misidentified [5,9]. *L. garvieae* has been reported to cause other infections including mastitis, diverticulitis, peritonitis, infective spondylodiscitis, liver abscess, and urinary tract infections [10]. Raw seafood is thought to be the main source of



**Fig. 2.** Histopathologic findings of the resected aortic valve showing leaflet perforation with vegetation along with neutrophil infiltration and fibrin on hematoxylin-eosin stain (A), and Gram-positive bacterial colonies (arrows) on Gram-stain (B).

**Table 2**  
Literature review of *Lactococcus garvieae*-associated infective endocarditis.

Case	Year	Author	Age, sex	Site of infection	Risk factors	Antibiotics	Antimicrobial susceptibilities	Surgery	Outcome
1	1998	Fefer	84 F	NMV/PAV		CTX	ND	Yes	Survived
2	2000	James	56 F	PAV		VAN	ND	No	Survived
3	2005	Fihman	86 F	PAV	GD	AMX+GEN	PEN, AMX, CTAX, VAN, TEI	No	Survived
4	2006	Vinh	80 M	NAV	GD	AMP	PEN, AMP, CAM, CPF, OFX, LEV, TC, VAN	Yes	Survived
5	2006	Wang	72 M	NMV	RF/GD	PEN+GEN	ND	No	Survived
6	2007	Yiu	67 M	NMV		AMP	ND	Yes	Survived
7	2008	Li	41 M	NMV		PEN+GEN	ND	Yes	Survived
8	2011	Hirakawa	58 F	PMV	RF	VAN	ND	No	Survived
9	2011	Wilbring	55 M	PTV		VAN+GEN, AMX+LEV	AMX, LEV	No	Survived
10	2011	Zuily	64 F	PMV	RF/GD	AMX+GEN	ND	No	Survived
11	2011	Watanabe	55 F	NMV		PEN+GEN, CTX+GEN	CTX, EM, VAN, LZD	No	Survived
12	2012	Russo	63 M	PAV/NMV	GD	VAN+GEN, AMP+GEN	EM, CTX, LEV, TC, IPM, AMP, AMX, CPF, DAP, VAN, GEN, TEI	No	Survived
13	2012	Fleming	68 M	PAV/NMV	RF/GD	VAN	VAN, AMP/SBT, CTX, PIPC/TAZ	No	Died
14	2013	Navas	64 M	NAV		VAN	ND	Yes	Survived
15	2014	Rasmussen	81 M	PAV/NMV	GD	PEN+TOB	PEN, TOB	No	Survived
16	2014	Tsur	76 M	PAV	GD	CTX+GEN	CTX, GEN	No	Survived
17	2014	Ortiz	70 F	NMV		AMK+GEN	CTX, CPF, EM, DAP, VAN	Yes	Survived
18	2014	Ortiz	77 F	NMV/NAV	GD	AMK+GEN	PEN, AMX, CPF, VAN	No	Died
19	2015	Igneri	83 M	PAV		AMP+GEN, CTX+GEN	ND	Yes	Survived
20	2015	Heras	68 M	NMV		GEN+AMP+CTX	CTX, EM, VAN, DAP, LEV	Yes	Died
21	2016	Suh	75 F	PMV	RF	CTX+GEN+RI, TEI+CTX	PEN, AMX, CTX, CTAX, VAN, LEV, MEPM, TEI	Yes	Survived
22	2016	Bazemore	45 M	PAV	GD	VAN+PIP/TAZ, CTX+GEN	ND	Yes	Survived
23	2017	Landeloos	82 F	PMV	GD	AMX, PEN+GEN	ND	No	Survived
24	2017	Lim	57 M	NMV	GD	AMX+GEN	PEN, GEN	Yes	Survived
25	2017	Clavero	72 F	NMV	RF	AMP+CLX, VAN+GEN	VAN, CTAX, PEN, EM, CPF, AMX	No	Died
26	2018	Lim	85 M	PAV/NMV/ NTV	GD	AMP+GEN, CTX	PEN, CTX, GEN	No	Survived
27	2019	Malek	50 M	NAV	RF/GD	VCM+GEN, CTX+GEN	PEN, CTX, VAN, LEV	Yes	Survived
28	2019	Rösch	78 M	PAV		VAN+GEN+RI, PEN	AMP, VAN, CTAX, CTX, PEN, GEN	Yes	Survived
29	2021	González-Bravo	78 M	PAV	GD	VAN+CFPM, CTX	CTX, LEV, VAN	No	Survived
30	2023	Wahbah	65 M	PAV		CTX+GEN	ND	No	Survived
31	2024	Kitagawa (Our case)	79 M	NAV	GD	AMP/SBT, AMP+GEN, CEZ, LEV	PEN, AMP, CEZ, CMZ, IPM, VAN, MINO	Yes	Survived

AMX, amoxicillin; AMP, ampicillin; AMP/SBT, ampicillin/sublactam; CAM, chloramphenicol; CEZ, cefazolin; CLX, cloxacillin; CMZ, cefmetazole; CPF, ciprofloxacin; CTAX, cefotaxime; CTX, ceftriaxone; DAP, daptomycin; EM, erythromycin; F, female; GEN, gentamicin; GD, gastrointestinal disorder; IPM, imipenem; LEV, levofloxacin; LZD, linezolid; M, male; MEPM, meropenem; MINO, minocycline; NAV, native aortic valve; ND, not described; NMV, native mitral valve; OFX, ofloxacin; PAV, prosthetic aortic valve; PEN, penicillin; PIP/TAZ, piperacillin/tazobactam; PMV, prosthetic mitral valve; PTV, prosthetic tricuspid valve; RF, raw fish; RI, rifampicin; TC, tetracycline; TEI, teicoplanin; TOB, tobramycin; VAN, vancomycin.

infection with *L. garvieae* with unpasteurized dairy products being another [11]. Other risk factors for infection include immunosuppression, previous heart valve surgery, and the presence of gastrointestinal diseases such as polyps, diverticulosis, peptic ulcers, and GERD [12]. In our patient's case, we considered caries or GERD as risk factors for infection. Since *L. garvieae* can easily be misidentified as *Enterococcus* spp. or streptococci, identification of these species should be confirmed by MALDI-TOF or 16 S ribosomal ribonucleic acid sequencing [9].

Rösch et al. reviewed 26 cases of IE associated with *L. garvieae* reported until 2018 [13]. We used all the relevant articles found in the literature with the exception of one Dutch article, and included newly reported cases after 2018 in our review [11, 13–16]. To date, 31 cases of *L. garvieae*-associated IE, including the present case, have been reported. We reviewed reported cases of IE caused by *L. garvieae* (Table 2). The mean age of the patients was  $68.8 \pm 12.0$  (range: 41–86) years. Twenty patients were men (64.5%) and 11 were women (35.5%). The most common sites of infection were the aortic and mitral valves in 18 patients (58%), followed by the tricuspid valve in two patients (6%). Eighteen patients (58%) had prosthetic valves, and five of the 18 patients (28%) underwent repeated valve surgery. In contrast, 13 cases (42%) involved a native valve, and multivalve IE was noted in six cases (19.4%). Risk factors included a history of raw fish consumption (7 patients, 23%) and gastrointestinal disorders (16 patients, 52%: colonic polyps,  $n = 6$ ; colonic/rectal diverticulosis,  $n = 3$ ; gastric ulcer/gastritis,  $n = 2$ ; GERD,  $n = 2$ ; colorectal cancer,  $n = 2$ ; and duodenal ulcer,  $n = 1$ ). All patients were treated with antibiotic therapy,

mainly  $\beta$ -lactam antibiotics, anti-Methicillin-Resistant *Staphylococcus aureus* agents, or antibiotics combined with gentamicin. Antimicrobial susceptibility was observed in 19 patients. The identified organisms were mainly susceptible to ampicillin, ceftriaxone, anti-Methicillin-Resistant *Staphylococcus aureus*, and quinolones. Regarding susceptibility to gentamicin, only our case and one reported case [17] were found to be resistant. Of the 31 patients, 14 (45%) underwent surgery as treatment, and only one patient who underwent surgery died. Regarding prognosis, 27 patients (87%) survived and four (13%) died.

In conclusion, we reported a case of IE caused by *L. garvieae* and summarized previous cases. A literature review revealed that the possible risk factors for IE caused by *L. garvieae* include older age, prosthetic valves, a history of raw fish consumption, and gastrointestinal disorders. Because the identification of *L. garvieae* can be difficult, reliable methods such as MALDI-TOF, which was used in our case, should be considered. Once *L. garvieae* infection is confirmed, our review suggests that physicians should choose between antibiotics such as ampicillin, ceftriaxone, anti-Methicillin-Resistant *Staphylococcus aureus*, or quinolones.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

## Ethical approval

This is a case report and no ethical approval is required in our institution.

## Funding

This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflict of interest

The authors declare that they have no conflicts of interest.

## CRediT authorship contribution statement

**Ryohei Ono:** Data curation, Writing – original draft, Writing – review & editing, Conceptualization. **Noriyoshi Ishikawa:** Visualization, Writing – review & editing. **Izumi Kitagawa:** Conceptualization, Data curation, Writing – original draft.

## Acknowledgement

We thank Editage [<http://www.editage.com>] for editing and reviewing the manuscript for English language.

## References

- [1] Vendrell D, Balcazar JL, Ruiz-Zarzuola I, de Blas I, Girones O, Muzquiz JL. *Lactococcus garvieae* in fish: a review. *Comp Immunol Microbiol Infect Dis* 2006; 29(4):177–98.
- [2] Cavanagh D, Fitzgerald GF, McAuliffe O. From field to fermentation: the origins of *Lactococcus lactis* and its domestication to the dairy environment. *Food Microbiol* 2015;47:45–61.
- [3] Gibello A, Galan-Sanchez F, Blanco MM, Rodriguez-Iglesias M, Dominguez L, Fernandez-Garayzabal JF. The zoonotic potential of *Lactococcus garvieae*: an overview on microbiology, epidemiology, virulence factors and relationship with its presence in foods. *Res Vet Sci* 2016;109:59–70.
- [4] Suh Y, Ja Kim M, Seung Jung J, Pil Chong Y, Hwan Kim C, Kang Y, et al. Afebrile multi-valve infective Endocarditis caused by *Lactococcus garvieae*: a case report and literature review. *Intern Med* 2016;55(8):1011–5.
- [5] Navas ME, Hall G, El Bejjani D. A case of endocarditis caused by *Lactococcus garvieae* and suggested methods for identification. *J Clin Microbiol* 2013;51(6): 1990–2.
- [6] Collins MD, Farrow JA, Phillips BA, Kandler O. *Streptococcus garvieae* sp. nov. and *Streptococcus plantarum* sp. nov. *J Gen Microbiol* 1983;129(11):3427–31.
- [7] Elliott JA, Collins MD, Pigott NE, Facklam RR. Differentiation of *Lactococcus lactis* and *Lactococcus garvieae* from humans by comparison of whole-cell protein patterns. *J Clin Microbiol* 1991;29(12):2731–4.
- [8] James PR, Hardman SM, Patterson DL. Osteomyelitis and possible endocarditis secondary to *Lactococcus garvieae*: a first case report. *Post Med J* 2000;76(895): 301–3.
- [9] Fefer JJ, Ratzan KR, Sharp SE, Saiz E. *Lactococcus garvieae* endocarditis: report of a case and review of the literature. *Diagn Microbiol Infect Dis* 1998;32(2):127–30.
- [10] Xie X, Pan Z, Yu Y, Yu L, Wu F, Dong J, et al. Prevalence, virulence, and antibiotics gene profiles in *Lactococcus garvieae* isolated from cows with clinical mastitis in China. *Microorganisms* 2023;11(2).
- [11] Gonzalez-Bravo DH, Alegre-Boschetti S, Silva-Cantillo R, Mercado-Maldonado J, Ramos-Marquez R, Torres-Rivera G, et al. *Lactococcus garvieae*: an uncommon human pathogen causing infective endocarditis in a valve-in-valve transcatheter aortic valve replacement. *Case Rep Cardiol* 2021;2021:5569533.
- [12] Choksi TT, Dadani F. Reviewing the emergence of *Lactococcus garvieae*: a case of catheter associated urinary tract infection caused by *Lactococcus garvieae* and *Escherichia coli* coinfection. *Case Rep Infect Dis* 2017;2017:5921865.
- [13] Rosch RM, Buschmann K, Brendel L, Schwanz T, Vahl CF. *Lactococcus garvieae* endocarditis in a prosthetic aortic valve: a case report and literature review. *J Invest Med High Impact Case Rep* 2019;7. 2324709619832052.
- [14] Lim SM, Wong B, Cross GB, Merchant R. *Lactobacillus garvieae* endocarditis presenting with leg cramps. *IDCases* 2018;13:e00427.
- [15] Malek A, De la Hoz A, Gomez-Villegas SI, Nowbakht C, Arias CA. *Lactococcus garvieae*, an unusual pathogen in infective endocarditis: case report and review of the literature. *BMC Infect Dis* 2019;19(1):301.
- [16] Wahbah Makhoul G, Mustafa A, Ling J, Asogwa N, Elhosseiny S, Siddiqui FS, et al. *Lactococcus endocarditis* after Bentall procedure presenting with intracranial hemorrhage. *IDCases* 2023;31:e01710.
- [17] Fleming H, Fowler SV, Nguyen L, Hofinger DM. *Lactococcus garvieae* multi-valve infective endocarditis in a traveler returning from South Korea. *Travel Med Infect Dis* 2012;10(2):101–4.