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CASE REPORT
Heart failure

Chryseobacterium bacteraemia in a patient with heart failure: case report and literature review

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Background A 29-year-old male with recently diagnosed biventricular failure from myopericarditis and subsequent constrictive pericarditis on home milrinone presented to the Emergency Department with fevers/chills.

Case summary On arrival to the Emergency Department, he was found to have septic shock and required vasopressor therapy. *Chryseobacterium indologenes* grew on his admission blood cultures, and he was treated with ciprofloxacin and piperacillin/tazobactam. He quickly improved, allowing for a successful pericardiectomy, was weaned off inotropes and discharged from the hospital.

Discussion *Chryseobacterium indologenes* is an environmental Gram-negative rod found in groundwater. It is rarely associated with human infection, but is associated with indwelling lines and has been documented in immunocompromised patients. Treatment typically involves line removal and a fluoroquinolone or piperacillin/tazobactam; the most optimal antimicrobial regimen and duration of treatment are unknown.

Keywords Septic shock • Catheter-related bloodstream infection • Constrictive pericarditis • Pericardiectomy • Cardiogenic shock • Case report

Learning points

- Patient populations at risk for *Chryseobacterium* bacteraemia include those who have an indwelling vascular line or device, have existing medical comorbidities, or who are immunocompromised.
- Empiric treatment options for *Chryseobacterium* bacteraemia include fluoroquinolones or piperacillin/tazobactam.

Introduction

Chryseobacterium is a rare human pathogen, but is becoming an emerging cause of bacteraemia in patients with indwelling lines or catheters.[1] It is important to recognize this given our increasingly complex patient population who are not infrequently discharged with vascular access devices. Additionally, one should be able to understand empiric treatment options should this be encountered. We report what we believe to be the first case of *Chryseobacterium* bacteraemia in a patient on chronic home inotropic therapy and systematically review the literature.

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Timeline

Date	Events
September 2018	A 29-year-old male hospitalized for cardiogenic shock, diagnosed with biventricular failure (ejection fraction 5–10%), imaging concerning for myopericarditis and constrictive physiology. Peripherally inserted central catheter (PICC) line placed and discharged on milrinone
5 November 2018	Presented to Emergency Department with septic shock, PICC line removed
	Started on IV vancomycin and piperacillin/tazobactam, transferred to intensive care unit for vasopressor support
7 November 2018	*Chryseobacterium indologenes* grew from his admission PICC line and peripheral blood cultures
	It was postulated that his PICC line dressing had become contaminated with tap water during bathing at home
	Antibiotics were changed to ciprofloxacin and piperacillin/tazobactam
	He was weaned off vasopressor support
15 November 2018	Underwent pericardiectomy
18 November 2018	Completed 14 days of antibiotics (ciprofloxacin and piperacillin/tazobactam)
21 November 2018	Discharged from the hospital off inotropes with stable vital signs and labs
October 2019	Seen in outpatient cardiology clinic, remains in good health with no evidence of recurrent infection

Case presentation

A 29-year-old male with biventricular failure due to non-ischaemic cardiomyopathy secondary to myopericarditis with features of constrictive pericarditis, New York Heart Association (NYHA) Class II symptoms, on home milrinone, presented to the Emergency Department with fevers/chills.

He was initially hospitalized in September 2018 for progressive fatigue and dyspnoea on exertion for 2–3 months. He had an extensive workup and was diagnosed with non-ischaemic cardiomyopathy thought to be secondary to viral myopericarditis. A computed tomography angiography of the coronary arteries revealed cardiomegaly, a dilated right atrium, passive hepatic congestion suggesting right ventricular failure, pericardial calcification, but no evidence of constrictive pericarditis. However, an echocardiogram showed biventricular failure and features of constrictive pericarditis. A cardiac magnetic resonance imaging showed a left ventricular ejection fraction (EF) of 23%, right ventricular EF of 36%, and delayed gadolinium enhancement demonstrating scarring/fibrosis of the subepicardial basal inferior and basal inferolateral wall. This was in a non-coronary artery disease hyperenhancement pattern, without evidence of an infiltrative process, most consistent with prior myocarditis. Additionally, there was a diastolic septal bounce and a concentrically thickened pericardium supporting constriction. His stay was complicated by atrial flutter with rapid ventricular response requiring radiofrequency ablation, and cardiogenic shock. For this, he was ultimately stabilized on inotrope therapy and was discharged on home milrinone infusion via a peripherally inserted central catheter (PICC line). Following this hospitalization, he was seen by cardiothoracic surgery as an outpatient and had plans for an elective pericardiectomy in early November due to his symptom burden. At that visit, it was discussed that his heart function may or may not ever recover following the operation.

In November 2018, days prior to his elective pericardiectomy, he was re-admitted with a fever of 38.7°C (101.8°F) and chills for 1 day at home. He had no other complaints. Home medications on admission consisted of furosemide 40 mg once daily, losartan 12.5 mg once daily, metoprolol succinate 12.5 mg once daily, milrinone 0.25 μg/kg/min, and spironolactone 12.5 mg once daily. Initial vitals were significant for fever of 38.7°C (101.8°F), tachycardia with a heart rate in the 110 s, and a blood pressure of 96/57 mmHg. Exam was pertinent for a heart that was tachycardic, but normal rhythm without any murmurs, rubs, or gallops. There were no signs of elevated jugular venous pressure and he did not have lower extremity oedema. His bilateral radial and dorsalis pedis pulses were equal and 2+ bilaterally. His lungs were clear to auscultation bilaterally in the anterior and posterior lung fields with a normal work of breathing. There was no redness or drainage around the PICC line. Chest X-ray showed no abnormalities. The electrocardiogram was significant for sinus tachycardia, normal axis, RSR′ pattern in V1, QRS duration of 90 ms, and non-specific T wave flattening in the inferolateral leads. Upon removal of his PICC line, he became febrile to 39.5°C (103.1°F) and developed severe rigours as well as hypotension with blood pressure in 70 s/40s mmHg, and an elevated lactate level of 5.5 mmol/L. Blood cultures were drawn both peripherally and from the PICC line. He was started on empiric vancomycin and piperacillin/tazobactam and transferred to the cardiac intensive care unit for vasopressor support to treat septic shock arising from a catheter-related bloodstream infection. The advanced heart failure service was consulted to help guide his care, with plans for an eventual pericardiectomy once stabilized.

Preliminary report of his blood cultures revealed Gram-negative rods which later speciated as *Chryseobacterium indologenes*. The cultures drawn from the PICC line became positive for growth hours before peripheral blood cultures, suggesting the PICC line as the most likely source of infection. Given the rarity of this pathogen, the infectious disease team was consulted for guidance. Due to this bacteria's expected susceptibility in the literature to fluoroquinolones and piperacillin/tazobactam, he was started on ciprofloxacin in place of the vancomycin and continued on piperacillin/tazobactam.[2] Susceptibility testing on the isolated *C. indologenes* demonstrated sensitivity to ciprofloxacin, piperacillin and trimethoprim/sulfamethoxazole, and resistance to meropenem.

He improved clinically on treatment with antibiotics, remained afebrile, and was able to be weaned off vasopressor support. His follow-up blood cultures remained negative. An interval echocardiogram

Table 1 Simultaneous right and left heart catheterization

HR	65 b.p.m.
BP	110/74/86 mmHg
VO_2	267 mL/min
RA (a/v/m)	12/15/12 mmHg
RV	30/15 mmHg
PCWP	15 mmHg
PA	30/19/23 mmHg
PA saturation	62.80% Hgb 13.50
Arterial saturation	95.50% on room air
CO (Fick)	4.46 L/min
CI (Fick)	2.08 L/min/m^2
CO (thermodilution)	3.70 L/min
CI (thermodilution)	1.73 L/min/m^2
Ao	93/66/75 mmHg
LV	101/27 mmHg

Ao, aorta; BP, blood pressure; CI, cardiac index; CO, cardiac output; Hgb, haemoglobin; HR, heart rate; LV, left ventricle; PA, pulmonary artery; PCWP, pulmonary capillary wedge pressure; RA, right atrium; RV, right ventricle; VO_2, oxygen consumption.

showed a dilated and hypertrophied left ventricle with a diastolic septal bounce consistent with constrictive pericarditis, and an EF of 30–35%. The right ventricle was dilated with reduced systolic function. There was no evidence of valvular stenosis, regurgitation, or vegetations. Additionally, a simultaneous right and left heart catheterization demonstrated discordance of the right and left ventricular pressures as well as diastolic equalization of pressures supporting the diagnosis of constrictive pericarditis (*Table 1*).

Optimal timing of the pericardiectomy was discussed with the advanced heart failure service, cardiothoracic surgery, and the infectious disease team. Given his symptom burden as an outpatient and the hopes for an improved quality of life, and the potential to be weaned off inotropes to avoid another PICC line placement, infectious disease stated there was no need to significantly delay the surgery from an infection standpoint as long as his repeat blood cultures remained negative at 5 days. Since they remained negative, cardiothoracic surgery took the patient for pericardiectomy on hospital day 11. Intraoperative findings showed dense areas of adhesions in multiple locations between the pericardium and epicardium, as well as a significant amount of calcium laterally and towards the apex of the heart. These adhesions were taken down and complete removal of the pericardium was performed successfully. On his follow-up transthoracic echocardiogram performed 5 days after the pericardiectomy, his left ventricular EF had increased to 50–55% and the right ventricular systolic dysfunction had improved.

Intravenous piperacillin/tazobactam 3375 mg every 6 h and oral ciprofloxacin 500 mg every 12 h were continued for a total of 14 days from his first negative blood culture, and the patient was discharged following completion of his antibiotic course. He was inotrope independent at the time of discharge. Additionally, he was continued on guideline-directed medical therapy for heart failure with reduced EF. His regimen included furosemide 40 mg once daily, metoprolol succinate 12.5 mg once daily, and sacubitril-valsartan 24–26 mg every 12 h. The patient continues to follow with his outpatient cardiologist and was last seen in October of 2019 where he reported great improvement in his functional status, denied any symptoms of heart failure classifying him as NYHA Class I, and had no evidence of recurrent infection.

Discussion

A review of *Chryseobacterium* bacteraemia was performed using Medline/PubMed with the search terms 'bacteremia AND chryseobacterium' which returned 44 articles. Abstracts and references were reviewed. Following this process, a total of 13 articles were identified in addition to our patient, all involving *C. indologenes* (*Table 2*).[1–13] Median patient age was 28 years old (ranging: 36 weeks to 77 years). Three of the cases were under the age of 1 year old.[3–5] The majority of the cases were males, representing 10/14 cases (71%),[1,2,4,6–11] with one case being of unreported gender in an infant.[5]

Pre-existing medical conditions were present in 11 out of 14 cases (79%).[1,2,5,7–13] Nine patients were immunocompromised (transplant recipients of either a solid organ or bone marrow, cancer treated with chemotherapy, or children under the age of 1 year old),1–5[7,10,12,13] three patients had heart failure or diabetes,[8,11] and one patient was on mechanical ventilation after surgery.[4] Only two cases of *Chryseobacterium bacteraemia* had no identifiable comorbidities.[6,9] An indwelling vascular device or line was present in 8/14 cases (57%).[1,2,7,10–13] One of these cases reported a peripheral IV as the only line present.[11] Of the cases that had an indwelling vascular device or line, 6/8 (75%) had it removed during treatment of the bacteraemia.[7,10–13] Of the two cases that did not confirm line removal, one specifically mentioned using antibiotic lock therapy to save the line,[1] and the second case did not mention saving or removing the line.[2] All of the patients survived with the exception of two (14% mortality).[4,10] The majority of the patients were treated with fluoroquinolones ($n = 9$).[1,4,6,8–10,12,13] Five of the cases used ciprofloxacin (only known dosing is our patient at 500 mg twice daily).[1,6,9,10] Two of the cases used levofloxacin,[8,13] one used ofloxacin,[4] and another used pefloxacin[12] (not available in the USA). The second most common treatment was piperacillin/tazobactam ($n = 6$).[2,7,8,12,13]

Conclusions

Chryseobacterium indologenes, originally a member of the *Flavobacterium* genus, is a Gram-negative, non-motile, indole-positive bacilli.[2] It is most commonly found in the environment from the groundwater and soil and is rarely associated with human infection unless the patient is hospitalized, immunocompromised, or has indwelling lines or devices.[14]

The patient described in our case report had several risk factors noted above that made him susceptible to bacteraemia with *C. indologenes*. First, he had a systemic illness, congestive heart failure secondary to constrictive myopericarditis. Second, he had an indwelling PICC line used for his milrinone infusion.

It was hypothesized that the source of our patient's bacteraemia was his home tap water. While samples of his tap water were not

Table 2 Characteristics of selected cases with *Chryseobacterium* bacteraemia

	Sex	Age	Pertinent comorbidities	Indwelling lines/devices	Organism	Line/device removed?	Treatment	Outcome
1 [1]	M	11 years	Ewing sarcoma, chemotherapy	Central venous catheter	*C. indologenes*	No	Ciprofloxacin × 9 days	Survival
2 [6]	M	22 years	None	None	*C. indologenes*	Not applicable	Ciprofloxacin, unknown duration	Survival
3 [7]	M	54 years	Metastatic squamous cell carcinoma, chemotherapy	Hickman	*C. indologenes*	Yes	Piperacillin/tazobactam × 10 days	Survival
4 [12]	F	38 years	Metastatic breast cancer, chemotherapy	Port-A-Cath	*C. indologenes*	Yes	Piperacillin/tazobactam × 10 days, reinfected 6 days later, port-A-Cath removed, and pefloxacin × 7 days	Survival
5 [13]	F	26 years	Cystic fibrosis, liver transplant	Subcutaneous port	*C. indologenes*	Yes	Piperacillin/tazobactam × 3 days until sensitivies came back then switched to levofloxacin and trimethoprim/sulfamethoxazole × 2 weeks with port removal on Day 7	Survival
6 [8]	M	77 years	Congestive heart failure, recent electrodessication and curettage for squamous cell carcinoma	None	*C. indologenes*	Not applicable	Piperacillin/tazobactam and gentamicin × 4 days until sensitivies came back then switched to levofloxacin × 14 days	Survival
7 [3]	F	33 days	None (infant)	None	*C. indologenes*	Not applicable	Ampicillin and cefotaxime × 1 day. Changed to cefotaxime and gentamicin on Day 2. Susceptibilities returned and switched to cefepime × 10 days	Survival
8 [2]	M	35 years	Leukaemia, chemotherapy, bone marrow transplant	Hickman	*C. indologenes*	Not reported	Piperacillin/tazobactam × 14 days	Survival
9 [4]	M	5 months		None	*C. indologenes*	Not applicable	Ceftriaxone and amphotericin B after surgery. Developed	Died

Continued

Table 2 ***Continued***

	Sex	Age	Pertinent comorbidities	Indwelling lines/devices	Organism	Line/device removed?	Treatment	Outcome
			Down syndrome, surgery, mechanical ventilation				sepsis on Day 7 and found to have *C. indologenes* in blood so switched to vancomycin and ofloxacin, unknown duration	
10 [5]	Not reported	36 weeks	Preterm	None	*C. indologenes*	Not applicable	Cefoperazone/sulbactam, unknown duration	Survival
11 [9]	M	53 years	None	None	*C. indologenes*	Not applicable	Ciprofloxacin, unknown duration. trimethoprim/sulfamethoxazole × 4 weeks for comorbid prostatitis symptoms	Survival
12 [10]	M	52 years	Myelodysplastic syndrome, bone marrow transplant	Hickman	*C. indologenes*	Yes	Ceftazidime and amikacin followed by ciprofloxacin and vancomycin, ultimately continued on piperacillin/tazobactam, ciprofloxacin, vancomycin, amphotericin B, unknown duration	Died
13 [11]	M	2 years	Diabetes mellitus Type I	Peripheral IV	*C. indologenes*	Yes	Ceftriaxone × 10 days	Survival
Present	M	29 years	Congestive heart failure	PICC	*C. indologenes*	Yes	Piperacillin/tazobactam and ciprofloxacin × 14 days	Survival

PICC, peripherally inserted central catheter.

collected to confirm, history obtained from the patient revealed that he had purchased online a sleeve to cover his catheter in attempts to make it water resistant during bathing. In the days leading up to hospitalization, he began noticing that the sleeve would fail, allowing water to seep under its edges, resulting in contamination of the PICC line dressing with tap water. It is possible that he acquired infection via this or a different mechanism. In conclusion, *Chryseobacterium* bacteraemia is an emerging pathology associated with systemic disease and indwelling vascular devices or lines, and should be treated expeditiously with appropriate antibiotics and line removal whenever possible (commonly including a fluoroquinolone).

Lead author biography

Taylor Wood earned his medical degree from the University of Louisville School of Medicine in 2018. He is currently an internal medicine resident at the Virginia Commonwealth University Health System in Richmond, Virginia. He has plans to pursue a Cardiology fellowship.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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