Case report

Emerging pathogens: A case of *Wohlfahrtiimonas chitiniclastica* and *Ignatzschineria indica* bacteremia

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**ABSTRACT**

*Wohlfahrtiimonas chitiniclastica* and *Ignatzschineria indica* are rare causes of infection in humans and have been linked to infection with fly larvae in open wounds. Both organisms are emerging causes of disease globally and co-infection resulting in bacteremia is rare. An 82-year-old male with bilateral lower extremity infections was hospitalized due to fall with associated right lower extremity pain. On exam, a maggot infested ulcer was identified on his right lower extremity. On day three of hospitalization, blood cultures grew gram-negative and gram-variable rods, and methicillin-resistant *Staphylococcus aureus*. Further analysis of the gram negative and gram variable rods revealed *W. chitiniclastica* and *I. indica* respectively. Both *I. indica* and *W. chitiniclastica* were pan sensitive to all antimicrobials tested with the exception of tetracyclines to which *W. chitiniclastica* was fully resistant and *I. indica* was moderately sensitive. The patient was treated with two weeks of IV ceftriaxone and was discharged with plans to complete a six-week course of IV daptomycin due to MRSA bacteremia. All repeat blood cultures were negative. Until recently *W. chitiniclastica* and *I. indica* infections have been documented only in farm and feral animals. Major risk factors for infection include: poor hygiene, open wounds, peripheral vascular disease, and myiasis. Due to the rarity of infection, identification of both organisms can be difficult, therefore a high index of suspicion is required.

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**Introduction**

Myiasis is defined as the larval infestation of vertebrate animals including humans [1,2]. Intentional controlled myiasis with fly larvae has been used for centuries to promote debridement and healing of wounds [3,4]. Studies have indicated that these larvae are particularly useful in reducing gram positive bacteria from wounds [4]. Since first approved by the FDA in 2004 the utilization of larvae in the clinical setting has gained in popularity [2,4]. These medical grade fly larvae are processed in sterile environments and are therefore free of pathogenic bacteria which may infect their human host [2,4].

Myiasis which occurs naturally in the environment does not have the benefit of sterility. These infestations place patients at risk of exposure to uncontrolled infestation as well as bacterial infection [1]. Of these bacteria, *Wohlfahrtiimonas chitiniclastica* was first identified in Hungary in 2008 while *I. indica* was first identified in 2011 [1,4,5]. Both species are commonly found in *Wohlfahrtia magnifica* a parasitic fly native to the Mediterranean, Asia, and continental Europe [1,4,6]. In the United States human infections with *W. chitiniclastica* and *I. indica* have been linked to Lucilia sericata also known as the green bottle fly though both bacteria have been isolated in other parasitic fly species [2,4–6]. To date approximately 23 case reports have emerged reporting human infection with *W. chitiniclastica* with the first U.S. infection documented in 2015 [2,8–16]. Fewer cases *I. indica* infections have been reported however this may be linked to its later identification (Fig. 1) [2,6,7,17,18]. Only one prior case was able to be identified reporting co-infection with *W. chitiniclastica* and *I. indica* resulting in bacteremia [2].

**Case**

The patient was 82 year old male with a history of mitral valve replacement due to mitral stenosis as well as peripheral vascular disease. He was additionally noted to have developed bilateral lower extremity infections over the past two months which he managed at home with an over the counter topical antibacterial ointment and hydrogen peroxide. The patient was transported to the hospital after a fall at home with associated confusion. Paramedics reported that the patient’s home was noticeably untidy and the patient was covered in fecal material. Examination
revealed swollen and erythematous right lower extremity with burrowing maggots throughout the extremity and in between the toes. Vitals with temperature: 36.6 °C, heart rate of 129 beats/minute, respiratory rate of 28 breaths/minute, and blood pressure of 112/67 mmHg. Laboratory analysis revealed lactic acidosis (7.1 mmol/L [reference range: 0.5–1.9 mmol/L]) and acute kidney injury with Creatinine: 3.52 mg/dL [reference range: 0.7–1.3 mg/dL]), BUN:87 mg/dL [reference range: 7–25 MG/DL], GFR:15 mL/min/1.73 sqm (reference range: 60–150 mL/min/1.73 sqm). No leukocytosis was noted at the time of admission (7.1 k/μL [reference range: 3.9–9.5 k/μL]) and creatinine kinase levels were slightly elevated (778 μ/L [reference range: 30–233 μ/L]).

The patient was aggressively fluid resuscitated and started on IV vancomycin and cefepime. The extremity was cleaned and myiasis was removed on the initial day of hospitalization with chlorhexidine scrub at bedside (Fig. 2). Computed tomography of the right lower extremity was completed and revealed circumferential edema suggestive of cellulitis as well as extensive cutaneous and subcutaneous calcifications suggestive of peripheral vascular disease. No evidence of osteomyelitis or abscess formation was noted.

The patient gradually improved and blood cultures on hospital day three grew methicillin-resistant Staphylococcus aureus (MRSA) in addition to gram negative and gram variable rods in aerobic bottles which were not initially identifiable. Matrix-Assisted Laser Desorption/Ionization-Time of Flight (MALDI-TOF) was used to aide in identification and revealed Wohlfahrtimonas chitiniclastica and Ignatzschineria indica respectively. MIC obtained from microscan indicated that W. chitiniclastica was pan-sensitive with the exception of resistance to tetracyclines (Table 1). Similarly I. indica was pansensitive with intermediate resistance to tetracyclines. No cardiac or valvular involvement was seen on echocardiogram. However, the patient was started on IV daptomycin with planned a 6 week course for MRSA bacteremia given recent mitral valve replacement. W. chitiniclastica and I. indica were treated with a two week course of IV ceftriaxone. Repeat cultures were all negative, the patient did well and was subsequently discharged.

**Discussion**

Wohlfahrtimonas chitiniclastica and Ignatzschineria indica are non-motile, non-spore forming, aerobic gram-negative rods which are both catalase and oxidase positive [1,2,5,6]. W. chitiniclastica is noted to have strong chitinase activity causing some to speculate that W. chitiniclastica may have a symbiotic relationship with its host fly and play a role in metamorphosis [8]. Optimal conditions for growth of W. chitiniclastica are temperature between 28–37 °C and pH 5–10.5 [1]. While optimal conditions for growth of I indica are 37 °C and pH 7.5 [5]. Identification of both species can be successfully confirmed by matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) and 16S rRNA gene sequencing [1,5,7,8,10]. Use of the VITEK 2 system has resulted in multiple reports of misidentification of W. chitiniclastica [8,10].

Clinical course in those infected range from simple wound infections to bacteremia culminating in septic shock and death [1,2,8–11]. Transmission is believed to take place when the bacteria are transmitted from larvae on to mucosal surfaces and damaged skin [2,8]. It therefore follows that almost all reports of human infection have involved open wounds and poor hygiene as was seen in this patient [2,10]. Other risk factors include proximity to livestock, alcoholism, peripheral vascular disease, low socioeconomic status, and increasing age (Table 2) [2,6,9,7,18]. While
myiasis is a documented cause of *W. chitiniclastica* infection not all cases have been able to clearly demonstrate myiasis [2,11]. Therefore, it is recommended that all patients with bacteremia due to any organism commonly found in flies undergo prompt investigation for occult myiasis [2].

Current treatment of *W. chitiniclastica* and *I. indica* infection includes complete removal of larvae with sequential debridement in addition to antimicrobials [2,8–11]. In some cases where myiasis is severe debridement may be extensive and amputation may be required [2]. Despite multiple cases of bacteremia no cases of endocarditis in humans resulting from either organism has been reported. However, it must remain a consideration in cases of bacteremia as endocarditis secondary to *W. chitiniclastica* has been demonstrated in other mammals [2].

Due to the rarity of infection there is no standardized antimicrobial protocol for the treatment of *W. chitiniclastica* or *I. indica* infections. The literature reports success with multiple antimicrobials for treatment of *W. chitiniclastica*, particularly beta lactams, suggesting that *W. chitiniclastica* is typically pan-sensitive, however fosfomycin resistance has been demonstrated [2,8,7]. Antimicrobial sensitivities of *I. indica* appear to be similar to that of *W. chitiniclastica* with resistance to fosfomycin noted [6,7]. In our case, resistance to tetracyclines was noted which had not been seen in previously reported cases. Despite limited information available for treatment options our patient experienced overall good results with use of Ceftriaxone for the eradication of both *W. chitiniclastica* and *I. indica* bacteremia.

In conclusion, *W. chitiniclastica* and *I. indica* are rare but emerging pathogens which require a high index of suspicion for correct identification. If myiasis and bacteremia are identified early treatment can be curative.

**Author contribution statement**

Dr. John Goldman was the initial consulting physician on the patient’s case and proposed to the team that the case be written up. Dr. Sam Synder reviewed and critical extracted information regarding the case from the patients file and with the assistance of Dr. Pratiksha Singh wrote the initial manuscript. Dr. Goldman reviewed the manuscript for essential edits and provided critical feedback and specialist insight. Dr. Snyder made the final edits, formatted all of the images and tables, and submitted the case to the Hospitals internal review board for approval. Once the final edits were completed and approved by Dr. Goldman, Dr. Snyder submitted the case. All of the above listed persons have made substantial contributions to this final manuscript.

**Declaration of Competing Interest**

None.

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