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CASE REPORT

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A case of septic shock caused by drug-resistant *Edwardsiella tarda* and literature review

Yan Zhou[1], De Ren[1], Yin Li[1] and Shuiqing Gui[1*]

Abstract

Background *Edwardsiella tarda* (*E. tarda*) causes highly mortality, which is rare in septic patients. We herein reported a case of septic shock caused by drug-resistant *E. tarda*.

Case presentation We herein describe a 32-year-old female with septic shock who had the medical history of abortion 1 month ago and "systemic lupus erythematosus and rheumatoid arthritis" presented abdominal pain, diarrhea, and dyspnea as the primary symptoms and rapidly deteriorated to MODS following breakfast (undercooked fish porridge) in the ICU. Sepsis surviving bundle was initiated by collecting pathogen culture (sputum, urine and blood samples), empirically broad-spectrum antibiotics administration (Meropenem), along with fluid resuscitation, vasopressor use. *E. tarda* was confirmed both in blood culture and mNGS (metagenomics next generation sequencing). Thus, the antibiotics were switched to piperacillin-tazobactam according to the susceptibility test that was susceptible to piperacillin-tazobactam and resistant to ampicillin, quinolones and gentamicin. The patient finally recovered and discharged after 18 days of ICU treatment.

Conclusions Empiric antibiotics should be selected with piperacillin-tazobactam and amikacin, and avoid ampicillin, quinolones and gentamicin for suspecting *E. tarda* infection in southern China. Bacteremia complicated with septic shock caused by *E. tarda* requires intensive care to improve survival rates.

Keywords Septic shock, *Edwardsiella tarda*, Bacteremia, Case report

Background

Edwardsiella tarda (*E. tarda*) is an intracellular parasitic facultative anaerobe of the genus *Edwardsiella* in the Enterobacteriaceae family. *E. tarda* infects aquatic fish, reptiles and amphibians, which is the only species in the genus *Edwardella* that infect humans [1]. In most cases, *E. tarda* could cause acute gastroenteritis other than the rare events of extraintestinal infection (including sepsis) which could lead to 38 – 50% mortality [2, 3].

We herein reported a case of septic shock caused by drug-resistant *E. tarda*. The aims of this study were: (1) review the clinical characteristics of this patient, the antimicrobial susceptibility analysis and the initial selection of empiric antibiotics; (2) summarize the published literature on sepsis caused by *E. tarda* infection, the potential risk factors of *E. tarda* bacteremia and antimicrobial susceptibility analysis of *E. tarda*; (3) provide evidence for the management and initial selection of antibiotics for critically ill patients with septic shock caused by *E. tarda* bacteremia.

*Correspondence:
Shuiqing Gui
guishuiqing@163.com
[1]Department of Critical Care Medicine, First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital, 3002 Sungang West Road, Futian District, Shenzhen 518035, Guangdong, China

Case presentation

A 32-year-old southern Chinese woman was urgently transported to the intensive care unit (ICU) of our hospital on August 18th with a 2-day complaint of abdominal pain, vomiting, and diarrhea after eating breakfast (undercooked fish porridge), and a 1-day history of dyspnea. She had the medical history of abortion 1 month ago and "systemic lupus erythematosus and rheumatoid arthritis" for 12 years which need long-term oral administration of "prednisone tablets 20 mg po quaque die/every day". On August 16th, she experienced abdominal pain, vomiting, and diarrhea following breakfast, which was take-out food (undercooked fish porridge). The vomiting consisted of gastric contents, and she had more than 10 episodes of watery stools. Later, the aforementioned symptoms worsened, and she developed jaundice on August 17th. Shortness of breath and difficulty breathing appeared next morning, without symptoms such as cough or sputum, leading to a visit to an emergency room of another hospital. Snapshot of physical examinations: temperature 37.4℃, Pulse rate 116 times/min, blood pressure 82/48 mmHg, peripheral oxygen saturation 89% (on room air). She was admitted to the ICU with a diagnosis of 'septic shock' and received empirical broad-spectrum antibiotics (imipenem and vancomycin), along with fluid resuscitation and organ function support. However, there was no significant improvement in oxygenation under non-invasive mechanical ventilation assistance. She received endotracheal intubation for mechanical ventilation and was transferred to our hospital's ICU for further treatment. Abdominal computed tomography (CT) was performed in Fig. 1 and revealed an edematous change in the small intestine. The diagnoses were: 1. Septic shock; 3. Acute gastroenteritis; 4. Infection-induced multi-organ dysfunction syndrome (involving respiratory, circulatory, liver, kidney, hematological, and gastrointestinal tract); 5. Systemic lupus erythematosus; 6. Lupus nephritis; 7. Rheumatoid arthritis.

The patient's treatment course is illustrated in Fig. 2. Initial investigations are presented in Supplementary Table 1. The white blood counts were $18.22 \times 10^{\wedge}9$/L, neutrophil counts were $17.42 \times 10^{\wedge}9$/L, and lymphocyte counts were $0.51 \times 10^{\wedge}9$/L on admission night. Besides, the level of highly sensitivity C-reactive protein (hsCRP)

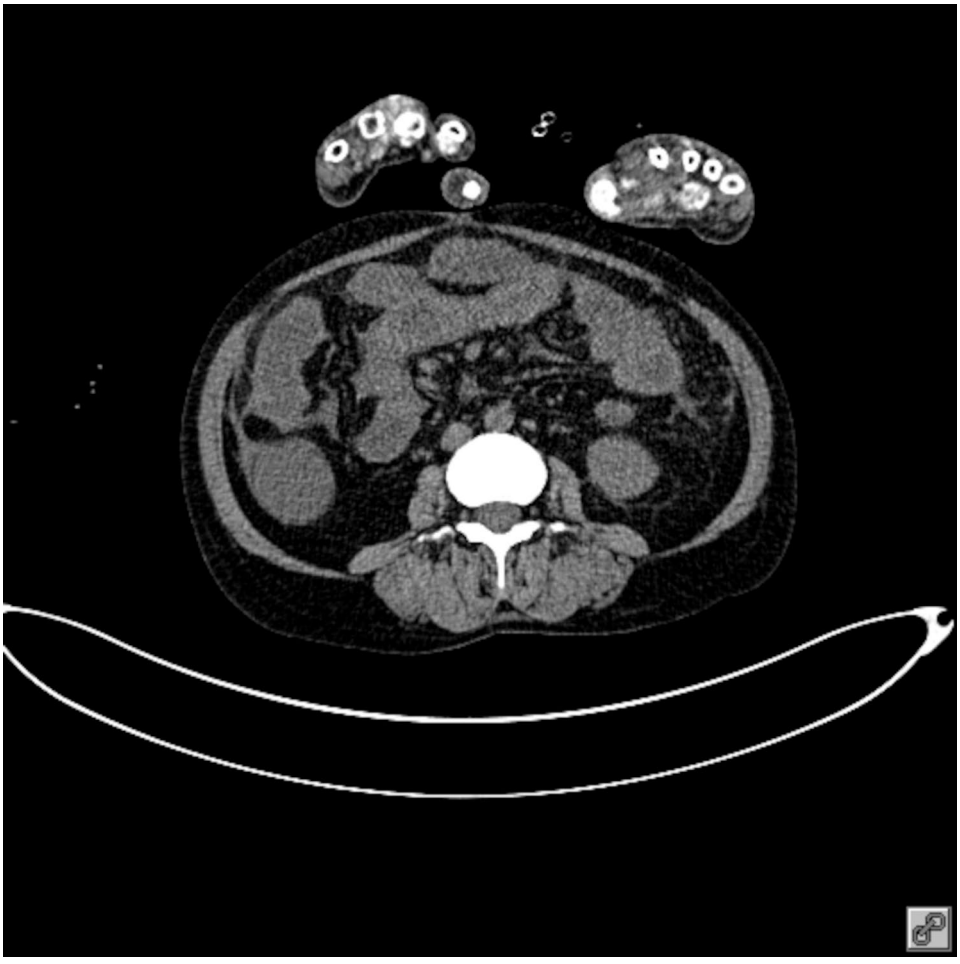

Fig. 1 Computed tomography of the abdomen showed that edematous changed in the small intestine wall indicated enteritis

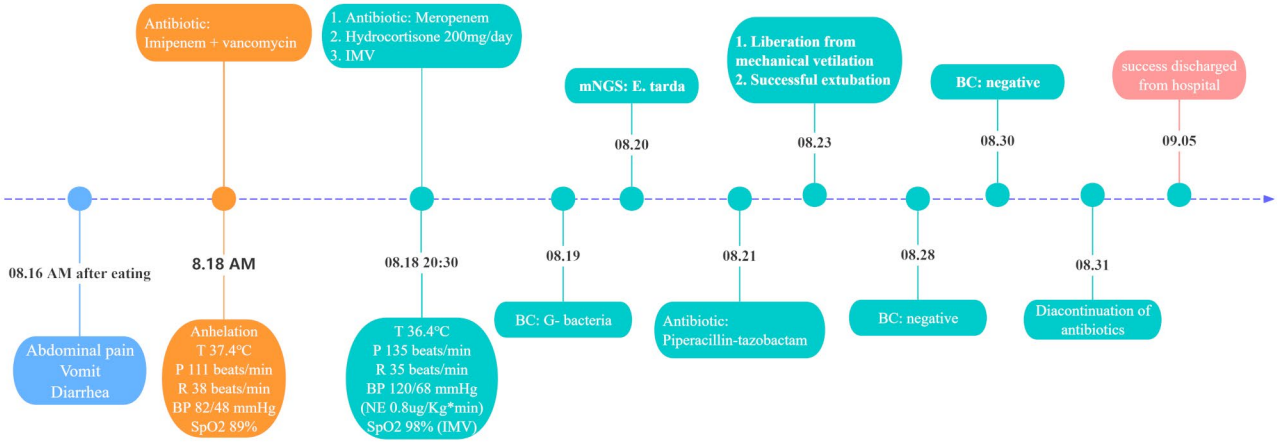

Fig. 2 Treatment timeline. AM, ante meridiem; BC, blood culture; BP, blood pressure; G- bacteria, Gram-negative bacteria; IMV, invasive mechanical ventilation; mNGS, metagenomics next generation sequencing; P, pulse rate; R, respiratory rate; T, temperature

was 266.99 mg/L, level of interleukin-6 (IL-6) > 4000 pg/ml, procalcitonin (PCT) > 100 pg/mL, and level of blood lactate 8.3 mmol/L at that time. The ANA was 1:1000, complement was C3 0.65 g/L, complement C4 was 0.131 g/L, and erythrocyte sedimentation rate was 5.73 mm/h. The patient had severe deformity of hands and feet supporting RA diagnosis. The acute physiology and chronic health evaluation II score (APACHEII score) was 39 and sequential organ failure assessment score (SOFA) was 22 at the admission ICU. 1-hour sepsis surviving bundle was initiated by collecting pathogen culture (sputum, urine and blood samples), empirically broad-spectrum antibiotics administration (Meropenem), along with fluid resuscitation, vasopressor use. Supportive measures for organ function, including blood component transfusion, continuous renal replacement therapy, as well as treatment for the autoimmune diseases with immunoglobulins, glucocorticoids and plasma exchange. Blood samples were analyzed using metagenomics next-generation sequencing (mNGS) on August 19th and indicated a total of 668 *E. tarda* sequences on August 20th. Additionally, blood cultures reported positive after incubating for 15 h and 50 min that revealed Gram-negative bacteria and identified *E. tarda* on August 21st (Specifically, blood cultures were collected under sterile conditions using BACTEC aerobic and anaerobic bottles (BD Biosciences, Franklin Lakes, NJ, USA) and incubated in the BACTEC FX automated blood culture system (BD Biosciences). Bottles that flagged as positive underwent Gram staining and were cultured on appropriate media. The discrimination of bacteria was used MALDI-TOF MS (VITEK Mass Spectrometry, bioMérieux Pioneering Diagnostics, French). The Automatic identification and drug sensitivity analysis system (Merieux, VITEK 2, United States) susceptibility of bacteria and skillful laboratory physician operated the Analyzer. An MIC was performed to evaluate the drug susceptibility of the pathogen, based on clinical breakpoints established by the Clinical & Laboratory Standards Institute (CLSI: M100 34th: 2024)). Antimicrobial susceptibility analysis showed that it was sensitive to imipenem, piperacillin-tazobactam and amikacin, resistant to tobramycin, cefazolin, ampicillin and ciprofloxacin, and naturally resistant to macrolides, clindamycin and rifampicin (Table 1). Thus, the antibiotics were switched to piperacillin-tazobactam according to susceptibility results on August 21st. On August 23th, the patient's oxygenation index improved, allowing her to be disconnected from the ventilator. After receiving antibiotics and supportive organ function treatment, two blood culture were negative that the blood was collected on August 28 and August 30, respectively. The antibiotics were discontinued on August 31, and the biomarkers of inflammation

Table 1 Antibiotic susceptibility of E. tarda from blood culture

Antibiotics	MIC (ug/ml)	Suscepti-bility
Piperacillin/tazobactam	<=4.0	S
Tobramycin	8	R
Cotrimoxazole	<=20.0	S
Ampicillin/sulbactam	>=32.0	R
Levofloxacin	>=8.0	R
Imipenem	<=1.0	S
Gentamycin	>=16.0	R
Cefepime	<=1.0	S
Ertapenem	<=0.5	S
Cefazolin	8	R
Cefotetan	<=4.0	S
Ceftriaxone	<=1.0	S
Ciprofloxacin	>=4.0	R
Ceftazidime	<=1.0	S
Aztreonam	<=1.0	S
Ampicillin	>=32.0	R
Amikacin	4	S

MIC, minimum inhibitory concentration; R, resistant; S, sensitive

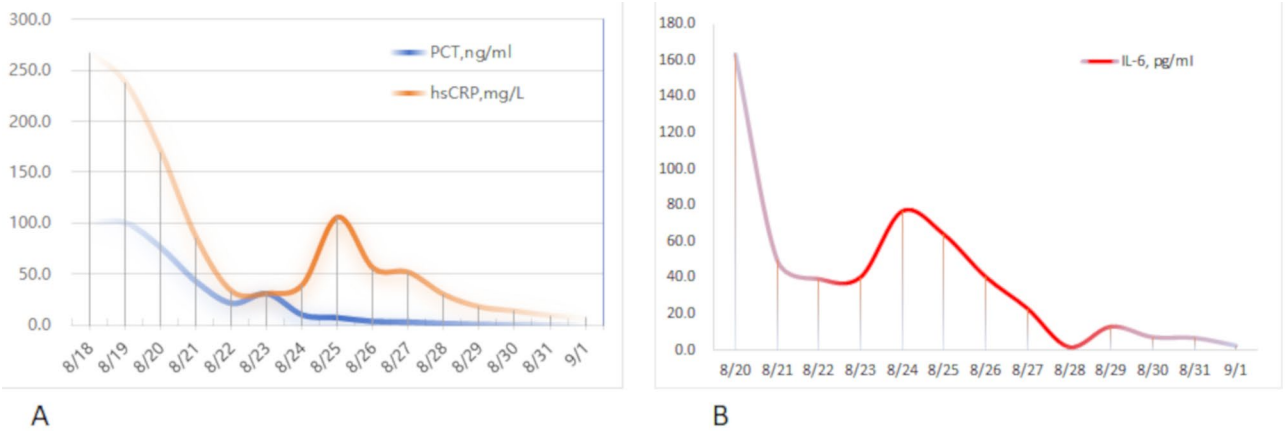

Fig. 3 The change trend of PCT, hsCRP and IL-6 values in intensive care unit days. (**A**) The yellow curve represents the decreasing trend of PCT values with the length of hospital, and level of PCT roses temporarily on August 23; The blue curve represents the decreasing trend of hsCRP values with the length of hospital. Level of hsCRP roses on August 23, and decreases after reaching a small peak on August 25. (**B**) The red curve represents the decreasing trend of IL-6 values with the length of hospital. Level of IL-6 roses on August 23, and decreases after reaching a small peak on August 24. X-axises present intensive care unit days. Y-axises present the levels of PCT, hsCRP, and IL-6. Levels of IL-6 were more than 4000 pg/ml on August 18th, and 2328.2 pg/ml on 19th, respectively. hsCRP, highly sensitivity C-reactive protein; IL-6, interleukin-6, PCT, procalcitonin

gradually decreased, eventually returning to normal (Fig. 3). The patient's condition stabilized, with no need for vasopressor and a peripheral oxygen saturation of 100% on room air, and she was discharged on September 5.

Discussion and conclusions

We reported a woman with sepsis caused by *E. tarda* bacteremia. The genus *Edwardsiella* was first named by Ewing et al. [4] and consists of three species of bacteria: *E. tarda*, *E. hoshinae* and *E. ictalurid* [5]. *E. tarda* not only infecting freshwater and seawater life, such as fish and amphibians, but also humans [1]. *E. tarda* infections are frequently reported in Japan, followed by the United States and China, particularly in humid and subtropical climates [2]. Limited studies showed that *E. tarda* bacteremia was rare (< 5%) [6], with a high mortality (22.7-44.6%) [2, 3, 6, 7].

The chosen of empiric antibiotics was key to success cure sepsis. The previous studies showed that *E. tarda* was sensitive to most antibiotics, and naturally resistant to tetracyclines, aminoglycosides, quinolones, fosfomycin and most β-lactams, penicillin, colistin and polymyxin B [8–10]. Unfortunately, several cases reported resistant strains (including ampicillin, quinolones, gentamicin, piperacillin-tazobactam, and Carbapenem) of *E. tarda* in humans [11–13], perhaps related to antibiotics have been prevalently used to control *E. tarda* infection in fisheries to improve the survival of fishes [14]. In this case, the susceptibility results showed that *E. tarda* was resistant to ampicillin, quinolones and gentamicin. Therefore, the case suspected *E. tarda* infective disease should avoid empiric use of certain antibiotics (ampicillin, quinolones and gentamicin) in south of China. As drug-resistant E. tarda strains have been reported in other regions [11, 12], the antibiotic de-escalation therapy should perform according to drug susceptibility to avoid treatment failure caused by premature de-escalation.

Limited studies explored the mechanisms of resistant *E. tarda*. A recent case showed that *E. tarda* resisted to quinolone relating to four gene (fimA, gadB, mukF, and sodB) [12]. Yubin Su et al. demonstrated that ciprofloxacin resistance mechanism is mediated by the elevated biosynthesis of fatty acids and the depressed pyruvate metabolism and energy metabolism in *E. tarda* [15]. Loss of purF, purH, cpxA, or ompF gene elevated antibiotic resist*ance in E. tarda* [16]. Most *E. tarda* are sensitive to ampicillin, but there are reports of resistance to ampicillin [6, 13]. Other study demonstrated that glucose abundance decreases progressively as ampicillin-sensitive strains acquire resistance to ampicillin [17]. The mechanisms of resistant *E. tarda* need more studies to explore.

The risk factors of *E. tarda* infection are exposure to infected animals, environment, eating undercooked fish or other amphibians and chronic underlying diseases [18–20]. In this study, the woman had "systemic lupus erythematosus, rheumatoid arthritis", long-term use of "glucocorticoids", immunocompromisation after abortion, and ate undercooked fish porridge. The CT of abdomen showed that the intestinal edema, so *E. tarta* was speculated transferring from intestine to blood, and caused septic shock and MODS. Coincidentally, Yamamuro et al. [21] reported that abdominal CT of a woman showed edema of the small intestine and caused necrotizing fasciitis in the United States in 2023. However, the pathogenesis of *E. tarda* remain unclear. It is known that bacterial protein secretion systems transport virulence directly into the cytoplasm of target cells [22]. The

type III and type VI secretion systems of bacteria (T3SS and T6SS) are thought to play an important role in the survival, replication, and virulence of *E. tarda* within the host. In particular, T6SS allows *E. tarda* to establish within the host, causing severe systemic infection and ultimately killing the host. Therefore, it is speculated that *E. tarda* bacteremia first colonized through the damaged barriers [23–27] (intestinal barrier, respiratory barrier and skin barrier), and then induced bloodstream infection. Patients with systemic lupus erythematosus [28] often have impaired intestinal barrier function and increased intestinal permeability, which may explain why the woman has bacteremia with MODS while her husband who eats the same take-out food (undercooked fish porridge) with the patient has no obvious gastrointestinal symptoms.

In conclusion, the key to prevent and treat *E. tarda* infection is to avoid eating unclean food or raw fish, or to ford in the wild especially in patients with tumors, diabetes, immune diseases, or taking immunosuppressive drugs. Previous studies showed that *E. tarda* is naturally resistant to polymyxin but sensitive to quinolones, aminoglycosides, and ampicillin. In this case, *E. tarda* was found to be resistant to ampicillin, quinolones, and gentamicin. Therefore, there is a high suspicion of *E. tarda* infection in southern China, making it essential to avoid the initial selection of these drugs. This provides a basis for the appropriate initial selection of antibiotics for such patients in southern China. Bacteremia complicated with septic shock caused by *E. tarda* requires intensive care to improve survival rates.

Abbreviations

ALB	Albumin
AM	Ante meridiem
APACHE II score	Acute physiology; and chronic health evaluation II score
APTT	Activated partial thromboplastin times
BC	Blood culture
BP	Blood pressure
BUN	Blood urea nitrogen
Cr	Creatinine
CT	Computed tomography
Ga	Serum calcium concentration
G-bacteria	Gram-negative bactieria
HGB	Hemoglobin
ICU	Intensive care medicine
IDTB	Indirect bilirubin
IMV	Invasive mechanical ventilation
K	Serum potassium concentration
LY	Lymphocyte counts
MIC	Minimum inhibitory concentration
mNGS	Meta genomics next generation sequencing
NEUT	Neutrophil counts
NT-proBNP	N-terminal pro-B-type natriuretic peptide
P	Pulse rate
PLT	Platelet count
R	Respiratory rate
T	Temperature
TBIL	Total bilirubin
WBC	White cell counts

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12879-025-10789-7.

Supplementary Table 1: Results of blood samples of patients on admission and before discharge

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Author contributions
SQG contributed to the project design. YZ contributed to literature review and data analyses. DR and YL contributed to collect data. SQG contributed to revise manuscript. All authors contributed to the writing of the final manuscript.

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Data availability
The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013), was approved by the Ethics Committee of the Second people's hospital of Shenzhen (approval No. 2024-332-01PJ).

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

Competing interests
The authors declare no competing interests.

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