Case Report

Investigating a Rare *Streptococcus Thoraltensis* Associated With Ventilator-associated Pneumonia: A Case Report

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ABSTRACT

Streptococcus thoraltensis is mainly isolated from the distal part of the animal gastrointestinal tract. *S. thoraltensis* is an emerging non-fully elucidated pathogen in humans because of recurrent infections in individual cases, which varied between bacterial sepsis, mouth infection, and pneumonia. This bacterium is isolated for the first time in Iraq from a 45-year-old male patient in the intensive care unit presented in this article. The patient showed decreased levels of consciousness, a Glasgow coma scale, and gasping breathing. Based on published cases, this is the first reported case of *S. thoraltensis* bacteremia associated with ventilator-associated pneumonia.

Keywords: Aspiration pneumonia, Intensive care unit, *Klebsiella pneumoniae*, Multi-drug resistance, Schwannoma, *Streptococcus thoraltensis*, Ventilator-associated pneumonia

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Case History

A male 45-year-old shepherd lived in a rural area. He has been a smoker for 25 years with no alcohol intake history. The patient was diagnosed with a rare tumor, a solitary cancerous Schwannoma in the sacral plexus. Also, this may be referred to as a malignant peripheral nerve sheath tumor (Ghosh et al., 1973).

Moreover, he did not acquire immunodeficiency syndrome or any dermatologic abnormalities, such as café-au-lait spots that indicate von Recklinghausen's disease. Based on the symptoms reported by the patient and imaging results that included magnetic resonance imaging and computed tomography, which found a mass in the sacral region, a series of radiotherapy was given, post a wide resection of L4/5 with partial excision of S1. After 12 h of the second radiotherapy, the patient's general condition deteriorated, which led him to be transported immediately to the hospital.

Clinical Presentation

On October 3, 2024, we saw the patient after admission to the intensive care unit. On examination, the patient's temperature was 37.6 ˚C, a decreased level of consciousness, Glasgow coma scale at 6, and gasping breathing. Moreover, oxygen saturation (SPO_2) was 85% under an endotracheal tube and positive pressure support via an Ambu bag mask and O_2. His heart rate was 120 per min, and his respiratory rate was 45 breaths per min with crepitation all over the chest. Additionally, the patient's blood pressure was 75/38 with vasopressor (dopamine) 15 mcg/kg/min. The patient was on mechanical ventilation with AC mode-volume control, FiO_2 100%, positive end-expiratory pressure at 5, tidal volume at 550 mL, and respiratory rate at 14 breaths per min. However, mechanical ventilation procedures were performed in all settings according to arterial blood gas results.

Diagnostic Testing

All specimens were collected under an aseptic technique every three consecutive days. However, respiratory specimens were collected by bronchoalveolar lavage. Additionally, the samples were processed by various methods. Firstly, reverse transcription-polymerase chain reaction was used to detect mycobacterium tuberculosis, COVID-19, influenza, adenovirus, and parvovirus. Secondly, the bacterial isolation was made by BACT/ALERT (bioMérieux, UK) as the initial cultivation process under aerobic and anaerobic conditions, then flowed using the traditional method. Furthermore, the isolates were confirmed by API 20 (bioMérieux, French) then VITEK II compact system (bioMérieux, UK). Alternatively, an antibiotic susceptibility test was conducted using Mueller Hinton agar (Himedia, India) with 5% sheep blood under aerobic and anaerobic conditions, then confirmed using AST for VITEK II compact system (bioMérieux, UK) to aerobic and facultative anaerobic bacteria. In addition, on the same day of entry, a group of Investigations was made, including chest x-ray, complete blood count, renal function test, liver function test, and specimens collected from cerebral spinal fluid, blood, and upper respiratory tract. The initial laboratory analysis showed white blood cell count at 9×10^3/uL with elevated neutrophil-lymphocyte ratio lymphocyte count at 0.4×10^3/uL, neutrophil at 7.9×10^3/uL, hemoglobin at 14.4 mg/dL, platelet at 134×10^3/uL, serum creatinine at 0.7 mg/dL, blood urea at 32 mg/dL, alanine aminotransferase at 17 U/L, aspartate transferase at 12 U/L, and total serum bilirubin at 0.4 mg/dL. Moreover, chest x-ray imaging showed bilateral atelectasis and microbiological results showed no bacterial growth aerobically and anaerobically for blood and cerebral spinal fluid specimens. While swabs from the upper respiratory tract revealed negative COVID-19, influenza viruses, adenovirus, and parvovirus, no pathogenic bacteria were isolated. The patient was administered a maintenance IV fluid, empirical antibiotics metronidazole 500 mg 1*3, ceftriaxone 1 gram 1*2, and acetaminophen vial 1 gram 1*3 according to general guidelines line (Khilnani et al., 2019). On the third day, fever developed to 39.5 ˚C with a transient response to antipyretics, SPO_2 decreased to 89%, heart rate at 130, and blood pressure at 128/88. Accordingly, a set of tests was conducted. The results were leukocytosis at 14.3×10^3/uL with an increase in the neutrophil to lymphocyte ratio, neutrophil at 13.6×10^3/uL, lymphocyte at 0.3×10^3/uL, hemoglobin at 14.4 mg/dL, and platelet at 163×10^3/uL. Moreover, renal function and liver function results were typical. Otherwise, a swab from the upper respiratory tract revealed gram-negative capsulated bacilli, lactose fermenter, and non-motile organisms identified as *Klebsiella pneumoniae*. The antibiotic susceptibility indicated its sensitivity to amikacin and metronidazole, so antibiotic therapy was adjusted accordingly (Ali et al., 2022; Al-Hasan et al., 2022).

Three days after antibiotic adjustment, the patient developed a sudden decrease in the SPO_2 of 56%, heart rate at 118 beats per min, blood pressure at 140/100, respiratory rate of 36 breaths per min, decreased air entry on the left side with hyper resonance to percussion, crepitation on the right side of the chest; therefore, pneumothorax

was suspected and chest x-ray was made, which confirmed the diagnosis and a chest tube was inserted. According to chest tube installation, swabs were taken from the pleural cavity and respiratory tract for bacterial cultivation. The results were no growth for *K. pneumonia* and other pathogenic bacteria (Mansor et al., 2022). The next day, the patient developed rapid atrial fibrillation, the pulse rate was 200 beats per min, irregularly irregular, and low volume. Besides, blood pressure decreased to 80/46, so electrical cardioversion was made by 100 joules with heparin 5000 units intravenous, amiodarone bolus 300 mg infusion for 20 min, amiodarone maintenance 300 mg/500 mL glucose water 5% in 8 h three times daily.

In the following days, the patient's temperature elevated to 40 ˚C, with a marked increase in chest crepitation and decreased air entry on the lower right chest with dullness to percussion. However, pleural effusion was suspected, so a chest x-ray confirmed it. A complete blood count was repeated, which revealed an increase in white blood cell count to 17.32×10^3/uL, neutrophil at 16.92×10^3/uL, and lymphocyte at 0.15×10^3/uL. Furthermore, liver function and renal function tests were normal.

Consequently, variables in the patient's health condition led us to adjust the antibiotic with meropenem 1g *3. Nevertheless, there was no benefit in the clinical or hematological aspects since white blood cell counts kept elevation to 19.6×10^3/uL. Therefore, specimens from multisystem, including urinary, cerebral spinal fluid, blood, and lower respiratory tract, were taken for screening for potential pathogens like *Mycobacterium tuberculosis* and other fastidious microorganisms. The results were negative for all except the lower respiratory tract specimen that shows a very rare anaerobic slow-growing gram-positive cocci that presented with gram stain as Diplo to Strepto cocci identified as *S. thoraltensis* as shown in Figure 1. Additionally, the isolate was extremely drug-resistant to almost all types of antibiotics (Hade et al., 2022)1864.

Study Assessments

Streptococcus thoraltensis is a gram-positive, non-motile, and non-spore-forming anaerobic bacterium that typically forms diplococci. It was first isolated from the distal gastrointestinal tract of swine and fecal samples of rabbits. *S. thoraltensis* is a rare and recently identified emerging pathogen in humans (Al-Tamimi et al., 2019; Wazir et al., 2019). It can cause significant complications, including severe pulmonary conditions, infective endocarditis, sepsis, and embolic stroke. Additionally, this bacterium exhibits a variable pattern of antimicrobial resistance. Only one case of *S. thoraltensis* causing pneumonia in a postpartum patient has been reported. Here, we describe a patient with ventilator-associated Pneumonia due to *S. thoraltensis*, a condition not previously reported (Al Wakeel, 2017). Mohamed and El-Zamkan, (2022) reported that *S. thoraltensis* isolated from raw milk carries multiple virulence factors, which may play a key role in causing the infection. Furthermore, preliminary evidence suggests that this bacterium could be considered a zoonotic pathogen, capable of transmission from animals to humans.

Ventilator-associated pneumonia (VAP) remains a significant challenge in intensive care units, despite advancements in its management and prevention. Studies suggest that VAP affects up to 28% of ventilated patients (Othman et al., 2017). Risk factors include gastric and oropharyngeal colonization, post-surgical procedures, emergency intubation, altered consciousness, and the use of medications like sedatives, antibiotics, radiotherapy, and immunosuppressants (Peña et al., 2013; Kharel et al., 2021; Natarajan et al., 2022).

A comprehensive review of 24 studies focusing on VAP microbiology reveals that gram-negative bacteria are the leading cause, followed by gram-positive bacteria, while fungal infections are less common (Khan et al., 2022). Furthermore, radiotherapy has been associated with an increased risk of infections caused by extensively drug-resistant bacteria, particularly within the first-month post-treatment (Khan & Maki, 2021).

In our case, the presentation of VAP included notable symptoms, such as decreased lung compliance, elevated airway resistance, and excessive secretions. This underscores the significance of considering uncommon pathogens, such as *S. thoraltensis* in the differential diagnosis of VAP, particularly due to its emerging presence and unique resistance profiles (Hunter, 2012; Mala, 2022). The current case report has substantial importance in the field of infectious diseases, particularly in expanding our understanding of emerging pathogens causing VAP. Unlike previous research primarily focused on more prevalent microbial agents, this study highlights the clinical implications of *S. thoraltensis*, a rare streptococcal species, in respiratory infections.

bioMérieux Customer:
System #:
Patient Name: [redacted]
Isolate: 73225-1 (Approved)
Card Type: GP Bar Code: 2421850503688249 Testing Instrument: 00000B4B6FBC (ISLAMIC UNIVERSITY)
Setup Technologist: Laboratory Supervisor(LabSuper)

Laboratory Report

Printed by: LabSuper
Patient ID: 73225

Bionumber: 410011743771221
Organism Quantity:

Selected Organism: Streptococcus thoraltensis

Comments:	

Identification Information	**Card:**	GP	**Lot Number:**	2421850503	**Expires:**	Dec 20, 2022 12:00 CST
	Status:	Final	**Analysis Time:**	3.87 hours	**Completed:**	Mar 7, 2022 13:20 CST
Organism Origin	VITEK 2					
Selected Organism	93% Probability **Streptococcus thoraltensis** Bionumber: 410011743771221 Confidence: Very good identification					
Analysis Organisms and Tests to Separate:						
Analysis Messages:						
Contraindicating Typical Biopattern(s) Streptococcus thoraltensis AMY(90),lLATk(1),						

Biochemical Details																	
2	AMY	-	4	PIPLC	-	5	dXYL	+	8	ADH1	+	9	BGAL	-	11	AGLU	-
13	APPA	-	14	CDEX	-	15	AspA	-	16	BGAR	-	17	AMAN	-	19	PHOS	-
20	LeuA	+	23	ProA	-	24	BGURr	-	25	AGAL	+	26	PyrA	-	27	BGUR	-
28	AlaA	+	29	TyrA	+	30	dSOR	+	31	URE	-	32	POLYB	-	37	dGAL	+
38	dRIB	+	39	lLATk	+	42	LAC	-	44	NAG	+	45	dMAL	+	46	BACI	+
47	NOVO	+	50	NC6.5	+	52	dMAN	+	53	dMNE	+	54	MBdG	-	56	PUL	-
57	dRAF	-	58	O129R	+	59	SAL	-	60	SAC	-	62	dTRE	+	63	ADH2s	-
64	OPTO	+															

Installed VITEK 2 Systems Version: 9.02
MIC Interpretation Guideline:
AES Parameter Set Name:

Therapeutic Interpretation Guideline:
AES Parameter Last Modified:

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Figure 1. VITEK II compact system laboratory report that presented 93% probability of *S. thoraltensis* with biochemical profile

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed of the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them. A written consent has been obtained from the subjects. principles of the Helsinki Convention was also observed.

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Authors' contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results, and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflict of interest.

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