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CASE REPORT

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The first report of *Streptococcus pluranimalium* infection from Iran: A case report and literature review

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Abstract

The *Streptococcus pluranimalium* was isolated from both of animals and human infection. There is limited information about pathogenicity of *S pluranimalium*. As fastidious bacteria, *S pluranimalium* is not isolated in the routinely culture media and easily misidentified with other streptococci species with conventional microbiology test. According to review of the literatures, the cephalosporins, aminoglycosides, vancomycin, and linezolid are the first choice agents for treatment of infection caused by *S pluranimalium*.

KEYWORDS

infection, Iran, septicemia, *Streptococcus pluranimalium*

1 | INTRODUCTION

Streptococcus pluranimalium is unusual streptococcal species, which is rarely isolated from human infection. Limited information is available about the pathogenicity of this species; the present study is the first report from Iran indicating infection with *S pluranimalium*; this study can be a novel insight in pathogenicity of this species.

The members of genus streptococcus are the gram-positive bacteria, which naturally live in the skin, mucosa membrane, respiratory tract, gastrointestinal tract, and urinary tract. Streptococcal infections were primarily described by Billroth in 1874.[1] So far, 163 species of this genus have identified, about half of which are reported from human infections.[1,2] *Streptococcus pluranimalium* was first isolated and reported by Devriese et al (1999) from domestic animal infections.[3] *S pluranimalium* can cause a wide range of infections, including mastitis, tonsillitis, genital tract infection, and brain abscesses in cattle, respiratory tract infection in canary, septicemia, and endocarditis in chicken, as well as tonsillitis in cat and goat.[4-6] Moreover, there are several reports nowadays about *S pluranimalium* from human infections, containing subdural empyema, endocarditis, brain abscesses, and septicemia.[7] Since the source of this bacterium is blood, milk, and other infectious secretions of animals, it seems that the microorganism has some animal reservoirs, and transmitted to human in the form of zoonosis.[8,9] According to review of the literatures, vancomycin, aminoglycosides, and cephalosporins are known as the first choice of therapeutic agents for *S pluranimalium* infection.[5] Despite many studies regarding the pathogenic or opportunistic nature of this bacterium, the fact is still not clearly understood.[7,10]

The aim of present study was to report the first case of human septicemia due to *S pluranimalium* in Iran.

2 | CASE PRESENTATION

An Iraqi 2.5-month-old infant with clinical manifestations such as lethargy, vomiting, and anorexia was brought to the emergency department of the pediatric hospital in Mashhad, Iran, in November 2018. The initial examinations were done, which included pupil dilation, temperature: 37.2°C, and blood pressure: 75/55. The laboratory results are listed in Tables 1, 2, 3, and 4.

However, the sonography results of lungs, kidneys, and urinary tract were normal, and also the result of patient's UC (urine culture) was negative. Nonetheless, patient immediately transported to the PICU ware, and pulse oximetry was done for patient. A chronic intraventricular hemorrhage (IVH) grade 1 was observed in the sonography of the right caudothalamic groove of brain (Figure 1A). Also, an obvious hypoechoic mass containing internal cystic region lacking vascularity was observed with 31x51 dimensions in the left temporal lobe. LP (lumbar puncture) was taken twice from the patient, and the results included albumin: 3.0-3.4, CSF culture (twice): negative. In another step, the blood culture was done three times for the patient by BACTEC method; the blood culture results were positive. After three days, the greenish-pinpoint (Colony size less than 1 mm) colonies were appeared on chocolate agar medium (containing 5% CO_2) (Figure 1B). The characterized properties of bacteria included gram-positive cocci, α-hemolytic, and negative catalase. However, the phenotypic tests were nonconclusive; for example, the laboratory results for this bacterium were negative for hippurate hydrolysis, inulin, and VP, as well as optochin-sensitive (Figure 1C). Finally, the desired bacterium was identified as *S pluranimalium* by using the VITEK 2 system, automated instrument for rapid and accurate microbial identification (ID) and antibiotic susceptibility testing (AST) (bioMérieux). Furthermore, the species identification was confirmed using 16S rRNA sequencing method (99% similarity with *S pluranimalium* strain DSM 15636). The phylogenetic relationship of our isolate and the closely related *S pluranimalium* were investigated using 16S rRNA gene sequence by MEGA 5 software, the Neighbor-Joining (NJ) method and Kimura's two parameter (K2P) distance correction model with 1000 bootstrap replications; the phylogenic analysis confirmed the high homogeneity of *S pluranimalium* strains (Figure 2).

Based on the CLSI instruction, the antibiogram test was done by disk diffusion method in Mueller-Hinton agar medium supplemented with 5% sheep blood. In this method, the sensitivity of *S pluranimalium* was investigated against several disks such as ampicillin, cefepime, cefotaxime, ceftriaxone, clarithromycin, clindamycin, levofloxacin, linezolid, penicillin, vancomycin, and trimetoprim-sulfametoxazol. Nonetheless, due to strict-growth nature of this bacterium, and lack of primary growth, the results were not reliable. Nevertheless, according to the previous reports, the patient was empirically initiated by using the daily administration of vancomycin (15 mg/kg) and ceftriaxone (50 mg/kg). Fortunately, the symptoms of disease improved and discharged from the hospital after 3 weeks, with proper satisfaction of the infant's parents, before they returned to their country.

3 | DISCUSSION

The *S pluranimalium* is an uncommon streptococcus species, which has been isolated and reported from human and animal infections. The term of pluranimalium indicates that

TABLE 1 Arterial blood values

Index	pH	pCO_2 (mm Hg)	pO_2 (mm Hg)	HCO_3^- (mmol/L)
Patient case	7.55	25.6	116.4	26.4
Normal range	7.35-7.45	35-45	80-100	22-28

TABLE 2 Analysis of complete blood count (CBC)

Index	WBC	RBC	Hb	HCT	Platelets
Patient case	22.760 (PMN: 87%, Lymph: 13%)	2.86	7.7	24.2	1284
Normal	5000-19500 (PMN: 1000-9000, Lymph: 2500-16500)	2.70-4.50	11-17.1	33-55	10000-45000

TABLE 3 Analysis of urine

Index	WBC	RBC	Epithelial cells	pH	SG (specific gravity)
Patient case	20	Many	1-5	5	1.010
Normal	0	0	1-3	4.6-6	1.010-1.020

TABLE 4 Analysis of biochemical factors in blood serum

Index	Urea	Creatinine	Na	K	AST	ALT	ALP	CRP
Patient case	23	0.6	137	4.72	33	51	465	78.5
Normal	2.0-7.0	0.2-0.4	130-140	3.5-6.0	9-80	13-45	113-360	10

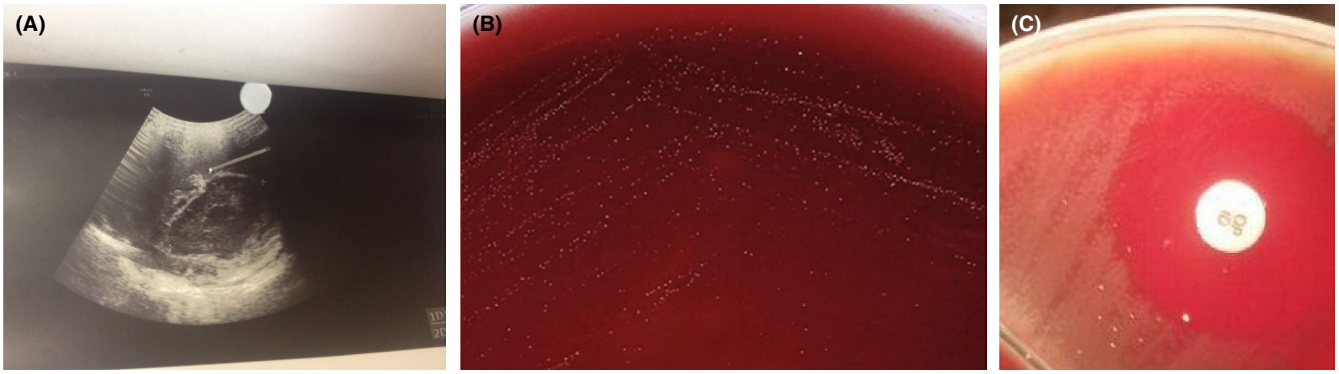

FIGURE 1 The results of clinical and laboratorial tests related to the *S pluranimalium*. A, Sonography of brain; B, The white small (needle-like) colonies on blood agar medium (the Fig. was from Siddaiah et al); and (C) The sensitivity to optochin disk on blood agar

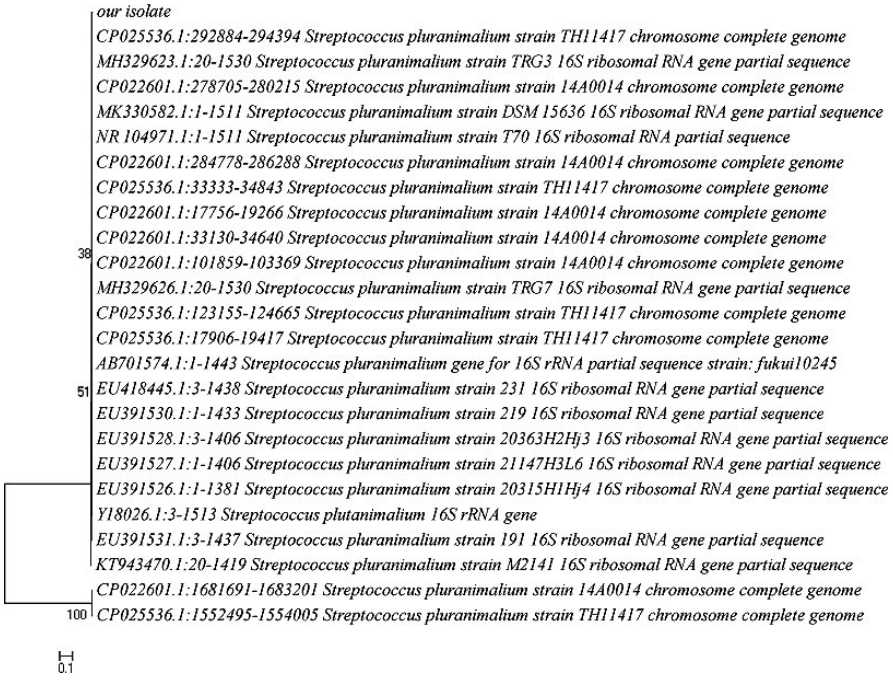

FIGURE 2 The phylogenic tree of our isolate and closely related *S pluranimalium* by 16S RRNA gene sequence

bacterium is able to cause infections in different animals.[3,4] Based on phylogenic studies of 16S rRNA, it is revealed that this bacterium has close relationship with some streptococcus species such as *S hyovaginalis*, *S thoraltensis*, *S halotolerans*, and salivarius group. In general, it seems that the *Streptococcus sobrinus*, *Streptococcus salivarius, and S pluranimalium* have been derived from a common ancestor.[6,11] Pan et al (2018) succeeded in sequencing the complete genome of *S pluranimalium*. The sequencing information showed that this bacterium has various virulence factors such fibronectin binding protein (FBP), hemolysin, sortase, IgA1 protease, type IV secretion system, and one series of antibiotic-resistance genes including *mef* (A), *msr* (D), and *lnu* (C), which cause resistance to Erythromycin and Lincomycin antibiotics.[6] In terms of phenotypic properties, it seems that *S pluranimalium* is quite similar to *Streptococcus suis*, *Streptococcus acidominimus*, *S hyovaginalis*, and *S thoraltensis*. However, sometimes, this bacterium may not be identified as compared to other closely related *Streptococci* species.[5,11] The most significant phenotypic features of *S pluranimalium* include white small needle-like colonies, α-hemolysis, hippurate hydrolysis, as well production of

TABLE 5 Information about six previous case reports regarding the *S pluranimalium* infections

Sex	Age	Infection	Previous disease	Diagnostic method	Ref
Male	44	Brain abscess	Tuberculosis	Vitek 2	5
Male	17	Brain abscess	Unknown	Vitek 2	10
Male	3	Brain abscess	Congenital cyanotic heart disease	Vitek 2	12
Male	37	Endocarditis	Sinusitis	Vitek 2	13
Female	53	Septicemia	Health	Vitek 2	14
Unknown	Unknown	Septicemia	Unknown	PCR	15

pyrrolidonyl arylamidase (PYR), β-galactosidase, alkaline phosphatase (ALP), and arginine dihydrolase enzymes.[5,10,11] Several methods such MALDI-TOFMS, sequencing of 16S rRNA, and commercial diagnostic kits such as API 20 Strep, Rapid ID32 Strep, and Vitek 2 are considered as accurate options for rapid and reliable identification of uncommon streptococcus species, including *S pluranimalium* of the clinical samples.[7] Similar to the present study, four reports of human infections by *S pluranimalium* were diagnosed by the use of Vitek 2.[5,10,12,13] Despite the reports about various infections in animals by *S pluranimalium*, the reports about human infections are limited, and it is not clear that this microorganism is either the initial pathogen or not.[7] The present study is so far the seventh report about human infection by this bacterium. Based on the issued reports, this bacterium was isolated from endocarditis, septicemia, and brain abscesses.[12-14] In this study, *S pluranimalium* was isolated from the disseminated infection occurred to a 2.5-month-old infant. According to the study by Jayavardhana and Maher, both cases with brain abscesses caused by *S pluranimalium* had predisposing risk factors for the infection.[5,12] Fotoglidis et al isolated this bacterium from the infective endocarditis in patient, who had previous contact with the infected animals.[13] Regarding the inefficiency of immune system in infants on the one hand, and also considering the previous studies on the other hand, it seems the infection with *S pluranimalium* can occur following the deficiency of immune system, and/or due to the risk factors with respect to the previous infections (Table 5).

The studies show that a combination therapy with vancomycin, tetracycline, and the third-generation cephalosporins is a reliable therapeutic regimen for endocarditis and septicemia infections.[13] Meanwhile, antibiotics such as vancomycin, the third-generation cephalosporins, imipenem, meropenem, amikacin are very effective on brain abscesses and CNS infections caused by this bacterium.[5,10,12]

4 | CONCLUSION

The current study demonstrates the seventh clinical case report about *S pluranimalium* infection isolated from the neonatal septicemia. Based on the results of present study and the previous studies, it seems that the *S pluranimalium* included in vancomycin, carbapenems, aminoglycosides, and 3rd generation cephalosporins performs as an opportunistic pathogen, and also the appropriate therapeutic regimen for the infections caused by this bacterium.

CONFLICT OF INTEREST

None to declare.

AUTHOR CONTRIBUTIONS

KG: performed clinical diagnosis and drafted the manuscript. MK: drafted the manuscript. HK: performed clinical diagnosis and contributed to the final revision of the manuscript. MK: drafted, revised the manuscript, and reviewed the manuscript.

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