URINARY TRACT INFECTION BY *STREPTOCOCCUS EQUINUS*: A PEDIATRIC CASE PRESENTATION

Christina Seitopoulou [a],
Marilena Stamouli [b],
Georgia Kalliora [c],
Antonia Mourtzikou [d]

[a] Laboratory of Biopathology, Nikea Prime Care Center, 2nd YPE, Greece.
[b] Laboratory of Biochemistry, Naval and Veterans Hospital of Athens, Greece.
[c] Faculty of Biology, National and Kapodistrian University of Athens, EKPA, Greece.
[d] Department of Microbiology, Laboratory of Molecular Diagnostics, GHNP "Agios Panteleimon", Greece.

ISSN 2220-7619 (Print)
ISSN 2313-7398 (Online)

ИНФЕКЦИЯ МОЧЕВЫХ ПУТЕЙ, ВЫЗВАННАЯ STREPTOCOCCUS EQUINUS: ПЕДИАТРИЧЕСКИЙ СЛУЧАЙ

Кристина Сейтопулу [1],
Марилена Стамули [2],
Джорджия Каллиора [3],
Антония Мурцику [4]

[1] Лаборатория биопатологии, Центр ухода Nikea Prime Care Center, 2-й YPE, Греция.
[2] Лаборатория биохимии, Госпиталь военно-морских сил и ветеранов Афин, Греция.
[3] Факультет биологии, Афинский национальный университет имени Каподистрии, EKPA, Греция.
[4] Отделение микробиологии лаборатории молекулярной диагностики ГНФ «Агиос Пантелеймон», Греция.

Резюме

Streptococcus equinus — неэнтерококковый *Streptococcus* группы D, грамположительная, негемолитическая, молочнокислая бактерия. Частота инфицирования людей увеличивается в сельской местности, где существует высокий риск контакта с фекалиями животных и ферментированными пищевыми продуктами.

Streptococcus equinus ассоциирована со специфическими заболеваниями, такими как костно-суставные инфекции, менингит, инфекции желчных путей, инфекционный эндокардит и колоректальный рак. Пациент мужского пола 10 лет, с бессимптомным течением и без сопутствующих заболеваний, был направлен на плановый осмотр в амбулаторную педиатрическую клинику больницы общего профиля Никея, Пирей, Греция. Согласно истории болезни, он провел две недели в летнем лагере, где имел непосредственный контакт с лошадьми, например, в ходе верховой езды, кормления и поения лошадей, а также ухода за ними и т. д. Однако, инфекция не выявлена у его брата с аналогичными контактами и занятиями. Осмотр глаз, рта, ушей, носа, горла и живота особенностей не выявил. Лабораторные анализы показали умеренный лейкоцитоз (12 000/мм3, с 80% нейтрофилов) и незначительное увеличение скорости оседания эритроцитов (30 мм/ч). Анализ мочи и микроскопия выявили бактериурию по нитритному тесту и пиурию, что обусловило проведение посева мочи (Multistix 10 SG Reagent Strips). , Siemens Healthineers) с обнаружением мономикробного S. equinus >105 КОЕ/мл. Бактерию идентифицировали с помощью системы идентификации RapIDTM REMEL ONE (Thermo Fisher Scientific). Тестирование чувствительности к противомикробным препаратам выявило устойчивость к клиндамицину, тетрациклину, цефотаксиму и высокую чувствительность к эритромицину. Пациент получал лечение эритромицином. Streptococcus equinus выделяется из кишечника примерно у 7% в общей популяции, а инфекции мочевыводящих путей встречаются реже. Факторами риска колонизации человека считаются

проживание в сельской местности и контакт с фекалиями животных. Описанный в настоящем исследовании пациент, пребывавший в летнем лагере, вероятно, контактировал с фекалиями лошадей во время соответствующих мероприятий, что привело к развитию инфекции, вызванной Streptococcus equinus.

Ключевые слова: Streptococcus equinus, мономикроб, колонизация, мочевыводящие пути.

Abstract

Streptococcus equinus is a non-enterococcal group D *Streptococcus*, Gram positive, non- hemolytic, lactic acid bacterium. The incidence of colonization in humans increases in rural areas, where there is high risk of exposure to animal feces and fermented food products.

It is associated with specific diseases, such as osteoarticular infections, meningitis, biliary infections, infective endocarditis and colorectal cancer. A male 10-year-old patient, asymptomatic, without underlying medical conditions, was referred for routine check-up at the Outpatient Pediatric Clinic of the Nikea General Hospital, Piraeus, Greece. According to patient history, he had spent two weeks at a summer camp, where he had direct contact with horses, such as horse riding, horse feeding, watering, horse care, etc. His brother, although he had the same contacts and activities, did not present an infection. Examinations of the eyes, mouth, ears, nose, throat and abdomen were normal. Laboratory tests showed mild leukocytosis (12,000/mm^3, with 80% neutrophils) and slightly increased erythrocyte sedimentation rate (30 mm/h).Urinalysis and microscopy revealed bacteriuria by nitrite test and pyuria, so urine cultures were performed (Multistix 10 SG Reagent Strips, Siemens Healthineers). The urine culture grew monomicrobial *S. equinus* $>10^5$ CFU/ml. The bacterium was identified by the RapID™ REMEL ONE identification system (Thermo Fisher Scientific). Antimicrobial susceptibility testing revealed resistance to Clindamycin, Tetracycline, Cefotaxime and high susceptibility to Erythromycin. The patient received treatment with Erythromycin. *Streptococcus equinus* has been isolated from the bowel in approximately 7% of the general population. Urinary tract infections are less common. Risk factors for human colonization are considered living in rural areas and having contact with animal feces. The patient, during his stay at the summer camp, had probably contact with horse feces during the relevant activities and therefore infected.

Keywords: *Streptococcus equinus*, monomicrobial, colonization, urinary tract.

1 Introduction

Streptococcus equinus is a non-enterococcal group D *Streptococcus,* which colonizes both humans and animals and is involved in food fermentation. It is a Gram positive, non-hemolytic, lactic acid, bile-esculin positive, non-lactose and non-mannitol fermenting bacterium. It is found predominantly in the alimentary tract of horses, and it is associated with specific diseases, such as osteoarticular infections, meningitis, biliary infections, infective endocarditis and colorectal cancer) (Marmolin et al., 2016; Kaiki et al., 2021; Vinciguerra et al., 2021). The incidence of colonization in humans increases in rural areas, where there is high risk of exposure to animal feces and fermented food products (Kaiki et al., 2021; Vinciguerra et al., 2021). Urinary tract infections are among the most frequent infections worldwide. They are detected in hospital and primary care consultations, and in some cases they are asymptomatic. Timely diagnosis and treatment of urinary tract infections can prevent from serious consequences. Urinary tract infections from *Streptococcus equinus* are very rare. The aim of our study is to present an asymptomatic pediatric case of urinary tract infection by *Streptococcus equinus,* acquired due to leisure time spent with horses.

CASE PRESENTATION

A 10-year-old male patient, asymptomatic, without underlying medical conditions, was referred for routine check-up to the Outpatient Pediatric Clinic of the Nikea General Hospital, Piraeus, Greece. According to patient history, he had spent two weeks at a summer camp, where he had direct contact with horses, such as horse riding, horse feeding, watering, horse care etc. His older brother, although he had the same contacts and activities, did not present any infection. Examinations of the eyes, mouth, ears, nose, throat and abdomen were normal. Laboratory tests, such as complete blood count, biochemical tests, urinalysis and urine culture were performed.

2 Materials and methods

The complete blood count was measured on the NIHON KOHDEN CelltacG hematology analyzer, biochemical tests were measured on the KONELAB 60 biochemistry analyzer, urinalysis was performed by the Multistix 10 SG Reagent Strips (Siemens Healthineers), and the urine cultures were performed on Columbia blood agar. For microbial identification, RapID STR REMEL™ (Thermo Scientific System), Gram stain and agglutination with streptococcal group sera (Streptococcal Grouping Kit, Oxoid Ltd., Basingstoke, UK) were applied. In addition, the drug susceptibility testing of the urine culture was performed by the Kirby Bauer disk diffusion susceptibility test, by implementing the EUCAST (European Committee on Antimicrobial Susceptibility Testing) 2023 criteria.

3 **Results**

Haematology tests showed mild leukocytosis (12.000/mm^3 with 80% neutrophils) and slightly increased erythrocyte sedimentation rate (30 mm/h). Biochemical test results were as follows: glucose 86 mg/dL, urea 30.5 mg/dL, uric acid 6.63 mg/dL, creatinine 0.98 mg/dL, GGT 22 U/L, GOT 20 U/L and GPT 22 U/L. Urinalysis and microscopy revealed bacteriuria by nitrite test and pyuria. The urine culture grew monomicrobial *Streptococcus equinus* >10^5 CFU/ml. Antimicrobial susceptibility testing revealed resistance to Clindamycin, Tetracycline, Cefotaxime and high susceptibility to Erythromycin. The patient received treatment with Erythromycin and recovered quickly.

4 **Discussion**

Equines play an important role in transmitting several zoonotic diseases to humans. The emergence and re-emergence of equine zoonotic pathogens have been described by many authors in the literature. *Streptococcus equinus* has been isolated from the bowel in approximately 7% of the general population. It has rarely been described as a human pathogen. Infections in humans are most often associated with bacteremia, with or without endocarditis (Chayakulkeeree et al., 2015; Marmolin et al., 2016; Jans and Boleij, 2018; Pompilio et al., 2019). Moreover, *Streptococcus equinus* has

been detected in food products including fermented milk in sub-Saharan Africa, Asia and Southern Europe, fermented fish in Asia and fermented plants in sub-Saharan Africa and Latin America suggesting a wide range of habitats and its adaptability to different environmental conditions (Khurana et al., 2015; Jans and Boleij, 2018; González-de la Cruz et al., 2021; Öberg et al., 2022). *Streptococcus bovis/Streptococcus equinus* complex (SBSEC), consists of commensal bacteria, mainly described as colonizers of the rumen, crop, and cloaca of animals and colon of humans, with a fecal carriage rate of SBSEC in humans ranging from 5% to over 60% (Khurana et al., 2015; Öberg et al., 2022). The variation of the percentage observed, is attributed to different detection techniques and regional differences. Moreover, most studies include specific population groups and not the general population (Jans et al., 2012; Lopes et al., 2014; Dekker and Lau, 2016). Epidemiological data about *Streptococcus equinus* are limited. The rare published cases include infective endocarditis cases (Keerty et al., 2021; Vinciguerra et al., 2021; Öberg et al., 2022; Stummer et al., 2023), bacteremia (Chayakulkeeree et al., 2015; Marmolin et al., 2016; Kaiki et al., 2021; Öberg et al., 2022; Stummer et al., 2023) and one case of endocarditis combined with histocytosis (Sechi et al., 2000). In 2013 three cases of *Streptococcus equinus* subspecies *zooepidemicus* were detected in Eastern Finland, in patients who were horse trainers and breeders. It is noteworthy that the disease in all three patients was invasive and severe, requiring prolonged treatment and rehabilitation. Human infections with *Streptococcus equinus subspecies zooepidemicus,* are very rare and are generally associated with contact with horses, and consumption of unpasteurized milk products, goat cheese or pork. In most cases *S. zooepidemicus* leads to fulminant infections (Pelkonen et al., 2013; Stummer et al., 2023). Urinary tract infections are much less common and their role of the SBSEC [*Streptococcus bovis/Streptococcus equinus complex*] as urinary pathogens is not well known (Matesanz et al., 2015; de Teresa-Alguacil et al., 2016; Rosales-Castillo et al., 2022). In Greece, there are no epidemiological surveillance data from the National Public Health Organization for *Streptococcus equinus*

infection, probably due to its rarity. In the recent past, no similar infections have been detected nor published in Greece, concerning any population age group. The patient in this case, during the stay at the summer camp, had probably contact with horse feces during the relevant activities and therefore was infected. No epidemiological data from the campsite were collected. The child was asymptomatic and the urine culture was performed on the basis of routine testing, so there may be cases of infection which have been under-diagnosed. The 10 year old patient has a higher risk of being infected, due to poor application of hygiene rules in his age group during vacations, without the supervision of parents or teachers. In Greece, horse riding is not a widespread sport and leisure with horses is very limited. Contact with horses occurs in most cases due to agricultural activities. Moreover, a National Equine Registry has not yet been established, despite the continuous efforts of the relevant animal welfare associations (Hellenic Society for the Equine Welfare and Panhellenic Equine Welfare Society). There is an increasing evidence that antibiotic resistance is widespread among *Streptococcus equinus* clinical isolates, with variable resistance rates reported for clindamycin, erythromycin, tetracycline, and levofloxacin (Boyle et al., 2018; Pompilio et al., 2019; Bohlman et al., 2023; Chhabra et al., 2023). Given the increasing infection rates it is of utmost importance to continuously evaluate the resistance profiles, as well as to determine the factors that enable colonization and establishment in animal and humans, in order to develop strategies to reduce public health risks. The diseases of equines put at risk significant part of the population, such as veterinarians, animal handlers, horse trainers and breeders, animal health personnel, the population of agricultural communities, as well as the general population that gets in contact with horses during sports or leisure time (Bohlman et al., 2023; Chhabra et al., 2023).

5 **Conclusion**

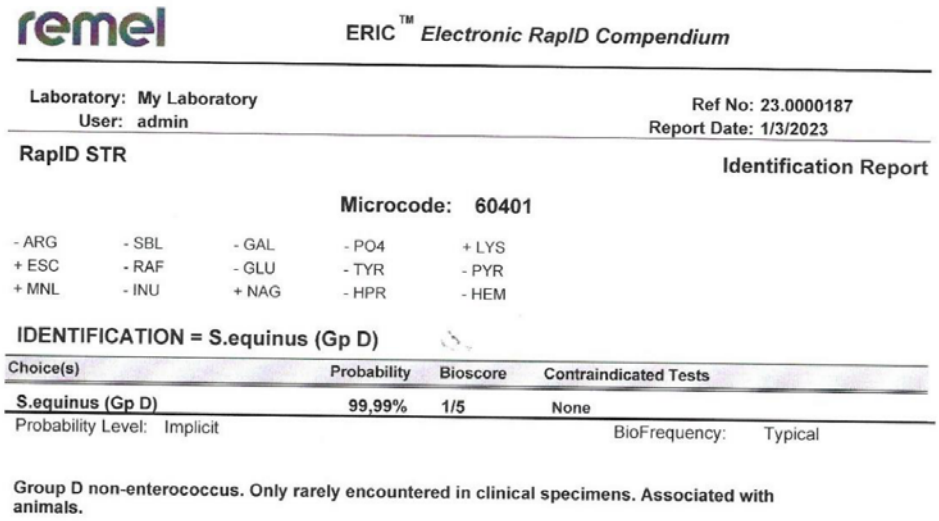
Streptococcus equinus is a rare Gram-positive bacterium, that may cause fulminant infection in humans. In this paper we describe a rare asymptomatic pediatric case of urinary tract infection with *S. equinus*, as a result of contact with horses. All

clinicians and laboratory physicians should be alert for timely diagnosis and specific therapeutic treatment, aiming to ensure the quality of life of patients and increase their survival expectancy.

ISSN 2220-7619 (Print)
ISSN 2313-7398 (Online)

FIGURES

Figure 1. Identification of *S. equinus* by RapID™ REMEL ONE.



remel ERIC™ *Electronic RapID Compendium*

Laboratory: My Laboratory
User: admin

Ref No: 23.0000187
Report Date: 1/3/2023

RapID STR **Identification Report**

Microcode: 60401

- ARG	- SBL	- GAL	- PO4	+ LYS
+ ESC	- RAF	- GLU	- TYR	- PYR
+ MNL	- INU	+ NAG	- HPR	- HEM

IDENTIFICATION = S.equinus (Gp D)

Choice(s)	Probability	Bioscore	Contraindicated Tests
S.equinus (Gp D)	99,99%	1/5	None

Probability Level: Implicit BioFrequency: Typical

Group D non-enterococcus. Only rarely encountered in clinical specimens. Associated with animals.

Figure 1. Identification of *S. equinus* by RapID™ REMEL ONE

ТИТУЛЬНЫЙ ЛИСТ_МЕТАДАННЫЕ

Блок 1. Информация об авторе ответственном за переписку

Antonia Mourtzikou – BSc, MSc in Clinical Chemistry, MPH, MPHM, EurSpLM, PhD, Scientific Supervisor, Laboratory of Molecular Diagnostics, GHNP "Agios Panteleimon", Greece.

Блок 2. Информация об авторах

Christina Seitopoulou – MD, MSc in Occupational and Enviromental Health, PhDc, Biopathologist, Laboratory of Biopathology, Nikea Prime Care Center, 2nd YPE, Greece.

Marilena Stamouli – BSc, MSc, EurSpLM, Director of Biochemistry Laboratory, Naval and Veterans Hospital of Athens ("NNA"), Greece.

Georgia Kalliora – Student at Faculty of Biology, National and Kapodistrian University of Athens (EKPA), Greece.

Блок 3. Метаданные статьи

URINARY TRACT INFECTION BY *STREPTOCOCCUS EQUINUS*: A PEDIATRIC CASE PRESENTATION

Сокращенное название статьи для верхнего колонтитула:

STREPTOCOCCUS EQUINES: CASE STUDY

Keywords: *Streptococcus equinus*, monomicrobial, colonization, urinary tract.

Краткие сообщения.

Количество страниц текста – 2, количество таблиц – 0, количество рисунков – 1.

24.05.2023.

Блок 1. Информация об авторе ответственном за переписку
Антония Мурцику, бакалавр, магистр клинической химии, магистр общественного здравоохранения, магистр управления первичной медико-санитарной помощью, Европейский специалист в области лабораторной медицины, к.н., старший научный руководитель лаборатории молекулярной диагностики, GHNP «Агиос Пантелеймон», Греция
электронная почта:antoniamour@yahoo.com

Блок 2. Информация об авторах
Кристина Сейтопулу, доктор медицинских наук, магистр в области гигиены труда и окружающей среды, доктор философии, биопатолог, лаборатория биопатологии, Центр первичной медико-санитарной помощи Nikea, 2-й YPE, Греция
электронная почта: xseitopoulou@yahoo.gr
Марилена Стамули, бакалавр, магистр в области управления здравоохранением, магистр всеобщего управления качества, Европейский специалист в области лабораторной медицины, директор лаборатории биохимии, Афинский госпиталь военно-морских сил и ветеранов («NNA»), Греция
электронная почта: marilena_stamouli@yahoo.com
Джорджия Каллиора, студентка биологического факультета Афинского национального университета имени Каподистрии (EKPA), Греция
электронная почта: geckalli9@gmail.com

Блок 3. Метаданные статьи
ИНФЕКЦИЯ МОЧЕВЫХ ПУТЕЙ, ВЫЗВАННАЯ STREPTOCOCCUS EQUINUS: ПЕДИАТРИЧЕСКИЙ СЛУЧАЙ

Краткое название:
Клинический случай инфекции, вызванной *Streptococcus equines*

Ключевые слова: Streptococcus equinus, мономикроб, колонизация, мочевыводящие пути.

СПИСОК ЛИТЕРАТУРЫ

1	Bohlman T, Waddell H, Schumaker B. A case of bacteremia and pneumonia caused by Streptococcus equi subspecies equi infection in a 70-year-old female following horse exposure in rural Wyoming. Ann Clin Microb and Antimicrob. 2023; 22, 65.	Annals of Clinical Microbiology and Antimicrobials	DOI: 10.1186/s12941-023-00602-1.
2	Boyle AG, Timoney JF, Newton JR, Hines MT, Waller AS, Buchanan BR. Streptococcus equinus Infections in Horses: Guidelines for Treatment, Control, and Prevention of Strangles-Revised Consensus Statement. J Vet Intern Med. 2018; 32(2):633-647.	Journal of Veterinary Internal Medicine	DOI: 10.1111/jvim.15043. PMID: 29424487 PMCID: PMC5867011.
3	Chayakulkeeree M, Nopjaroonsri P, Leelapornand A. Clinical Characteristics of Group D Streptococcal Bacteremia in a University Hospital in Thailand. Open Forum Infectious Diseases. 2015; 2(1): 831-843.	Open Forum Infectious Diseases	DOI: 10.1093/ofid/ofv133.548.
4	Chhabra D, Bhatia T, Goutam U, Manuja A, Kumar B. Strangles in equines: An overview. Microb Pathog. 2023; 178:106070.	Microb Pathog	DOI: 10.1016/j.micpath.2023.106070. PMID: 36924902.

5	Dekker JP, Lau AF. An Update on the Streptococcus bovis Group: Classification, Identification, and Disease Associations. J. Clin. Microbiol. 2016; 54:1694–1699.	Journal of Clinical Microbiology	DOI: 10.1128/JCM.02977-15. PMID: 26912760. PMCID: PMC4922088.
6	de Teresa-Alguacil J, Gutiérrez-Soto M, Rodríguez-Granger J, Osuna-Ortega A, Navarro-Marí JM, Gutiérrez-Fernández J. Clinical interest of Streptococcus bovis isolates in urine. Rev Esp Quimioter. 2016; 29(3):155-8.	Revista Espanola de Quimioterapia	PMID: 27084880.
7	González-de la Cruz JU, Rodríguez-Palma JJ, Escalante-Herrera KS, de la Torre Gutiérrez L, Pérez-Morales R, de la Cruz-Leyva MC. Identificación genética de bacterias ácido lácticas nativas en leche cruda de vaca y queso Poro artisanal. Manglar. 2021; 18(1): 7-13.	Manglar	DOI: 10.17268/manglar.2021.001.
8	Jans C, Lacroix C, Meile L. A Novel Multiplex PCR/RFLP Assay for the Identification of Streptococcus bovis/Streptococcus equinus Complex	FEMS Microbiology Letters	DOI: 10.1111/j.1574-6968.2011.02443.x.

	Members from Dairy Microbial Communities Based on the 16S rRNA Gene. FEMS Microbiol. Lett. 2012; 326:144–150.		
9	Jans C, Boleij A. The road to infection: host-microbe interactions defining the pathogenicity of Streptococcus bovis/Streptococcus equinus complex members. Front Microbiol. 2018; 9:603.	Frontiers in Microbiology	doi: 10.3389/fmicb.2018.00603. eCollection 2018.
10	Kaiki Y, Kitagawa H, Tadera K, Taogoshi H, Ikeda M, Kano M, Harino T, Nomura T, Omori K, Shigemoto N, Takahashi S, Ohge H. Laboratory identification and clinical characteristics of Streptococcus bovis/Streptococcus equinus complex bacteremia: a retrospective, multicenter study in Hiroshima, Japan. BMC Infect Dis. 2021; 21(1):1192.	BioMed Central Infectious Diseases	DOI: 10.1186/s12879-021-06880-4. PMCID: PMC8626886 PMID: 34836500.
11	Keerty D, Yacoub AT, Nguyen TC, Haynes E, Greene J. First Case of Infective Endocarditis With Streptococcus equinus in an Immunocompetent Patient in North America: A Case Report and Review of Literature. Cureus. 2021;13(11):e19473.	Cureus	PMID: 34912614 PMCID: PMC8664352 DOI: 10.7759/cureus.19473.

12	Khurana SK, Dhama K, Prasad M, Karthik K, Tiwari R. Zoonotic pathogens transmitted from equines: diagnosis and control. Adv. Anim. Vet. Sci. 2015; 3(2s): 32-53.	Advances in Animal and Veterinary Sciences	DOI: 10.14737/journal.aavs/2015/3.2s.32.53.
13	Lopes PG, Cantarelli VV, Agnes G, Costabeber AM, d'Azevedo PA. Novel Real-time PCR Assays Using TaqMan Minor Groove Binder Probes for Identification of Fecal Carriage of Streptococcus bovis/Streptococcus equinus Complex from Rectal Swab Specimens. J. Clin. Microbiol. 2014; 52:974–976.	Journal of Clinical Microbiology	DOI: 10.1128/JCM.03253-13.
14	Marmolin ES, Hartmeyer GN, Christensen JJ, Nielsen XC, Dargis R, Skov MN, et al. Bacteremia with the bovis group streptococci: species identification and association with infective endocarditis and with gastrointestinal disease. Diagn Microbiol Infect Dis. 2016; 85(2):239–242.	Diagnostic in Microbiology and Infectious Disease	DOI: 10.1016/j.diagmicrobio.2016.02.019. PMID: 27117515.
15	Matesanz M, Rubal D, Iñiguez I, Rabuñal R, García-Garrote F, Coira A,	European Journal of Clinical Microbiology and Infectious Disease	DOI: 10.1007/s10096-014-2273-x. PMID: 25416160.

ISSN 2220-7619 (Print)
ISSN 2313-7398 (Online)

	García-País MJ, Pita J, Rodriguez-Macias A, López-Álvarez MJ, Alonso MP, Corredoira J. Is Streptococcus bovis a urinary pathogen? Eur J Clin Microbiol Infect Dis. 2015; 34(4):719-25.		
16	Öberg J, Nilson B, Gilje P, Rasmussen M, Inghammar M. Bacteraemia and infective endocarditis with Streptococcus bovis-Streptococcus equinus-complex: a retrospective cohort study. Infectious Diseases. 2022; 54(10): 760-765,	Infectious Diseases (London, England)	PMID: 35730935. DOI: 10.1080/23744235.2022.2089730.
17	Pelkonen S, Lindahl SB, Suomala P, Karhukorpi J, Vuorinen S, Koivula I, Väisänen T, Pentikäinen J, Autio T, Tuuminen T. Transmission of Streptococcus equi subspecies zooepidemicus infection from horses to humans. Emerg Infect Dis. 2013;19(7):1041-8.	Emerging Infectious Diseases	PMID: 23777752. PMCID: PMC3713971. DOI: 10.3201/eid1907.121365.
18	Pompilio A, Di Bonaventura G, Gherardi G. An overview on Streptococcus bovis/Streptococcus equinus complex isolates: identification to the species/subspecies level and	International Journal of Molecular Sciences	PMID: 30678042. PMCID: PMC6386949. DOI: 10.3390/ijms20030480.

	antibiotic resistance. Int J Mol Sci. 2019; 20(3):480.		
19	Rosales-Castillo A, Jiménez-Guerra G, Ruiz-Gómez L, Expósito-Ruíz M, Navarro-Marí JM, Gutiérrez-Fernández J. Emerging Presence of Culturable Microorganisms in Clinical Samples of the Genitourinary System: Systematic Review and Experience in Specialized Care of a Regional Hospital. J. Clin. Med. 2022, 11(5): 1348.	Journal of Clinical Medicine	PMID: 35268439. PMCID: PMC8911399. DOI: 10.3390/jcm11051348.
20	Sechi LA, De Carli S, Ciani R. Streptococcus equinus endocarditis in a patient with pulmonary histiocytosis X. Am J Med. 2000;108(6):522-3.	The American Journal of Medicine	DOI: 10.1016/s0002-9343(99)00331-9.
21	Stummer M, Frisch V, Glitz F, Hinney B, Spergser J, Krücken, J, et al. Presence of Equine and Bovine Coronaviruses, Endoparasites, and Bacteria in Fecal Samples of Horses with Colic. Pathogens. 2023;12(8):1043.	Pathogens (Basel, Switzerland)	PMID: 37624003. PMCID: PMC10458731. DOI: 10.3390/pathogens12081043.
22	Vinciguerra M, Santamaria V, Romiti S, D'Abramo M, Toto G, De Bellis A,	Frontiers in Cardiovascular Medicine	PMID: 33996945. PMCID: PMC8116484.

	Taliani G, Sangiorgi G and Greco E. Case Report: Streptococcus alactolyticus as a Rare Pathogen of Mitral Endocarditis. Front. Cardiovasc. Med. 2021; 8:648213.		DOI: 10.3389/fcvm.2021.648213.