

**GENERALIZED RHODOCOCOSIS IN A 6 DAY OLD FILLY.  
CASE REPORT**  
RODOCOCOZĂ GENERALIZATĂ LA O MÂNZĂ DE 6 ZILE.  
STUDIU DE CAZ

C. CRECAN<sup>1)</sup>,  
Alexandra MUREȘAN<sup>1)</sup>,  
I. MORAR<sup>1)</sup>

**ABSTRACT | REZUMAT**

A 6 day old filly was presented in the Equine Clinic of the Faculty of Veterinary Medicine of Cluj-Napoca, for lameness and anorexia.

The clinical exam on admission revealed persistence of the urachus canal, bronchopneumonia and severe lameness on the hind limbs, with SIRS symptoms. Samples from the joint fluid were sent to the laboratory, while waiting for the results, was carried out an emergency hydro-electrolytic resuscitation, and due to suspicion of *R. equi* infection, the filly was started on specific antibiotics.

Evolution of the filly overnight was worse, so intra-articular treatment and regional perfusion, as well as plasma transfusions were initiated with success. The urachus was clamped. Laboratory confirms an intra-articular infection with *R. equi*.

After a 4 weeks stay, at the owners wish the filly was discharged and continued the treatment at home.

Checks from 1 month and then after 6 months confirmed the good prognosis, with complete recovery.

**Keywords:** rhodococcus, plasma, equine, synovial fluid

O mână cu vârsta de 6 zile a fost prezentată în Clinica de Ecvine a Facultății de Medicină Veterinară din Cluj-Napoca, cu anamneza de șchiopătură și anorexie.

Examenul clinic la internare a relevat persistența canalului urac, bronhopneumonie și claudicație severă pe membrele posterioare, cu simptome de SRIS. Probe de lichid sinovial au fost trimise la laborator, iar în așteptarea rezultatelor, s-a efectuat de urgență reechilibrare hidroelectrolitică și, din cauza suspiciunii de infecție cu *R. equi*, s-a instituit terapia cu antibiotice.

Evoluția peste noapte a fost nefavorabilă, astfel încât tratamentul sistemic și perfuzia regională și intra-articulară cu antibiotice, precum și transfuziile de plasmă au fost inițiate cu succes. Canalul urac a fost închis. Laboratorul confirmă infecția intraarticulară cu *R. equi*.

După o internare de 4 săptămâni, la dorința proprietarilor mână a fost externată, continuând tratamentul acasă.

La verificările la 1 lună și apoi după 6 luni, s-a confirmat prognosticul favorabil, cu recuperare completă.

**Cuvinte cheie:** rhodococcus, plasmă, ecvine, lichid sinovial

Rhodococcosis is an infectious disease caused by a gram positive facultative intracellular bacteria called *Rhodococcus equi* (previously known as *Corynebacterium*) [4], which mainly affects horses, other animals and humans as well [9, 19, 27].

The bacteria can be found in farms, located in the soil [24] and can also, rarely, affect adult horses (they are passive carriers) [23], and it can be carried from one farm to another by migrating animals [14].

In foals, the bacteria multiply in the gut and heavily pollute the environment [2, 7, 16].

*R. equi* is very resistant to environmental factors and thrive in dry and warm climates, especially on pH neutral soil.

The bacterium affects young horses that have a weak immune system, by breathing in the cocci and

having them multiply in the alveolar macrophages [15], being found in BAL and TBS fluid of sick foals through microbiological cultures and/or PCR [28].

In the past twenty years, virulence proteins (VAP) have been determined, that are very important for intra-macrophage proliferation and pathogenicity in the foal but also used for diagnosis [5, 17].

It is also possible to find intestinal infections due to swallowing of pulmonary mucus when coughing, with patients presenting abdominal involvement characterized by diarrhea, colic, weight loss, multifocal ulcerative enterocolitis and tiplitis as well as abscess formation [21, 26]. The age of onset is between 3 weeks to 6 months, but infections at younger ages can appear as well. *R. equi* mostly affects the lungs, causing purulent bronchopneumonia [1, 9, 22], but it can also colonize other organs as well, causing purulent arthritis, phlegmons, uveitis and even renal, hepatic and heart inflammations [1, 7]. Laboratory testing of conventional

1) University of Agricultural Sciences and Veterinary Medicine, Faculty of Veterinary Medicine of Cluj-Napoca, Romania

inflammatory markers like serum amyloid A are not be of high value but screening of foals in the first weeks of age for fibrinogen kinetics might be useful [20].

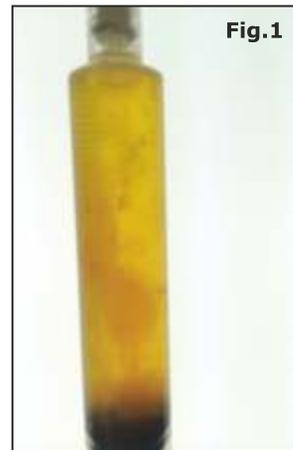
The bacteria is resistant to common antibiotics, due to living intracellular, and also being difficult to target beyond the thick membranes of abscesses. Also, late recognition of the symptoms leads to a high mortality of this infection [1].

Treatment with Azythromycin (golden standard) is needed for up to 9 weeks [8], though there have been reports of Aziythromycin resistance in foals affected by *R. equi* [10, 25]. Recent in vivo studies suggest that enrofloxacin, gentamicin, and vancomycin are the most active drugs in equine monocyte-derived macrophages infected with the pathogens [6], but whether the results can be correlated with in vivo activity remains to be seen.

## MATERIALS AND METHODS

The presented patient was a 6 day old filly, body-weight 70 kg, which came in our clinic due to severe lameness on the posterior right limb and suspected omphalophlebitis. The first examination revealed a dull behavior, with elevated temperature (39,6°C), pulse (170 beats per minute, low tension) and respiration (80 breaths per minute, dyspneic). The foal was presented in decubitus and remained that way during examination. The right hind knee was painful, warm and enlarged, as was the left hock. A quick blood test showed she was hypoglycemic. The patient was slightly dehydrated (skin fold 3 seconds), mucous membranes were congested and the capillary refill time was 1 second. The umbilicus was painful and inflamed. The filly was stranguric and polyuric. After being supported up, the filly managed to get to feed on her mother's milk and remained in an upright position. The animal was suspected of systemic inflammatory response syndrome/sepsis due to clinical symptoms and a blood sample was sent to the laboratory for hematology and biochemistry. The results showed leukocytosis and neutrophilia, confirming our suspicion towards SIRS.

Ultrasonographic examination of the abdomen/umbilicus showed that the umbilical vein was enlarged and shrouded in fibrin. Ultrasound of the affected joints showed a medium quantity of synovial fluid, rich in fi-brin. We then sampled synovial fluid from the right hind knee joint, macroscopically it was sero-hemorrhagic, TP was 6g/DI (Fig. 2). Left hock sample showed a TP of 4g/dL, bright yellow, dark yellow color and thick, with flocculation (Fig. 1).



**Fig.1**



**Fig.2**

**Fig. 1.** Aspect of the synovial fluid in the left hock. Fibrinous aspect and yellow color.

**Fig. 2.** Aspect of the synovial fluid in the right hind knee joint. Sero-hemorrhagic aspect.

Therapeutically, we decided on Amikacin 500 mg and Triamcinolon 10 mg/ joint intraarticular in both knees hind and left limb as well as both hocks, repeated every four days, for a total of 4 administrations. Systemically we chose Gentamicin iv 3 mg/kg bid, Cobactan 2 mg/kg im s.i.d and Ranitidin 5 mg/ kg iv b.i.d. for gastric protection, after 48 h the lab results showed in the antibiogram from the samples amikacin, rifampicin, erythromycin sensitive and penicillin and cefquinome resistant which led to a change in treatment to Rifampicin 5 mg/kg and Erythromycin 25 mg/kg iv t.i.d. Rhodococcus infection was confirmed by microbiology from synovial fluid after 48 h.

Later in the day, the filly improved its general status and was less apathetic than earlier, opposed resistance when examined, and was able to bear weight on the right limb, walking around the box. Both affected joints were enlarged, but only the left hock was also painful. Both front left knees and the right hock are also enlarged, but not painful. To target the joints directly but not risk a contamination if not needed through intraarticular injection, we chose to perform regional perfusion on all limbs, with Gentamicin 5 mg/kg sid, for 5 days. After an initial improvement, the patient got worse during the night, showing symptoms of fever and being highly apathetic, as well as tachypnea and tachycardia.

An abdominal ultrasound showed that the umbilical veins and arteries were clustered with fibrous tissue, the urachus had no tendency to close. Around the umbilicus, there was a light serous discharge.

Clinically, examination of the respiratory apparatus revealed dyspnea, wet rales, and mucopurulent nasal

discharge, the owner chose not to have further imaging examinations due to financial reasons.

A diagnosis of incipient Rhodococcal bronchopneumonia was placed based on the clinical symptoms alone. Therefore, we decided to do a plasma transfusion - 6 liters of blood were sampled from the mother, which resulted in 3 l of plasma, and were administered slowly i.v., alternatively with lactated Ringer fluid, through a central venous catheter.

We also decided on urachus clamping, shaving the area and performing antisepsy in the affected area with betadine, chlorhexidine and alcohol. With a syringe adapted to a Foley catheter we first aspirated the existing fluid (both urine and a light quantity of purulent matter) and then performed lavage with Chlorhexidine 5%, 5.0 ml. The external part of the canal together with the skin was clamped with a human use umbilical cord clamp.

Two days after clamping, a local reaction appeared in the proximal part above the area that was clamped, which we treated locally with a gel with prednisolone, lidocaine, and DMSO.

Remission took place after three days. After plasma transfusion, localized perfusion of the affected joints, as well as systemic treatment, and urachus clamping, the filly started improving by the hour and was kept under supervision and systemic treatment for the next 4 weeks. She was discharged improved, and sent home with indications about treatment for the owner.

Check up at 1 month revealed light lameness in the hind limbs, she was therefore treated with hyaluronic acid 50 mg/ml, 2 ml/joint, every 6 weeks, glucosamine and chondroitinsulphate per os for eight more weeks.

## RESULTS AND DISCUSSIONS

Although the most common site of multiplication of *R. equi* in foals is the pulmonary apparatus, the laboratory data and history of this case shows that the main site of colonization in this case was the skeletal system, with multiple severely affected joints.

The case was complicated by umbilical pathology, the persistence of the urachus was probably the favoring factor for the development of rhodococcosis in such a young age. Samples from the bedding and soil at the owner's facility were positive for *R. equi* presence. The filly showed symptoms of both an incipient purulent bronchopneumonia (wet rales, dyspnoea, mucopurulent nasal discharge but no localized foci of dullness) and acute septic arthritis, which were complicated by the apparition of SIRS.

While the lungs have cleared up fast with treatment, the affected joints (right hind knee, left hock) had persisting symptoms of an acute septic inflammation and were treated initially with intraarticular injections and then with localized perfusion.

Current election treatment in *R. equi* infections is Azythromycin or Tulathromycin, combined with Rifampicin, for at least 4 weeks [6, 29], which was what we also used. Localized perfusion is a practical approach to joint pathology due to infectious causes, and was chosen in this case to allow repeated treatment, avoid contamination of the rest of the joints and deliver antibiotics in a concentrated form to the infection site [3, 30].

Due to a rapidly degrading general state in the third night of the filly's stay and suspicion of SIRS, plasma transfusion was decided on, which led to a visible improvement by the morning. The main reason for this was offering a source of equine IgG. Plasma transfusion in *R. equi* infections are one of the main staples of treatment, with studies showing that foals that receive IgG boosts show a reduced incidence of disease compared to control foals [18]. Also, it is recommended that all septic foals benefit of plasma transfusion regardless of their IgG status [11].

The owner's choice was to bring the foal home and she completed the remaining treatment on her own. A check up after 1 month revealed the urachus healed, no symptoms of bronchopneumonia, but slightly lame on the hind limbs. The chosen supporting treatment for this was hyaluronic acid and chondroitin sulphate for the next 8 months. The 6 months and one year checks showed the filly doing a complete recovery even in the affected joints with no lameness at all.

## CONCLUSION

It was confirmed that hyaluronic acid has reduced pain in joint problems, as well as a protective effect on the joint cartilage through prevention of loss of proteoglycan from the synovial space. [12, 13]

## REFERENCES

1. *Ainsworth Dorothy*, (1999). Rhodococcal infections in foals, *Equine Veterinary Education*, Vol.11, Iss 4, p.191-198
2. *Buntain Stephanie, Carter C., Kuskie K., et al.*, (2010). Frequency of *Rhodococcus equi* in Feces of Mares in Central Kentucky, *Journal of Equine Veterinary Science* Vol. 30, Iss 4, p. 191-195

3. *Cimetti L.J., J.G. Merriam, S.N. D'Oench, (2004).* How to Perform Intravenous Regional Limb Perfusion Using Amikacin and DMSO, 50th Annual Convention of the American Assoc. of Equine Practitioners, Denver, CO, Publisher: AAEP, Lexington KY
4. *Goodfellow M., (1987).* The taxonomic status of *Rhodococcus equi*, *Veterinary Microbiology*, Vol.14, Iss. 3, p. 205–209
5. *Giguère Steeve, M.K. Hondalus, J.A. Yager, P. Darrah, D.M. Mosser, J.F. Prescott, (1999).* Role of the 85-Kilobase Plasmid and Plasmid-Encoded Virulence-Associated Protein A in Intracellular Survival and Virulence of *Rhodococcus equi*, *Infect. Immun.*, Vol. 67, Iss.7, p. 3548-3557
6. *Giguère Steeve, L.J. Berghaus, E.A. Leeb, (2015).* Activity of 10 antimicrobial agents against intracellular *Rhodococcus equi*, *Veterinary Microbiology*, Vol. 178, Issues 3–4, p. 275–278
7. *Heidmann P., Madigan J.E., J.L. Watson, (2006).* *Rhodococcus equi* Pneumonia: Clinical Findings, Diagnosis, Treatment and Prevention, *Clinical Techniques in Equine Practice*, Vol.5, Iss. 3, p. 203-210
8. *Hillidge C.J., (1987).* Use of erythromycin-rifampin combination in treatment of *Rhodococcus equi* pneumonia, *Veterinary Microbiology*, Vol.14, Iss.3, p. 337–342
9. *Hondallus Mary, (1997).* Pathogenesis and virulence of *Rhodococcus equi*, Vol. 56, Iss. 3–4, p. 257–268
10. *Huimin Liu, Wang Y., Jing Y., Chengmin W., Hongxuan H., (2014).* Appearance of Multidrug-Resistant Virulent *Rhodococcus equi* Clinical Isolates Obtained in China, *J. Clin. Microbiol.*, 52:2 703, doi:10.1128/JCM.02925-13
11. *Madigan J., (2008).* Plasma – how and when to use it. *Proceedings of the Rosedale and Partners Foal Care Course*, British Racing School, Newmarket, p. 131–132
12. *Mayer W., Schumacher J., (2007).* Equine Joint Injection and Regional Anesthesia, *MediMedia USA*, p. 24-29
13. *Moreland L.W., (2003).* Intra-articular hyaluronan (hyaluronic acid) and hylans for the treatment of osteoarthritis mechanism of action, *Arthritis Research Therapy*, 5(2): 54–67.
14. *Morton Anna, A.P. Begg, Anderson G.A. et al., (2001).* *Appl. Environ. Microbiology*, Vol. 67, no. 5, p. 2167-2175
15. *Muscatello G., (2012).* *Rhodococcus equi* pneumonia in the foal – Part 1: Pathogenesis and epidemiology, *The Veterinary Journal*, Volume 192, Issue 1, p. 20–26
16. *Muscatello G., Anderson G.A., Gilkerson J.R., Browning G.F., (2006).* Associations between the Ecology of Virulent *Rhodococcus equi* and the Epidemiology of *R. equi* Pneumonia on Australian Thoroughbred Farms, *Appl. Environ. Microbiol*, Vol. 72, no. 9, p. 6152-6160
17. *Okoko Tebekeme, E.V. Blagova, J.L. Whittingham, L.G. Dover, A.J. Wilkinson, (2015).* Structural characterisation of the virulence-associated protein VapG from the horse pathogen *Rhodococcus equi*, *Veterinary Microbiology*, Vol.179, iss.1-2, p.42-52
18. *Palmer L., Cooke C.D., Holmes M.A., Manning F.M., Challis M., Cash R., Stoneham S.J., (2008).* Studies on the persistence of transfused *Rhodococcus equi* antibodies in thoroughbred foals. *Proceedings of the 4<sup>th</sup> Havemeyer workshop on Rhodococcus equi*, p. 67
19. *Passamonti F., Lepri E., Coppola G., et al., (2011).* Pulmonary rhodococcosis in a cat, *Journal of Feline Medicine & Surgery* Vol.13, Iss.4, p. 283–285
20. *Passamonti F., D.M. Vardi, V. Stefanetti, M.L. Marenzoni, S. Prato, P. Cévese, M. Coletti, M. Pepe, P. Casagrande Proietti, F. Olea-Popelka, (2015).* *Rhodococcus equi* pneumonia in foals: An assessment of the early diagnostic value of serum amyloid A and plasma fibrinogen concentrations in equine clinical practice, *The Veterinary Journal*, Vol. 203, Iss. 2, p. 211–218
21. *Reuss S.M., Chaffin M.K., Schmitz D.G., Norman T.E., (2011).* Sonographic characteristics of intra-abdominal abscessation and lymphadenopathy attributable to *Rhodococcus equi* infections in foals, *Vet Radiol Ultrasound.*, 52(4):462-5. doi: 10.1111/j.1740-8261.2011.01804.x.
22. *Sanz M., Loynachan A., Sun L., et al., (2013).* The effect of bacterial dose and foal age at challenge on *Rhodococcus equi* infection, *Veterinary Microbiology*, Vol.167, Iss.3–4, p.623–631
23. *Tapprest J., Bouyer B., Pannequin M. et al., (2012).* Major outbreak of rhodococcosis in adult equidae, *Journal of Equine Veterinary Science*, Vol.32, Iss.10, Supplement, p. S15-S16
24. *Takai S., Fujimori T., Katsuzaki K., S. Tsubaki, (1987).* Ecology of *Rhodococcus equi* in horses and their environment on horse-breeding farms, *Veterinary Microbiology*, Vol.14, Iss.3, p. 233–239
25. *Takai S., Takeda K., Nakano Y. et al., (1997).* Emergence of rifampin-resistant *Rhodococcus equi* in an

- infected foal, *Journal Clin. Microbiology*, Vol. 35, no. 7, p. 1904-1908
26. *Valdes A., Johnson J.R.*, (2005). Septic pleuritis and abdominal abscess formation caused by *Rhodococcus equi* in a foal, *J Am Vet Med Assoc*, 227 (6):960-3, p. 919.
27. *Vázquez-Boland J.A., Giguère S., A. Hapeshia, et al.*, (2013). *Rhodococcus equi*: The many facets of a pathogenic actinomycete, *Veterinary Microbiology*, Vol. 167, Iss. 1-2, p. 9-33
28. *Venner Monica, Heyers P., K. Strutzberg Minder, et al.*, (2007). Nachweis von *Rhodococcus equi* durch mikrobiologische Kultur und mittels Polymerasekettenreaktion (PCR) im Tracheobronchialsekret von Fohlen, *Berlin Münch. Tierärztl. Wochenschr.*, 120, Heft 3/4, p. 126-133
29. *Venner Monica*, (2014). Gerer la Rhodococcose en 2014, Conference presentation - 14e Journee AVEF Roissy-Actualites en Antibiotherapie chez le cheval.
30. *Whitehair K.J., Adams S.B., Parker J.E.*, (1992). Regional limb perfusion with antibiotics in three horses. *Vet Surg.*, 21:286-292.
31. *Wright I.M.*, (2001). Oral supplements in the treatment and prevention of joint diseases: a review of their potential application to the horse, *Equine Veterinary Education*, 13(3):13-139.