Besondere Aspekte beim Einsatz von Antibiotika beim Fohlen

L.M. Hermans
Dipl. ECEIM

Fohlen ≠ Adult

- Körperwassergehalt ↑
  - o Intrazellulärer Flüssigkeitsraum ↓
  - o Extrazellulärer Flüssigkeitsraum, Blut und Plasma Volumen ↑
  - → Höhere Dosierung hydrophile Medikamente: Aminoglykoside
- Hepatische Metabolisierung und renale Exkretion ↑ im Alter
- Darmflora → keine Dickdarmfermentation
- Pharmakokinetische Studien in gesunden Fohlen

Sepsis

= häufigste Todesursache in den ersten 7 Lebenstagen

Risikofaktor = Failure of passive transfer

Offener Darm → direkter Zugang für Bakterien aus der Umgebung

Verursacht auch:

- Septische Arthritis
- Physitis
- Osteomyelitis
- Meningitis
- Omphalitis

Behandlung

- Unterstützende Pflege
- Antibiotika

→ Breites Spektrum – Empirisch

→ Bakterizid

→ Intravenös

→ Blutkultur + Sensibilitätstest → 23.4-49% der Fälle + Ergebnis

Meist isolierte Keime:

- Gramm -: *E. coli, Enterobacter* spp., *Klebsiella* spp., *Actinobacillus* spp. und *Pasteurella* spp.
- Gramm +: *Streptococcus* spp., *Enterococcus* spp., *Staphylococcus* spp.

48h nach stationärer Aufnahme häufig andere Keime worunter auch Keime involviert in Krankenhausinfektionen: *Acinetobacter* spp., *Klebsiella* spp., *Pseudomonas* spp. und *Serratia* spp.

Welches Antibiotikum einsetzen?

- Kombination Ampicillin + Amikacin

→ Gramm + und Gramm – Spektrum + in Vitro gute Wirksamkeit Ampicillin gegen *Enterococcus* spp.

→ Alternativ Amikacin + Penicillin oder Gentamicin + Penicillin

- Chloramphenicol?
- Cephalosporine

Systemic antimicrobial therapy in foals

E. F. Floyd[†], C. A. Easton-Jones[†] and M. J. P. Theelen[‡§]*

Antibiograms of Bacterial Cultures From Equine Neonates at a United Kingdom Hospital: 381 Samples (2018–2023)

Annabelle E. Graham[1] | Victoria A. Colgate[2] | Emily F. Floyd[2]

Initial antimicrobial treatment of foals with sepsis: Do our choices make a difference?

Mathijs J.P. Theelen[a,b,*], W. David Wilson[c], Barbara A. Byrne[d], Judy M. Edman[c], Philip H. Kass[e], K. Gary Magdesian[c]

Table 1

Cumulative susceptibility at 'foal level' of bacteria isolated from foals with sepsis at hospital admission (UC Davis, USA) between 1 January 1990 and 31 December 2015.

Antimicrobial drug (combination)	Number of foals	Percentage of foals from which all isolates were susceptible	95% confidence interval
Amikacin	213	63.4%	56.5–69.9
Amikacin + penicillin	210	88.6%	83.5–92.5
Amikacin + ampicillin	213	91.5%	87.0–94.9
Gentamicin	213	62.0%	55.1–68.5
Gentamicin + penicillin	211	82.0%	76.1–86.9
Gentamicin + ampicillin	213	83.6%	77.9–88.3
Ceftiofur	211	86.3%	80.9–90.6
Ceftiofur + amikacin	211	89.6%	84.6–93.4
Ceftizoxime	194	89.7%	84.5–93.6
Chloramphenicol	207	81.6%	75.7–86.7
Enrofloxacin	211	82.9%	77.2–87.8
Imipenem	175	92.6%	87.6–96.0
Trimethoprim/sulfa-methoxazole	213	59.6%	52.7–66.3

(Theelen et al., 2019)

Rhodococcus equi (Hoagii)

- ↑ Resistenzen
- Strategie der Behandlung: ↓ Anzahl behandelte Fohlen + Entwicklung Resistente Stämme
  - o Subklinische Pneumonie in 70-80% der Fälle → keine Behandlung
  - o Wann behandeln?
    - o Klinische Symptome
    - o Leukozyten
    - o Summe der maximalen Durchmesser der sonographischen Läsionen im Thorax Ultraschall >10 cm

→ 30% weniger Antibiotika eingesetzt, keine ↑ Mortalität

Rhodococcus Equi: Challenges to Treat Infections and to Mitigate Antimicrobial Resistance

Courtney Higgins, Laura Huber*

Changing policy to treat foals with Rhodococcus equi pneumonia in the later course of disease decreases antimicrobial usage without increasing mortality rate

Denise Arnold-Lehna [1], Monica Venner [2], Londa J Berghaus [3], Roy Berghaus [4], Steeve Giguère [3]

Welches Antibiotikum einsetzen?

- Kombination Makrolide + Rifampin
  - o Monotherapie Makrolide?
    - o ↓ Konzentrationen Makrolide in Plasma und BAL und Bioverfügbarkeit Clarithromycin
    - o Monotherapie nicht minderwertig

→ ABER:

- o Konzentration in BAL bleibt über MIC
- o Resistenzen wahrscheinlicher bei Monotherapie
- o Keine Beweise bei mittelschwerer und schwerer Pneumonie

Rhodococcus equi foal pneumonia: Update on epidemiology, immunity, treatment and prevention

Angela I. Bordin[1] | Laura Huber[2] | Macarena G. Sanz[3] | Noah D. Cohen[1]

- Makrolide
  - o Clarithromycin, Azythromycin, Erythromycin, Tulathromycin und Gamithromycin
  - o Bakteriostatisch + zeitabhängig
  - o Gamithromycin als Monotherapie vielversprechend
    →Nebenwirkungen in 58% der Fohlen nach IM Injektion

Dosierung
- o Clarithromycin: 7.5 mg/kg PO q12h
- o Azythromycin: 10 mg/kg PO q24h 5 Tage, danach q48h
- o Erythromycin: 25 mg/kg PO q6-8h
- o Tulathromycin: 2.5 mg/kg IM q1Woche
- o Gamithromycin: 6 mg/kg IM q1Woche

- Durchfall
- Hyperthermie → Anhidrose/Hypohidrose
- Lokale Reaktionen → IM Injektion
- ARDS (Erythromycin)

- Rifampin
  - o Gramm + Spektrum + intrazelluläre Bakterien
  - o Bakterizid/bakteriostatisch + konzentrationsabhängig
  - o Gute Gewebedistribution
  - o Wirkt auch gegen Mycobacterien, *S. aureus*, *Haemophilus* in schwer zugänglichen Infektionsherden

Dosierung:
- o 10 mg/kg PO q12h evt. Q24h

- Alternative:
  - o Doxycyclin + Rifampin

Vielen Dank für Ihre Aufmerksamkeit!

Fragen??

LITERATUR

- Amtsblatt der Europäischen Union: DURCHFUHRUNGSVERORDNUNG (EU) 2022/1255 DER KOMMISSION vom 19. Juli 2022
- Amtsblatt der Europäischen Union: Verordnung (EU) 2019/6 des europäischen Parlaments und des Rates vom 11.12.2018 über Tierarztneimittel und zur Aufhebung der Richtlinie 2001/82/EG
- Arnold-Lehna D., Venner M., Berghaus L.J., Berghaus R., Giguère S. (2020). Changing policy to treat foals with Rhodococcus equi pneumonia in the later course of disease decreases antimicrobial usage without increasing mortality rate. Equine Vet J, 52, 531–7. doi: 10.1111/evj.13219.
- Bordin, A.I., Huber, L., Sanz, M.G., Cohen, N.D. (2022). *Rhodococcus equi* foal pneumonia: Update on epidemiology, immunity, treatment and prevention. *Equine Vet J.*, 54, 481–494. doi: 10.1111/evj.13567
- Bundestieraïztekammer (BTK): Leitlinien für den sorgfaltigen Umgang mit antibakteriell wirksamen Tierarzneimitteln.
- Corley and Stephen, 2008, The Equine Hospital Manual
- De Briyne, N., Atkinson, J., Pokludová, L., Borriello, S.P., Price, S. (2013). Factors influencing antibiotic prescribing habits and use of sensitivity testing amongst veterinarians in Europe. Vet Rec., 173, 475. doi: 10.1136/vr.101454.
- Durie, I. & Galen van, G. (2023) Can the use of antimicrobials in adult equine patients with acute colitis be justified in the era of antimicrobial stewardship? *Equine Veterinary Education*, 35, 103–112. doi: 10.1111/eve.13657.
- Ellerbrock, R.E., Canisso, I.F., Roady, P.J., Litsky, A., Durgam, S., Podico, G., Li, Z. and Lima, F. (2020). Administration of enrofloxacin during late pregnancy failed to induce lesions in the resulting newborn foals. Equine Vet J, 52: 136-143. doi: 10.1111/evj.13131
- Ellerbrock, R.E., Canisso, I.F., Podico, G., Roady, P.J., Uhl, E., Lima, F.S., Li, Z. (2019). Diffusion of fluoroquinolones into equine fetal fluids did not induce fetal lesions after enrofloxacin treatment in early gestation. Vet J., 253, 105376. doi: 10.1016/j.tvjl.2019.105376.
- Floyd, E.F., Easton-Jones, C.A. and Theelen, M.J.P. (2022), Systemic antimicrobial therapy in foals. Equine Vet Educ, 34: 49-56. doi: 10.1111/eve.13467
- Graham, A.E., Colgate, V.A., Floyd, E.F. (2025). Antibiograms of Bacterial Cultures From Equine Neonates at a United Kingdom Hospital: 381 Samples (2018-2023). J Vet Intern Med., 39(5):e70198. doi: 10.1111/jvim.70198.
- Hardefeldt, L.Y., Browning, G.F., Thursky, K., Gilkerson, J.R., Billman-Jacobe, H., Stevenson, M.A. and Bailey, K.E. (2017) Antimicrobials used for surgical prophylaxis by equine veterinary practitioners in Australia. Equine Vet. J. 50, 65-72. doi: 10.1111/evj.12709.

LITERATUR

- Hardefeldt, L.Y., Bailey, K.E. and Slater, J. (2021), Overview of the use of antimicrobial drugs for the treatment of bacterial infections in horses. Equine Vet Educ, 33: 602-611. doi: 10.1111/eve.13371.
- Hildebrand, F., Venner,. M., Giguère, S. (2015). Efficacy of gamithromycin for the treatment of foals with mild to moderate bronchopneumonia. J Vet Intern Med., 29, 333–8. doi: 10.1111/jvim.12504.
- Higgins, C., Huber, L. (2023). Rhodococcus Equi: Challenges to Treat Infections and to Mitigate Antimicrobial Resistance. J Equine Vet Sci., 127, 104845. doi: 10.1016/j.jevs.2023.104845
- Isgren, C.M. (2022), Improving clinical outcomes via responsible antimicrobial use in horses. Equine Vet Educ, 34: 482-492. doi: 10.1111/eve.13502.
- Mair, T.S. and Parkin, T.D. (2022), Audit of antimicrobial use in eleven equine practices over a five-year period (2014–2018). Equine Vet Educ, 34, 404-408. doi: 10.1111/eve.13438.
- Merle, R., Feuer, L., Frenzer, K., Plenio, J.-L., Bethe, A., Sarnino, N., Lübke-Becker, A., Bäumer, W. (2025) Antibiotic Use in Horses: Analysis of 57 German Veterinary Practices (2018–2023). *Antibiotics*, *14*, 953. doi: 10.3390/antibiotics14090953.
- Prescott, J.F. (2021), Outpacing the resistance *tsunami*: Antimicrobial stewardship in equine medicine, an overview. Equine Vet Educ, 33, 539-545. doi: 10.1111/eve.13318.
- Reed and Bayly, 2018, Equine Internal Medicine, 4th Edition, 2018
- Ross, S.E., Duz, M., Rendle,. D.I. (2016). Antimicrobial selection and dosing in the treatment of wounds in the United Kingdom. Equine Vet J., 48, 676–80. doi: 10.1111/evj.12535.
- Ryan, C.A., McNeal, C.D., Credille, B.C. (2023) Ceftiofur use and antimicrobial stewardship in the horse. *Equine Vet J.*, 55(6), 944–961. doi: 10.1111/evj.13930.
- Schmerold, I., van Geijlswijk, I., Gehring, R. (2023). European regulations on the use of antibiotics in veterinary medicine. Eur J Pharm Sci., 189, 106473. doi: 10.1016/j.ejps.2023.106473.
- Schwechler, J., van den Hoven, R., Schoster, A. (2016) Antimicrobial prescribing practices by Swiss, German and Austrian equine practitioners. Vet Rec., 27, 178(9):216. doi: 10.1136/vr.103438.
- Southwood, L.L. (2023) Surgical antimicrobial prophylaxis: Current standards of care. Equine Veterinary Education, 35, 607–616. doi: 10.1111/eve.13864.
- Tallon, R. (2023) Room for improvement? The use of antimicrobials in equine respiratory disease. *Equine Veterinary Education*, 35, 572–575. doi: 10.1111/eve.13840.

LITERATUR

- Tallon, R.E., Whitt, B., Bladon, B.M. (2024). Antibiotic usage in 14 equine practices over a 10-year period (2012-2021). Equine Vet J., 56 (3), 544-551. doi: 10.1111/evj.13988.
- Theelen, M.J.P., Wilson, W.D., Byrne, B.A., Edman, J.M., Kass, P.H. and Magdesian, K.G. (2019) Initial antimicrobial treatment of foals with sepsis: Do our choices make a difference? Vet. J. 243, 74-76. doi: 10.1016/j.tvjl.2018.11.012.
- Verwilghen, D. (2019) Surgical Techniques, Surgical Techniques. In: Auer, J.A., Stick, J.A. & Kummerle, J.M. (Eds.) *Equine Surgery*, 5th edition. Elsevier, St. Louis, Missouri: T. Prange, pp. 198–213.
- WHO's List of Medically Important Antimicrobials: a risk management tool for mitigating antimicrobial resistance due to non-human use. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.
- Wilson, A., Mair, T., Williams, N., McGowan, C., Pinchbeck, G. (2023). Antimicrobial prescribing and antimicrobial resistance surveillance in equine practice. Equine Vet J., 55(3), 494-505. doi: 10.1111/evj.13587.
- Zendri, F., Isgren, C.M., Devaney, J., Schmidt, V., Rankin, R., Timofte, D. (2023). Resistome-based surveillance identifies ESKAPE pathogens as the predominant gram-negative organisms circulating in veterinary hospitals. Front Microbiol., 7, 14, 1252216. doi: 10.3389/fmicb.2023.1252216.
- https://www.bvl.bund.de/SharedDocs/Fachmeldungen/05_tierarzneimittel/2025/2025_07_09_Fa_Neuigkeiten_AB-Meldungen.html
- https://www.beva.org.uk/Portals/0/Documents/ResourcesForVets/PROTECTME/0.%20ProtectMe%20-%20Full%20Toolkit.pdf