SAEVA Antibiotic Use Toolkit

Categorisation of Antibiotics Commonly Used in Equine Practice – derived from the European Medicines Agency recommendations

D **PRUDENCE**	• Should be used as first-line treatments, whenever possible • As always should be use prudently, only when medically needed	• Procaine penicillin • Ampicillin, amoxicillin • Oxytetracycline, doxycycline • Potentiated sulphonamides • Metronidazole
C **CAUTION**	• Alternatives in human medicine • For some veterinary indications, there are no alternatives belonging to Category D • Considered only when there are no antibiotics in Category D that could be clinically effective	• Amoxicillin-clavulanic acid • Cefazolin • Chloramphenicol • Gentamicin, amikacin • Erythromycin, azithromycin, clarithromycin
B **RESTRICT**	• Critically important in human medicine and use in animals should be restricted to mitigate the risk to public health • Considered only when there are no antibiotics in Categories C or D that could be clinically effective • Use should be based on antimicrobial susceptibility testing	• Ceftiofur, cefquinome, cefotaxime • Enrofloxacin, marbofloxacin • Polymixin B
A **AVOID**	• Classes/products without veterinary registration in EU • Not for use in food animals • For use in companion animals in exceptional circumstances*	• Rifampicin • Imipenem • Vancomycin

*Exceptional circumstances can be defined as use in an individual animal based on culture and sensitivity results where there are no alternatives and where there is a good chance of treatment success.

Antibiotic Dosing Recommendations

Drug	Dose	Route	Dosing Interval	Spectrum			Notes
				Gram +ve	Gram -ve	Anaerobe	
Amoxicillin	13-20mg/kg	PO	q 8-12 hrs	++	+	++	Foals only due to risk of colitis in adults
Ampicillin	15-20 mg/kg	IV	q 8-12 hrs	++	+	++	Useful alternative to procaine penicillin where IV administration is preferred.
Procaine penicillin	22-50 mg/kg	IM	q 8-12 hrs	++	-	++	Avoid products containing "long-acting" penicillins (benzathine penicillin) in horses as they don't reach therapeutic concentrations. Anaerobic activity good other than against *Bacteroides*.
Potentiated sulphonamides (TMPS)	25-30 mg/kg	PO/IV/IM	q 12 hrs	++	++	-	Inactivated by purulent material. Should not be used in combination with procaine penicillin as this reduces its efficacy. Bioavailability reduced by feeding so withhold feed shortly before and after treatment.
Oxytetracycline	6.6 mg/kg	IV	q 12 hrs	++	++	+	Administer by slow IV injection or transfusion.
Doxycycline	10mg/kg	PO	q 12 hrs	++	++	+	Bioavailability reduced by feeding so withhold feed shortly before and after treatment.
Metronidazole	10mg/kg foal (<14 days) 15-25 mg/kg	PO/IV PO/IV	q 12 hrs q 8-12 hrs	-	-	+++	May be given per-rectum if PO route contraindicated but dose should be doubled.
Amoxicillin-clavulanate	13-20mg/kg of amoxicillin component	PO	q 8-12 hrs	++	++	++	Foals only due to risk of colitis in adults. The clavulanate component extends the Gram -ve spectrum compared to amoxicillin alone.
Cefazolin	11-22 mg/kg	IV	q 6-8 hrs	++	++	++	Useful alternative to procaine penicillin where IV administration is preferred.
Chloramphenicol	4-10 mg/kg foal 25-50 mg/kg adult	PO PO	q 6-8 hrs q 6-8 hrs	+++	+++	+++	Risk of idiosyncratic aplastic anaemia in people so should not be used in food-producing animals.
Gentamicin	8.8-12 mg/kg foal 6.6 -9.6 mg/kg adult	IV IV	q 24 – 36 hrs q 24hrs	+	+++	-	Inactivated by purulent material. Reserve amikacin for gentamicin-resistant but amikacin-susceptible infections without alternatives.
Amikacin	25mg/kg foal 10-15 mg/kg adult	IV IV	q 24 hrs q 24 hrs	+	+++	-	
Azithromycin	10 mg/kg	PO	q 24 hrs	+++	+	+	Foals only due to risk of colitis in adults.
Ceftiofur	2.2-10 mg/kg foals 2.2-4.4 mg/kg adults	IM/IV IM/IV/SC	q 6-12 hrs q 12 hrs	+++	++	++	
Enrofloxacin	5 mg/kg 7.5 mg/kg	IV PO	q 24 hrs q 24 hrs	+	+++	-	
Marbofloxacin	2 mg/kg	IM/PO	q 24 hrs	+	+++	-	
Rifampicin	5mg/kg	PO	q 12 hrs	+++	+	++	Empiric therapy only for *Rhodococcus equi* in combination with a macrolide. Otherwise, rifampicin should be reserved for exceptional circumstances.

Suggested Antibiotic Treatment for Common Bacterial Diseases in Horses

CONDITION	FIRST LINE	ALTERNATIVE	NOTES
Upper Respiratory Tract Disease			
Strangles • **Formed abscess**	Not indicated unless dyspnoeic Penicillin		In early clinical cases antibiotics are not considered necessary. Drainage of abscesses is usually curative in more advanced cases.
Primary bacterial sinusitis	Penicillin	Potentiated sulphonamides (TMPS)	Primary bacterial sinusitis is rare in adult horses. Consider underlying dental disease or pituitary *pars intermedia* dysfunction (PPID).
Guttural pouch empyema/chondroids	Systemic and topical penicillin		In combination with lavage and removal of chondroids.
Lower Respiratory Tract Disease			
Primary pneumonia/pleuropneumonia	Penicillin and gentamicin (and metronidazole)	Tetracycline	Rare in adult horses. A tracheal aspirate should be obtained for culture before starting empiric antibiotic treatment.
Secondary pneumonia (asthma)	Not indicated	Doxycycline	Bacterial contamination of the lower airways may occur in equine asthma but usually resolves with treatment for asthma. Antibiotic treatment for secondary infection is very rarely warranted.
***Rhodococcus equi* pneumonia**	Azithromycin/clarithromycin and doxycycline (mild-moderate cases)	Azithromycin/clarithromycin and rifampicin (severe cases)	Consider that many cases will resolve without antibiotic treatment.
***Streptococcus zooepidemicus* pneumonia**	Penicillin	Ampicillin or cefazolin	
Gastrointestinal Disease			
Periodontal disease	Potentiated sulphonamides (TMPS)	Doxycycline	
Periapical abscessation	Doxycycline		Consider dental extraction.
Acute diarrhoea (adult)	Not usually indicated	Metronidazole if clostridial disease suspected	Consider acute larval cyathostominosis as a differential diagnosis.
Chronic diarrhoea	Not usually indicated		
***Lawsonia* infection**	Doxycycline (mild-moderate cases)	Oxytetracycline (severe cases)	
Bacterial cholangiohepatitis	Potentiated sulphonamides (TMPS)	Penicillin and gentamicin	Consider liver biopsy for culture especially if no response to first-line treatment.
Peritonitis	Penicillin, gentamicin and metronidazole	TMPS and metronidazole	Collect peritoneal fluid sample for culture before starting empiric antibiotic treatment.

CONDITION	FIRST LINE	ALTERNATIVE	NOTES
Urogenital Tract Disease			
Cystitis	Potentiated sulphonamides (TMPS)	Penicillin and gentamicin	Primary bacterial cystitis is very rare in horses. Rule out underlying causes such as a cystolith or sabulous cystitis. Collect urine for culture prior to starting empiric antibiotic treatment.
Endometritis	Intra-uterine ampicillin and/or aminoglycoside		No evidence for routine post-service treatment. Should be guided by culture and sensitivity results.
Placentitis	Potentiated sulphonamides (TMPS)		No evidence for prophylactic or pulse therapy.
Post-foaling metritis and retained placenta	Penicillin, gentamicin (and metronidazole)	Potentiated sulphonamides (TMPS)	In combination with large volume uterine lavage and ecbolics. No evidence for intra-uterine antibiotics.
Ocular Disease			
Conjunctivitis	Topical chloramphenicol	Topical tetracycline	
Superficial corneal ulceration	Topical chloramphenicol	Topical moxifloxacin	
Deep/melting corneal ulceration	Topical moxifloxacin		Collect corneal sample for culture before initiating empiric treatment. Consider fungal infection too.
Skin/Hoof Disease			
Subsolar abscess	Not indicated		Drainage usually curative.
Subsolar abscess with pedal osteitis	Tetracycline	Penicillin, gentamicin and metronidazole	
Cellulitis	Tetracycline	Penicillin and gentamicin	Oral potassium iodide may be a useful adjunctive treatment.
Pyoderma	Potentiated sulphonamides (TMPS)	Doxycycline	Consider topical treatment with chlorhexidine washes rather than antibiotics.
Wounds			
Contaminated wound (uncomplicated)	Not indicated	Potentiated sulphonamides (TMPS)	
Contaminated wound (synovial sepsis)	Penicillin and gentamicin	Tetracycline	Collect synovial sample for culture prior to starting empiric antibiotic treatment. Synovial lavage most likely indicated.

CONDITION	FIRST LINE	ALTERNATIVE	NOTES
Neonatal Disease			
Patent umbilicus	Not indicated	Potentiated sulphonamides (TMPS)	
Umbilical infection	Doxycycline	Chloramphenicol or potentiated sulphonamides (TMPS)	Collect sample for culture if possible. Consider surgical resection.
Pneumonia	Doxycycline	Ampicillin, gentamicin (and metronidazole)	Collect tracheal aspirate for culture if severe or no response to initial treatment.
Diarrhoea	Potentiated sulphonamides (TMPS) (moderate)	Ampicillin, gentamicin and metronidazole (severe)	In many cases supportive treatment may be all that is necessary. Antibiotics may be indicated in more severe cases for treatment of bacteraemia.
Sepsis	Ampicillin and gentamicin	Ampicillin and amikacin or Ceftiofur	Collect blood for culture before starting empiric antibiotic treatment. Ceftiofur should be reserved for cases with/at risk of kidney injury.
Septic arthritis/physitis	Ampicillin and gentamicin/amikacin	Tetracycline	Collect synovial sample for culture before starting antibiotics. Synovial lavage most likely indicated for septic arthritis.
Meningitis	Potentiated sulphonamides (TMPS)	Ampicillin and gentamicin/amikacin	
Premature/dysmature	Potentiated sulphonamides (TMPS)	Cefazolin or Ampicillin and gentamicin	If there is concern over sepsis.
Cardiovascular Disease			
Septic thrombophlebitis	Doxycycline	Potentiated sulphonamides (TMPS)	
Endocarditis	Penicillin and gentamicin	Potentiated sulphonamides (TMPS)	Collect blood for culture before starting empiric antibiotic treatment.

Surgical Prophylaxis			
	Pre-operative	**Post-operative**	**Duration of prophylaxis**
Clean surgery	Penicillin	None	
Contaminated surgery	Penicillin and gentamicin	Penicillin and gentamicin	1-3 days. Consider TMPS if longer treatment required.
High-risk surgery	Penicillin and gentamicin	Penicillin	24 hours

These suggestions have been developed from international guidelines in combination with knowledge of drugs available in South Africa and susceptibility of common equine pathogens in South Africa. In some circumstances these suggestions may not reflect localised susceptibility patterns which should always be taken into account.

Antibiotic-Resistant Bacteria to be Aware of in Equine Practice

- **Methicillin-resistant *Staphylococcus aureus* (MRSA)**
  - Resistance to cefoxitin on antibiotic susceptibility testing is highly suggestive of MRSA
  - Don't treat with any beta-lactam antibiotics regardless of in-vitro susceptibility pattern

- **Extended-spectrum beta-lactamase producing Enterobacterales (ESBLs)**
  - Not susceptible to penicillins and cephalosporins
  - May be susceptible to fluoroquinolones, aminoglycosides, potentiated sulphonamides or amoxicillin-clavulanate.

- **Macrolide and/or rifampicin resistant *Rhodococcus equi***
  - The widespread practice of ultrasonographic screening for *R. equi* pneumonia in foals has led to a marked increase in the use of rifampicin and macrolides in equine practice. This has led to a dramatic increase in the prevalence of *R. equi* with resistance to macrolides and/or rifampicin in some populations. A number of studies have shown that foals with mild to moderate *R. equi* pneumonia recover without antibiotic treatment. In cases where antibiotic treatment is deemed necessary consideration should be given to doxycycline/macrolide combination to reduce use of rifampicin. This is due to the importance of rifampicin in the treatment of tuberculosis in people.

Useful Links and References

Arnold-Lehna, D., Venner, M., Berghaus, L. J., Berghaus, R. & Giguere, 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 Veterinary Journal*. 52(4), 531-537. https://doi.org/10.1111/evj.13219

Australian Veterinary Prescribing Guidelines. Available at: https://vetantibiotics.science.unimelb.edu.au/

British Equine Veterinary Association Protect Me Toolkit. Available at: https://www.beva.org.uk/Protect-Me

European Medicines Agency Categorisation of Antibiotics for Use in Animals. Available at: https://www.ema.europa.eu/documents/report/categorisation-antibiotics-use-animals-prudent-responsible-use_en.pdf

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