

Tuberculosis treatment protocols and complications for elephants

A photograph showing three men sitting on a large, tall pile of sticks and branches that is balanced on the backs of two elephants. The elephants are in a lush, green forest. The man on the left is wearing a white tank top and red shorts. The man in the middle is wearing a blue shirt. The man on the right is wearing a green shirt and grey pants. The text is overlaid on the image.

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Mycobacteria tuberculosis complex

- *M. tuberculosis* (M.tb)
- *M. bovis*
- *M. microti*
- *M. africanum*
- *M. kinetti*
- *M. caprae*
- *M. pinnipedi*



- Any species not in the *M. tb* complex is not truly tuberculosis.
- Infection from these are classified as mycobacteriosis.
- In people and elephants the most frequently identified tuberculosis causing agent is *M. tuberculosis*.

Elephant management options

- Isolation
- Euthanasia
- **Treatment**



Most Effective Therapy

- Prompt diagnosis
- Culture and Sensitivity
- 3-4 first line agents
- Adequate plasma drug levels
- Adequate length of treatment
- Close monitoring of hemogram and organ function.
- **Close monitoring of the patient**



Routes of administration

- Over the feed – not recommended, poorly accepted, poorly effective
- Directly oral – preferred, best absorption
- Rectally – good alternative to direct oral for some meds

Direct oral

- Deposit in back of throat behind base of tongue
- Use large 400 cc syringe with modified extended tip or stiff tubing.
- Train to take a bite block





Rectally

- Large animal syringe 400cc - multiple
- Flexible tubing
- Suppositories
- Lecithin – may increase absorption, increases volume





Guidelines

- First developed in 1998
- Modified several times to reflect experience and investigational results

First line drugs

- Isoniazid (INH)
- Pyrazinamide (PZA)
- Rifampin (RIF)
- Ethambutol (ETH)
- Streptomycin (STR)



INH

- Peripheral neuropathy
- Optic nerve toxicity
- Nausea, vomiting, anorexia
- *Pica*, epigastric distress
- *Elevated liver enzymes*, hepatitis.
- Agranulocytosis, *anemia*
- Skin eruptions, fever, vasculitis
- Pyridoxine deficiency, Rheumatic syndrome
- Systemic lupus erythematosus-like syndrome

PZA

- Hyperuricemia → gouty arthritis
- *Hepatocellular damage, elevated enzymes*
- Nausea, vomiting, *anorexia*
- *Arthralgia, myalgia*
- *Photosensitivity*
- Porphyrinuria, fever

RIF

- *Anorexia*, nausea, vomiting
- Thrombocytopenia
- *Muscle weakness, ataxia*, limb pain
- Headaches, visual disturbances
- Elevated BUN and serum uric acid
- Pruritis, urticaria, *rash*
- *Conjunctivitis*

ETH

- Optic neuropathy
- Acute renal failure



PZA/Enrofloxacin

- Group of female Asians
- Varying degrees excessive epiphora, blepharitis.
- Some with stiffness/soreness of one or more limbs.

Multi-drug resistance

- MDR TB
- Typically resistance to INH and RIF
- Employ second line drugs for therapy
- Some second line drugs more toxic than first line agents.

Second line drugs

- Amikacin
- Ethionamide
- Quinolones
- Capreomycin



Aminoglycosides

- Amikacin, Capreomycin
- Potential side effects
 - Ototoxicity
 - *Nephrotoxicity*

Ethionamide

- Digestive problems
- Psychotic disturbance
- Dizziness
- Liver problems
- Photosensitivity
- Thrombocytopenia



Quinolones

- Nausea, abdominal pain
- Vomiting, diarrhea
- Dizziness, seizures
- Rash
- Crystalluria
- *Phototoxicity*, tendinopathy

Literature

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Altered regimen

- Diminishing side effects in elephants
- Withdraw medications 1-2 days a week
- Give double the dose of meds on every other day schedule = Pulse therapy

- Success of treatment -----
- Not 100%.
- Many elephants “apparently” treated successfully to date. (rectal, oral, suppositories)
- Some have not had infection successfully eliminated. (based on necropsy findings)
- One Asian euthanized due to MDR and drug toxicity.

Other Aspects

- Cost of treatment \$50,000 + US
- Labor intensive
- Additional costs: Blood work, serum drug level monitoring, employee time, extra materials, isolation.
- Limitations of drug availability
- Success depends on all animal care staff.

Early Detection

- Cultures take up to 8 weeks for results
 - Additional time for sensitivities
 - Contamination of samples
 - Quality of sample collection
- Serological tests are rapid in comparison

Early detection cont'

- Rapid test – screening test (ElephantTB STAT-PAK[®] Assay)
- Mutiantigen Print Immunoassay (MAPIA)
- DNA extractions
- Immunologic markers
- Other technology

Resources

Most recently available guidelines
Veterinarians who have experience with this disease in
elephants
State Veterinarian
USDA Animal Care/ Elephant Specialist
Infectious disease/ tuberculosis specialists (MD, DVM, VMD)



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