Lessons from “Mycobacterium-related” Elephant necropsy cases

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My “files”

• 41 “adult” animals spanning 11 years
  – Fetal and neonatal deaths excluded
  – Herpes virus cases excluded

• 21 Asians
  – Musculoskeletal, repro neoplasia, cardiac disease, GI disease, Mycobacterial disease

• 20 Africans
  – Musculoskeletal disease, GI disease, Mycobacterial disease
Mycobacterial-related disease

• 14 cases
  – 6 Africans
    • 1 confirmed *M. tuberculosis* by post mortem culture
      – Gross and histologic granulomatous disease
      – *Negative* acid-fast stains
    • 5 confirmed atypical Mycobacterial disease
      – Culture (4), PCR (1)
  
  – 8 Asians (skewed sample?)
    • 6 confirmed *M. tuberculosis* by post mortem culture
    • 2 gross and/or histologic granulomatous disease, acid-fast negative, and culture negative*
African elephants
African elephants with Mycobacterium-related disease

1 confirmed *M. tuberculosis* by post mortem culture
   – Exposure and trunk wash history unknown
   – Gross and histologic granulomatous disease
   – Negative acid-fast stains***

5 confirmed atypical Mycobacterial disease
   – M. szulgai - 3 cases by culture
   – M. smegmatis – 1 case by culture
   – M. aurupense – 1 case by PCR
African elephant with *Mycobacterium*-related disease

1 confirmed *M. tuberculosis* by post mortem culture

– No mention of TB in history
  • Clinical evidence of musculoskeletal disease

– Gross findings
  • Several pulmonary granulomas > 12cm diameter
  • Caseous material in bronchioles
  • Tracheobronchial lymph nodes enlarged
  • Sublumbar lymph node enlarged and caseous
African elephant with *Mycobacterium*-related disease

1 confirmed *M. tuberculosis* by post mortem culture

— Histopathology
  • Evaluated by highly qualified zoo pathologist
  • “Numerous” granulomas evaluated
  • Central caseous debris and mineralization
  • Multiple acid-fast stains negative
  • Diagnosed as highly suspicious for *M. tuberculosis*.

— Culture (NVSL)
  • Positive from lung
  • Negative from lymph node and bronchial
Asian elephants
Mycobacterium-related disease in Asian elephants

- 6 confirmed *M. tuberculosis* by post mortem culture
  - 2 historically trunk wash positive, tx hist unknown
  - 4 had at least an exposure history to TB+ animal
- 2 gross and/or histologic granulomatous disease, acid-fast negative, and culture negative
  - 1 historically trunk wash positive, treated
  - 1 pos STAT-pak, MAPIA, treated
M. tb confirmed Asian elephants (n=6)

• Gross pathology
  – Lesions limited to lungs and lymph nodes – 3
  – Lesions present in lungs, lymph nodes, and other sites/organs – 3
    – Trachea, repro tract, mesenteric LN
  – Caseous and mineralized granulomas
  – Fibrotic areas of lung
  – Dorsal lung lobes common
  – Tracheobronchial LN most common
$M. \text{tb}$ confirmed Asian elephants (n=6)

- **Histopathology**
  - Inflammation
    - Classic granulomatous pneumonia
    - Areas of histiocytic and necrosuppurative bronchopneumonia
  - AF positive bacteria rare or very rare
    - Small % of granulomas examined are AF positive
      - 10%
    - Bacteria can be as few as 3-5 organisms

- **Cytology**
  - My experience, not valuable in the field
Mycobacteriosis

- Post mortem diagnosis
  - Numerous sections of lung and lymph node must be cultured and examined
  - Acid-fast bacteria are exceedingly hard to find on histopathology

Fites acid-fast
400x
Mycobacteriosis

- Post mortem diagnosis
  - Numerous sections of lung and lymph node must be cultured and examined
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Fites acid-fast
400x
Mycobacteriosis

- Post mortem diagnosis
  - Numerous sections of lung and lymph node must be cultured and examined
- Acid-fast bacteria are exceedingly hard to find on histopathology

Fites acid-fast 1000x
M. tb confirmed Asian elephants (n=6)

• Culture
  – NVSL most common
  – Lung lesions most commonly positive
  – Do not have data on # of tissues submitted
  – Formalin fixed + fresh tissue preferred to NVSL
Tb related disease in Asians

– 2/8 animals

• 1 - Gross and histopathologic granulomas in lung
  – Acid-fast negative
  – Historically trunk wash positive

• 1 – Gross lesions in lymph node/trachea/lung
  – Granulomas in lymph node and trachea
  – Lung described as fibrosis
  – No granulomatous inflammation on histopath
  – No trachea listed on histopath report
  – Historically STAT-pak, MAPIA positive

• Both animals culture negative
• Both animals had been treated
Summary

• Mtb more common in Asians than Africans
• Lung and thoracic LN pathology most common
• Histopathologic lesions vary
• Acid-fast organisms are rare
• Culture of post mortem lesions is often successful
• Sampling techniques are inconsistent
• Historical information is lacking
Recommendations

• Good solid necropsy data can help...
  – Identify active cases
  – Define latency
  – Provide information with regard to accuracy of diagnostic testing
    • Trunk wash
    • Serologic
    • Other
Recommendations

• For elephants with a “TB related history”... post mortem TB workup should be HIGH priority
  – Stat-PAK/MAPIA
  – Culture positive
  – Exposure history

  – Human safety always takes priority
Recommendations

• Post mortem TB work up should include
  – Peri-mortem serologic testing if possible (bank at least)
  – Post-mortem “secretion” cultures
    • Trunk, trachea, airways
  – Thorough sampling of lung and lymph node lesions
    • Individually labeled tissue
    • Multiple tissues for culture
    • Multiple tissues for histopathology
    • Tissue for culture rather than swab
    • Be sure to sample lesional tissue
    • NVSL +/- NJ
    • Histopathology by pathologist with TB experience
Recommendations

• Modify SSP necropsy/research protocol
  – Detailed procedures for TB sampling
    • Secretions
    • Tissues
  – Detailed requests for exposure, trunk wash, serologic history, clinical signs