



## SPECIAL MEDICAL ALERT

### DISSEMINATED IDIOPATHIC MYOSITIS (DIM) IN FERRETS

DIM appears to be a “new” disease in ferrets. The cause is unknown. DIM was first described in 2003 independently by Drs. Katrina Ramsell and Mark Burgess (Southwest Animal Hospital, Beaverton, OR), Dr. Michael Garner (NW Zoopath, WA), and others. Usually it results in a fatal inflammatory condition of muscles: “myositis.” Approximately 40 cases have been described to date, most occurring in young ferrets between 3 and 18 months of age. It is unknown if the condition is contagious, although many cases lived with other ferrets who have remained unaffected.

**PHYSICAL SIGNS:** Fever ( $> 104^{\circ}$  F), tiredness, weakness, reluctance to move, pain on handling (over the back or hips), decreased appetite, increased respiratory and heart rates, clear nasal discharge, enlarged single or multiple external lymph nodes on leg(s) or neck area.

**LABORATORY SIGNS:** White Blood Count initially may be normal, but within 7-10 days typically mature neutrophils can rise to 12 – 100 K (cells per  $\mu$ l blood) and neutrophils are frequently toxic; mild to moderate anemia (initially nonregenerative, new red blood cells seen later); Serum Chemistry tests: Glucose is frequently elevated. Creatinine kinase (CK) and aspartate aminotransferase (AST) (both enzymes detect muscle damage) are usually normal. Alanine aminotransferase (ALT) (a liver-specific enzyme) has been elevated in a few ferrets. Bilirubin is unremarkable.

**PATHOLOGY:** Biopsy: Lymph node - suppurative (“produces pus”) to granulomatous inflammation. Postmortem: widespread suppurative inflammation affecting skeletal, cardiac and smooth muscles (esophagus frequently severely affected). Non-muscular organs such as brain, liver, lung, and spleen have also been affected (e.g. bronchopneumonia in the lungs and extramedullary hematopoiesis in the spleen). Testing has been negative for infectious organisms (cultures, special stains, electron microscopy, and viral isolation studies for bacteria, parasites, and viruses).

**ETIOLOGY/ TRANSMISSION:** DIM appears to be an immune-mediated disease. Vaccines (or vaccine adjuvants), genetic predisposition, viral infections, and diets are currently being investigated as potential causes or triggers to this condition. Despite the suppurative inflammation, there are no current data to support a bacterial cause for this disease.

**DIAGNOSIS AND TREATMENT:** Presumptive: based on physical and laboratory signs (see above); Definitive: biopsy/necropsy of external skeletal muscle (e.g. leg) or esophagus. Supportive treatment: hand feeding, IV fluids if the patient is very ill; broad-spectrum antibiotics such as enrofloxacin (Baytril®) and amoxicillin may minimize secondary infections. One ferret appears to be responding to a combination of cyclosporin and ketoconazole (5 mg/kg for each drug orally once a day). (Note: Physical symptoms are consistent with DIM and histopathology indicated strong suspicion for DIM in this ferret, although the small tissue sample prevented a definitive diagnosis). One ferret initially made a transient recovery following administration of Interferon-alpha (IFN- $\alpha$ ) (orally 600 I.U./day x 2 months) with WBCs and behavior returning to normal. After several weeks in remission, this animal relapsed, WBC's again reaching 40.0 (per  $\mu$ l). Similar results have not been observed in other ferrets. [NB: oral IFN- $\alpha$  is not approved in either animals or humans for any indication.] **Following drugs have not shown efficacy:** corticosteroids, non-steroidal anti-inflammatories, erythropoietin, cyclophosphamide, antibiotic combinations (penicillins, cephalosporins, tetracyclines, quinolones (such as Baytril®), clarityromycin, metronidazole, or chloramphenicol.) Brief improvement on antibiotics might be due to treating a secondary bacterial infection.

**COURSE/OUTCOME:** Severe, rapid onset, or progressive over several weeks; most cases to date have been fatal. Mean survival following diagnosis is unknown.

**RECOMMENDATIONS:** *This Alert is for informational purposes only and should NOT be construed as veterinary advice. This alert is intended to assist practitioners and pathologists in recognizing the condition. In order to develop a better understanding of this condition, your assistance is needed in collecting information about each new case.*

#### **VETERINARIANS:**

1. **Accurate Diagnosis:** Conduct appropriate diagnostic evaluations (biopsy/necropsy; blood tests, cultures for bacteria and other micro-organisms). Proper collection of tissues is paramount. Cultures for micro-organisms should be collected **prior to starting antibiotics**, using appropriate sterile collection techniques. Fresh tissues (or pieces of whole unfrozen tissues in saline) should be saved and immediately submitted to a microbiology lab for both aerobic & anaerobic cultures. Surgical biopsies should be bisected and several touch imprints of the cut surface prepared and air-dried for cytologic examination and gram staining: Half of the tissue placed in formalin and the other half immediately frozen for bacteriological examination. Untreated animals presenting for necropsy should have the widest range of tissues collected, including esophagus, skeletal muscle, viscera, brain, and bone marrow. Again, equal tissue samples should be formalin-fixed and frozen. Screening of cytologic preps and formalin-fixed tissues will be performed to determine whether further investigation (bacteriology, virology, etc.) is warranted.

Pathology samples are requested by: Dr. Michael Garner at NW Zoopath ([zoopath@aol.com](mailto:zoopath@aol.com)) tel. 360-794-0630. or Dr. Bruce Williams, AFIP 202-782-2392 [williamsb@afip.osd.mil](mailto:williamsb@afip.osd.mil)]

2. **Supportive Treatment is warranted** (rehydration; feeding). Administration of a combination of cyclosporin and ketoconazole is strongly recommended, and administration of antiviral drugs, such as IFN- $\alpha$  may also be beneficial.

3. For each presumptive case, PLEASE complete the AFA DIM Case Report Form (see attachment or the AFA website: [www.ferret.org](http://www.ferret.org) )

4. **VETERINARIANS ONLY:** For questions regarding the above, contact Dr. Ramsell at [exoticpetvet@hotmail.com](mailto:exoticpetvet@hotmail.com) or Southwest Animal Hospital at [burgess@swanimalhospital.com](mailto:burgess@swanimalhospital.com) (tel.: 503-643-2137). Clients should work through their veterinarians and not call directly.

**FERRET OWNERS:** If you suspect your ferret has DIM, contact your veterinarian as soon as possible. For up to date information, please visit the AFA website: <http://www.ferret.org>.