

### What is FISS?

- So-called Feline injection-site sarcomas (FISS) are invasive sarcomas (mostly fibrosarcomas) that are considered the most serious of adverse effects following vaccination in cats. They behave more aggressively than other sarcomas (not typically associated with injections).
- FISS occur at approximately 1 to 4 in every 10,000 vaccinated cats.

### Pathogenesis

- The pathogenesis of FISS has not been definitively clarified. However, chronic inflammatory reactions are considered the trigger for subsequent malignant transformation.
- FISS commonly develop at sites of previous vaccination or other injections
  - Risk of FISS development seems to be higher for vaccines compared to other injections; amongst vaccines, the risk seems to be higher when adjuvanted vaccines are used (e.g. against rabies and feline leukaemia virus).
  - Injections of long-acting drugs, such as glucocorticoids, long-acting penicillin, lufenuron, cisplatin and meloxicam have also been associated with sarcoma formation.
- FISS can occur as early as four months and up to three years after an injection.
- FISS are most commonly located in the subcutis, but can also occur intramuscularly. They are characterized by invasive local growth, often with spread along fascial planes.
- Metastasis occurs in 10 to 28% of cases. The lungs are the most common site of metastasis, followed by regional lymph nodes and abdominal organs, such as kidney, spleen, intestines and liver.

### Diagnosis and Disease management

- Fine-needle aspiration and cytology can be diagnostically useful. However, for a definitive diagnosis, a surgical biopsy and histology are usually necessary. FISS show histological characteristics of typical perivascular infiltration of lymphocytes and macrophages at the tumour periphery, a central area of necrosis, inflammation, and local infiltration of tumour cells.

- Preoperatively, (contrast-enhanced) computed tomography (CT) or magnetic resonance imaging (MRI) should be obtained for staging and to determine the extent of the tumour and the size of the radiation field required to maximize the chance of a successful outcome.
- Multi-modal treatment is most successful.
  - Aggressive, radical excision is most important to avoid tumour recurrence.
  - Preoperative or postoperative radiation therapy significantly decreases recurrence rates and prolongs remission times.
  - The benefit of chemotherapy is not proven since large prospective randomized controlled trials are lacking. Chemotherapy mainly remains an option for palliative treatment in cats with non-resectable FISS, when radiation therapy is not available.
  - Recombinant feline IL-2 is now commercially available in Europe for the treatment of FISS in combination with excision and radiation therapy.

### Prevention

- Appropriate sites for injections should be selected, at which a subsequent mass may be easily surgically removed, such as distally in a leg or in the skin of the lateral abdomen. Injections at the interscapular region should generally be avoided.
- Whenever possible, oral application of drugs is to be preferred over injection, but if injections are necessary, subcutaneous injection is preferred to intramuscular injection.
- Injection of irritating substances should be avoided.
- Cats should be vaccinated no more than necessary (in accordance with current guidelines).
  - Non-adjuvanted (modified-live or recombinant) vaccines should be preferred over those containing adjuvant (if available and proven equally effective).
  - Vaccines with a long duration of immunity should be used.
  - FeLV or rabies vaccinations should not be administered to strictly indoor-only cats, and immune cats should not be vaccinated (e.g. if presence of antibodies is detected).
  - Vaccines should be brought to room temperature prior to administration (but should not be kept unrefrigerated for hours).

## Post-vaccination monitoring

- Any lump at the site of injection that is still present **three** months after vaccination, that is larger than **two** cm in diameter, or that is increasing in size **one** month after vaccination should be surgically removed ("3-2-1" rule).
- Histologic examination should be performed to confirm or rule out FISS.

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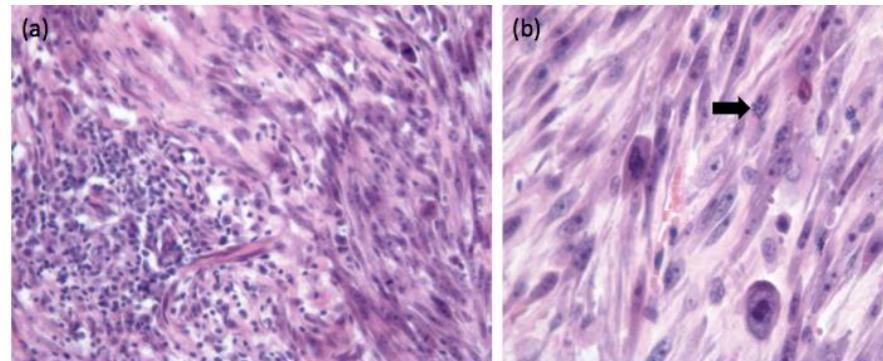


- *Cat with feline injection-site sarcoma.*



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- (a) A focus of lymphoplasmacytic inflammation is contained within the surrounding sarcoma.
- (b) Higher magnification of the neoplastic tissue reveal a pleomorphic population of neoplastic spindle cells with occasional giant nuclei and irregular mitotic activity (arrow).

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