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Toxoplasma gondii

Prevalence

- Mice and rats frequently been found naturally infected
- Spontaneous toxoplasmosis in lab rodents are rare

Significance

- Suggested that subclinical infection would interfere with behavioral phenotyping due to induced encephalitis
- Infection results in upregulation of both inflammatory and anti-inflammatory mediators of the immune system and apoptotic pathways in ocular tissues
- Mice are key to determining the genetics of resistance to toxoplasmic encephalitis – BALB/c are resistant, C57BL/6 are susceptible
- Mice used as model to investigate aspects of congenital transmission of toxoplasmosis (importance of natural killer cells and efficacy of candidate vaccines)

Disease

- Most rats resistant:
    - Rarely clinical signs
    - Newborn/young – often fatal pneumoniae
    - Older rats with large number administered – may experience fatal infection
    - Alters cognitive function (innate aversion to cats diminished facilitating predation and life cycle completion)
- Infections in laboratory mice essentially nonexistent:
    - Parasite is pervasive and the infection subclinical
    - Mice are frequent intermediate hosts (as are all warm-blooded animals)
    - Requires cats as definitive host – excrete infective oocysts in stools which sporulate in the environment after a few days
- Clinical signs:
    - Subclinical with minimal gross necropsy lesions
    - Unthrifty appearance, weight loss and paralysis
    - Enlarged, edematous, and necrotic MLNs
    - Congested, edematous, and necrotic ileum
    - Focal hepatitis and myocarditis with leukocytic infiltration
    - Interstitial pneumonia with intralesional parasites
    - Intra- and extracellular tachyzoites in brain parenchyma
- Virulence dependent on:
    - Mouse strain
    - *T. gondii*-type strain
    - Stage of parasite
    - Parasite dose

Transmission

- After ingestion by the intermediate host, sporozoites are released in small intestine
- Invade suitable host cell and rapidly replicate – acute toxoplasmosis
- After being transported by blood or lymph, invade additional tissues (lungs, spleen, kidneys, liver, heart, pancreas, brain, and skeletal muscle)
- Mice can sustain infection through cannibalism or congenital transmission

Isolation and Diagnosis

- Primarily by histology:
    - Tissue cysts observed in CNS, myocardium, or skeletal muscle
    - Sporozoites identified in cells of the ileal lamina propria, endothelium of SI or lungs, within leukocytes on peripheral blood smears, or in the heart and skeletal muscle
- PCR
- Serology
- Screening of unstained impression smears of brain material
- Differentiate sporulated oocysts from *Isospora spp*. on faecal flotation

Prevention and Control

- No effective treatment in rats – unfit for treatment, culled
- Acute toxoplasmosis in mice is amenable to chemotherapeutic intervention (tissue cysts forms are resistant)
- Separation of species and elimination of potential transport vectors
- Barrier maintenance and rederivation by embryo transfer
- Oocysts from bedding, caging and other equipment inactivated by autoclaving or heat treatment at 70°C for 10mins

Reading

- S.W. Barthold, S.M. Griffey, & D.H. Percy. Pathology of Laboratory Rodents and Rabbits (Fourth Edition), 2016
- J.G. Fox, S.W. Barthold, M.T. Davisson, C.E. Newcomer, F.W. Quimby, A.L. Smith. The Mouse in Biomedical Research (Second Edition), 2007
- D.G. Baker. Flynn's Parasites of Laboratory Animals (Second Edition), 2007