GENERAL

Wombats are large herbivorous burrowing marsupials native to Australia, of which there are three extant species: the southern hairy nosed wombat (*Lasiorhinus latifrons*), the northern hairy nosed wombat (*Lasiorhinus krefftii*), and the common wombat (*Vombatus ursinus*).

The southern hairy-nosed wombat occurs mainly as separate populations in southern South Australia and south-eastern Western Australia (Source: IUCN, Assessed 2008). This species is abundant on the Nullarbor Plain, where there are estimates of between 50,000 and 100,000 in the South Australia portion. There are no population estimates for the Western Australia portion of the Nullarbor Plain. In the Murraylands, there seem to be 10,000 - 15,000 individuals, but the population has declined by about 70 percent here since 2002, probably due to drought and sarcoptic mange. Increased wombat mortalities were also reported after heavy summer rainfall and flooding events of 2010 – 2011. The species is highly fragmented on the Yorke and Eyre Peninsulas. The northern hairy-nosed wombat (*Lasiorhinus krefftii*) is critically endangered and occurs as a single isolated population of approximately 100 individuals at Epping Forest in central Queensland, 120 km north-west of Clermont in central Queensland (Source: IUCB, Assessed 2008). The common wombat (*Vombatus ursinus*) occurs mainly in coastal areas east of the Great Dividing Range in New South Wales and eastern Victoria and in Tasmania. There are small isolated populations just over the borders from these states in Queensland and South Australia. This species is considered common and currently stable by the IUCN (Last assessed 2008).

The distribution of all three species of wombat has contracted since European settlement and is largely due to land clearing for agriculture, persecution and competition with introduced herbivores. Disease has possibly been a contributing factor, most notably sarcoptic mange. Wombats are a relatively poorly studied taxon compared with their more popular closest marsupial relative, the koala, with most published information and knowledge of diseases of wombats sourced from opportunistic observations of individuals, with only a few published longitudinal studies of populations. Continued publication of case reports and more epidemiological studies on the health of wombats is needed to assure their continued and progressive understanding and management.

Recent reviews or texts detailing important diseases and parasites of wombats include:


VIRAL DISEASES

Reports of viral disease in wombats are presently limited to single cases of reports of herpesvirus (Rothwell et al. 1988) and encephalomyocarditis virus (Moloney et al. 2001) infections. Whether
wombats may act as reservoirs for viruses or other pathogens of importance to human and domestic animal health, such as Ross River virus, has also been discussed (Doube 1982).

**Herpesvirus (undescribed, Family: Herpesviridae)**

**Significance**
An undescribed herpesvirus was associated with the death of a captive 10-month-old orphaned common wombat. This may represent spill over of herpesviruses from other hosts, as the wombat was housed with other marsupials including brush tailed possums and three species of macropod.

**Clinical Signs and Gross Pathology**
- Lethargy
- Numerous yellow-white foci in the liver
- Petechial and ecchymotic haemorrhages in the intestines and on peritoneal surfaces

**Microscopic Pathology**
- Acute multifocal necrosis in liver, lung, intestines, bronchial lymph node and lymphoid areas of the spleen
- Numerous hepatocyte and some enterocyte nuclei contained inclusion bodies
- Ultrastructural findings: Degeneration and necrosis of hepatocytes with viral procapsids, nucleocapsids and paracrystalline arrays in the nuclei and enveloped virus particles in cytoplasm. These viruses were consistent in appearance and size with herpesviruses.

**Diagnostic Pathway**
The current routine techniques are histology, electron microscopy, virus isolation and PCR from frozen and fixed tissues.

**Encephalomyocarditis virus (EMC virus, Family: Picornaviridae)**

**Significance**
Three fatal cases of EMC virus infection in captive common wombats were described in 2001. EMC is zoonotic however there are no published reports of human cases in Australia.

**Clinical Signs and Gross Pathology**
- Sudden death
- Focal or diffuse myocardial pallor, especially ventricles. Sometimes no gross myocardial lesions.
- Pulmonary congestion

**Microscopic Pathology**
- Necrotising non-suppurative myocarditis, with or without myocardial fibrosis
- Pulmonary and hepatic congestion and pulmonary oedema

**Diagnostic Pathway**
Histology of fixed tissues, immunofluorescence, serology, and virus isolation from fresh/ frozen tissues.

**References**


BACTERIAL DISEASES

Tyzzer’s disease

Agent
- *Clostridium piliforme* is a gram-negative obligate intracellular spore-forming rod bacteria that infects the digestive tract and spreads to other tissues, most notably the liver and heart.
- Faecal oral transmission most likely.
- Wide host range and is found globally. Infection is usually subclinical.

Significance
- Caused the death of a hand-raised, 30 week old common wombat (Hum & Best 1988).

Clinical Signs and Gross Pathology
- Convulsions, depressed, hyperthermic and jaundiced.
- Yellow ascites, enlarged, friable liver with multifocal haemorrhage and grey-white foci.

Microscopic Pathology
- Multifocal necrotising hepatitis composed of centres of cellular debris surrounded by coagulative necrosis of hepatocytes.
- Warthin-Starry stain revealed bacteria consistent with *C. piliforme* within lesions and hepatocytes.

Diagnostic Pathway
- Histology, Silver stains (e.g. Warthin Starry) or Giemsa, GMS, Immunohistochemistry, PCR. Will not grow on cell free media.

Other bacterial infections
- *Staphylococcus* and *Streptococcus* have been associated with traumatic injury and sarcoptic mange, and may become systemic if left untreated (Skerratt et al 1999).
- *Salmonella* has been associated with enteritis, sometimes leading to death (Doube 1982).
- *Leptospira interrogans* ser. pomona has been associated with microscopic interstitial nephritis in wild wombats, and natural infections appear largely subclinical (Munday & Corbould 1973). However experimental infection of two wombats with this serovar was associated with depression, anorexia, and jaundice; histologically nephrosis or subacute interstitial nephritis was seen, with leptospires present within the renal tubules (Munday & Corbould 1973). Serological evidence to multiple serovars has been reported in common wombats in Victoria, however wombats were not considered to act as significant reservoirs of this disease (Durfee & Presidente 1979; Hartley & English 2004).
- *Dermatophilus congolensis* reported as a cause of dermatitis in a captive common wombat (Presidente 1982).
- *Helicobacter* spp. have been identified in the lower gastrointestinal tract of the common wombat, not associated with significant pathological changes (Coldham 2004).

References


FUNGAL DISEASES

Adiaspiromycosis

Agent

- Pulmonary adiaspiromycosis in wombats is caused by Emmonsia (Chrysosporium) parva, a dimorphic fungus.
- Aleuriospores of Emmonsia are ubiquitous and soil borne, and on inhalation form thick-walled non-replicating adiaspores in host tissues which continue to increase in size with time.

Significance

- Report as both an incidental finding at post mortem and as a cause of interstitial pneumonia in some individuals (Doube 1982, Mason & Gaughwin 1982; Nimmo et al 2007).
- The habitat and burrowing habits of the wombat is thought to render them prone to infections.
- Infection of wombats is thought to occur when they are pouch young, and a linear increase in Emmonsia spherule size with increasing wombat age has been observed (Mason and Gauhwin 1982).

Clinical Signs and Gross Pathology

- Infection is usually subclinical, but may be associated with pneumonia.
- Gross findings have ranged from minimal change, to pale consolidation of ventral lung lobes with mucopurulent exudate in the bronchi and bronchioles (Mason & Gauhwin 1982; Nimmo et al. 2007).

Microscopic pathology

- Mild to moderate histiocytic interstitial pneumonia and fibrosis with intralesional adiaspores.
- Adiaspores occur free within alveolar luminae or more commonly within multinucleated alveolar macrophages; spores are round, refractile, and measure 22 - 35 µm in diameter, with a thin 1-2 µm thick lightly basophilic translucent capsule.

Other fungal diseases

- Reported case of overgrowth of Candida albicans in the stomach of a hand-raised pouch-young common wombat causing death (Doube 1982).
- Pneumocystis jiroveci (previously carinii) was associated with microscopic pneumonia in a common wombat with lymphosarcoma and sarcoptic mange (Skerratt 1998).
- Dermatomycosis and cryptococcosis have been reported in the common wombat (Ladds 2009).
References


PROTOZOAL PARASITIC DISEASES

Toxoplasmosis

Agent

- Toxoplasma gondii is an apicomplexan parasite with a global distribution and wide host range, including humans.
- Marsupials are particularly susceptible to severe toxoplasmosis leading to death.

Significance

- Toxoplasmosis is the second most important infectious disease known of wombats after sarcoptic mange.
- A serological survey near Sydney found 26% of 23 wild common wombats with evidence of previous exposure to T. gondii (Hartley and English 2005). The natural history of the disease in wombats is similar to other marsupials.

Clinical Signs and Gross Pathology

- Lethargy, anorexia, weight loss and respiratory and neurological signs.
- Sometimes rapid severe morbidity and death.


- Alveolar oedema and multifocal predominantly histiocytic pulmonary inflammation.
- Multifocal interstitial mononuclear inflammation, necrosis and dystrophic calcification of myocardium.
- Granulomata and perivascular cuffing composed of histiocytes and lymphocytes and focal areas of necrosis in the brain.
- Mononuclear inflammation and calcification in skeletal muscle and necrosis of the muscle layer of the small intestine.
- Tachyzoites and tissue cysts seen throughout or near these lesions

Diagnostic Pathway

The current routine techniques are histology, serology using direct and modified agglutination tests, immunohistochemistry and PCR from serum and frozen and fixed tissues.

References


Coccidiosis

Agents
- *Eimeria arundeli*, *E. ursinus* and *E. wombati*

Significance
- Many infections are innocuous.
- Clinical enteric infections associated with post weaning period and immaturity, also concurrent infections (e.g. Salmonellosis).
- *E. arundeli* has been associated with severe enteritis and death in two captive juvenile common wombats (Hum et al 1991).
- *E. ursinus* and *E. wombati* have been associated with microscopic enteritis, as has *E. arundeli*, but these infections were subclinical (Hum et al 1991, Skerratt 1998).

Clinical Signs and Gross Pathology
- Green mucoid to liquid or pasty foul smelling faeces, weight loss and bloating (Hum et al 1991).
- Diarrhoea may or may not be a feature.
- Distal small intestinal contents yellow and mucoid.
- Thickening of distal small intestine with mottled yellow white areas raised above surrounding mucosa.
- Intestinal anal prolapse seen in one case (Ladds 2009).

Microscopic Pathology
- *E. wombati* in southern hairy-nosed wombats (Barker et al 1979).
  - Intraloesional coccidian gametotogenous stages in the duodenum and lower intestine
  - Microgametocytes 208 x 177 μm and full of swirling microgametes; Macrogametes up to 100 μm; oocysts up to 65 x 39 μm
  - Lesions in mucosa and submucosa, associated with villous hypertrophy and hyperplasia of underlying connective tissue
- *E. arundeli* in common wombats (Barker et al 1979; Hum et al 1991)
  - Lamina propria of the small intestine distending with microgametocytes and developing oocysts
  - Microgametes159 μm diameter and macrogametes seen in hypertrophic cells of the lamina propria.
  - Oocysts 56 x 32 μm
- Schizonts not commonly reported – seen in the lacteals of a sick young wombat that died (Glastonbury 1994).

Diagnostic Pathway
The current routine techniques are histology, serology using direct and modified agglutination tests, immunohistochemistry and PCR from serum, frozen and fixed tissues.
Other protozoal parasitic diseases

- Trypanosomes have been seen in blood smears and detected by PCR in the blood of wombats but are likely to be non pathogenic (Clark 2004, Noyes et al 1999).

References


METAZOAN PARASITIC DISEASES

Helminths

A number of helminth parasites have been described in the wombat. Most are non-pathogenic.

See Table 1. Helminth parasites described in wombats.
Table 1. Helminth parasites described in wombats

<table>
<thead>
<tr>
<th>Nematodes</th>
<th>Location</th>
<th>Species affected</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Strongyloides spearei</em></td>
<td>Intestinal epithelium</td>
<td>Common wombat, SHN wombat</td>
<td>Disease has not been described in wombats in the wild. However, an immature common wombat in captivity with a heavy infection, weight loss and hypoproteinaemia was cured and recovered after anthelmintic treatment.</td>
</tr>
<tr>
<td><em>Oesophagostomoides</em></td>
<td>Colon, may occur in large numbers</td>
<td>Common wombat, SHN wombat, NHN wombat</td>
<td>Feed on gut contents, not thought to be pathogenic.</td>
</tr>
<tr>
<td><em>Macropostrongyloides</em></td>
<td>Colon and caecum, may occur in large numbers</td>
<td>SHN wombat, common wombat</td>
<td>Appears to feed on blood, may therefore be a potential pathogen (Beveridge &amp; Mawson 1978).</td>
</tr>
<tr>
<td><em>Phascolostrongylus</em></td>
<td>Colon, may occur in large numbers</td>
<td>Common wombat</td>
<td>Feed on gut contents, not thought to be pathogenic.</td>
</tr>
<tr>
<td><em>Baylisascaris tasmaniensis</em></td>
<td>Viscera</td>
<td>Common wombat</td>
<td>Wombat is the intermediate host. Granulomas 1-2mm in diameter containing nematode larvae of ascarid type in wall of intestine, mesentery, spleen, liver, kidney, heart and lung (Munday &amp; Gregory 1974).</td>
</tr>
<tr>
<td><em>Marsupostrongylus coulstoni</em></td>
<td>Airways of the lung</td>
<td>Common wombat</td>
<td>No association with significant pulmonary disease (Skerratt 1998).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cestodes</th>
<th>Location</th>
<th>Species affected</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Paramoniezia johnstoni</em></td>
<td>Small intestine</td>
<td>Common and SHN wombats</td>
<td>Not thought to be pathogenic.</td>
</tr>
<tr>
<td><em>Phascolotaenia comani</em></td>
<td>Small intestine</td>
<td>Common wombat</td>
<td>Not thought to be pathogenic.</td>
</tr>
<tr>
<td><em>Progamaotaenia spp.</em></td>
<td>Bile ducts</td>
<td>Common and SHN wombats</td>
<td>Cestodes occasionally found in the bile ducts associated with hyperplasia and fibrosis (Doube 1982; Presidente and Beveridge; Canfield and Hartley 1992).</td>
</tr>
<tr>
<td><em>Echinococcus granulosus</em></td>
<td>Hydatid cysts in lung or liver</td>
<td>Common wombats</td>
<td>Only in common wombats from Victoria (Jenkins 2006). Low prevalence/ absence of hydatid infection in wombats from many areas may imply that they, unlike kangaroos and wallabies, are not an important intermediate host.</td>
</tr>
<tr>
<td><em>Taenia hydatigena</em></td>
<td>Liver</td>
<td>Common wombat</td>
<td>Wombat is an aberrant host with limited parasite development. Lesions include subcapsular granulomas and tracts (Presidente 1979).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trematodes</th>
<th>Location</th>
<th>Species affected</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Fasciola hepatica</em></td>
<td>Liver</td>
<td>Common wombats</td>
<td>Infestation associated with extreme fibrosis of the bile ducts and liver parenchyma through which flukes have migrated. Although common wombats are not likely to be a major reservoir host, the pathological reaction appears to be more extreme than in most other marsupials (Spratt et al 2008).</td>
</tr>
</tbody>
</table>

SHN = Southern hairy-nosed; NHN = Northern hairy-nosed
References


ARTHROPOD PARASITIC DISEASES

Sarcoptic mange (Courtesy Dr Lee Skerratt)
Sarcoptic mange is a cosmopolitan disease of mammals caused by the astigmatid mite Sarcoptes scabiei. There have been numerous studies of sarcoptic mange in domestic animals and in humans where the disease is referred to as scabies. In contrast there have been few studies in free-living mammals although it is an emerging disease of wildlife throughout the world. The mite originates from a human ancestor and is thought to have spread to domestic and then free-living animals (Skerratt 2005).

Significance
This is the most significant disease of common wombats in terms of conservation and welfare (Skerratt 2002, Skerratt et al 1998, 2002). It also occurs in southern hairy-nosed wombats but has not been reported from northern hairy-nosed wombats (Martin et al 1998). Sarcoptic mange is distributed throughout the range of the common wombat. Point prevalence of the disease is generally low, with less than 5% of wombats in a population affected (Skerratt et al 2004b). This level of endemic disease appears to slow or halt population recovery. Whilst mange epizootics are sporadic, they have the potential to dramatically reduce wombat abundance and threaten the survival of small, remnant populations of wombats (Skerratt 2005). There are no fixed genetic differences among S. scabiei from wombats, dogs or humans or from different localities. Nor is there significant phylogenetic divergence among mites from different hosts or localities. This suggests recent transfer of this mite to wombats probably after European arrival given the mass mortality of wombats due to sarcoptic mange reported in New South Wales early last century. In support of this is the ready
transfer of mites from wombats to humans who handle dead mangy wombats (Skerratt and Beveridge 1999). These mites are able to survive for some time and cause moderate dermatitis in humans.

**Clinical Signs and Gross Pathology**

Initial signs of mange are erythema followed by parakeratosis, alopecia, excoriation and fissuring of parakeratotic crust and skin (Skerratt 2003a). The number of mites and the severity of clinical signs, namely thickness of scale crust and the degree of alopecia are correlated and are symmetrical on each side of the body. In skin scrapings, mites are generally abundant. Severe sarcoptic mange causes emaciation, anaemia and starvation in wombats eventually leading to death. It also predisposes wombats to bacterial infection of internal organs and myiasis. These severely affected animals may try to feed during the day to meet extra energy demands of the disease and are often easily approached (Skerratt et al 1999, 2004a).

**Microscopic Pathology**

There are marked epidermal changes of spongiosis, acanthosis and rete-ridge formation with thick adherent parakeratotic scale also containing neutrophilic debris, bacteria and numerous mites (Skerratt 1998). Eosinophils may be present in the dermis suggesting that a Type I (immediate) hypersensitivity response may develop after a Type IV (delayed) hypersensitivity response and some immune tolerance may occur with severe infections (Skerratt 2003b).

**Differential Diagnosis**

Moderate to severe sarcoptic mange has a pathognomonic appearance of thick parakeratotic scale and musty smell. Mild cases could be confused with bite wounds along the back due to intraspecific aggression or infestations with other specific wombat mites such as *Acaroptes vombatus* which has been associated with mild dermatitis (Skerratt 2001). The distribution of lesions usually differs with sarcoptic mange occurring predominately on anterolateral surfaces whereas the others occur mainly dorsally.

**Diagnostic Pathway**

The current routine techniques are examination of skin scrapings and parakeratotic crusts in sealed petri dishes under a dissecting microscope and histology.

**References**


Other arthropod parasitic diseases

- **Ticks**
  - Aponomma auruginans is found frequently on common wombats. Tick burdens may be quite heavy and a significant reaction to tick bites may occur (Skerratt 1998).
  - Ixodes tasmani, I. cornuatus and I. victoriensis are also found on common wombats.

- **Fleas**
  - Two species of Lycopsylla fleas occur only on wombats.
  - Stick-fast fleas (Echidnophaga spp.) are commonly found on wombats, particularly the southern hairy-nosed wombat, on which they occur in clusters along the belly. Five species occur on this host, three of them being restricted to this host species. Heavy infections may cause mild dermatitis (Spratt et al 2008).

References


TOXICOSIS

- Sodium fluoroacetate “1080” has an LD₅₀ of 1.5mg/kg and causes heart failure.

- Suspected pyrrolizidine alkaloid in Southern hairy-nosed wombats (Woolford et al 2011)
  - Syndrome of hair loss and dermatitis recently observed in southern hairy-nosed wombats in the Murraylands population in South Australia.
  - Clinical signs and gross pathology in two juvenile females included:
    - Extensive dorsal and lateral symmetrical alopecia and exudative and haemorrhagic dermatitis with sparing of the ventrum. Similar dermatitis over dorsum of the head, ears and periorbital region
    - Poor body condition
    - Secondary bacterial skin infections
    - Icterus (one animal)
    - Altered grazing habits (grazing during the day)
Microscopic pathology
- Skin of dorsal and lateral body, eyelids and ears: superficial dermal neutrophilic vasculitis, thrombosis and ischaemic dermal necrosis
- Liver: periportal fibrosis, bile ductular hyperplasia, cholestasis, hepatocytic anisocytosis, anisokaryosis with variable megalocytosis and/or non-suppurative or necrosuppurative multifocal random hepatitis.
- The combined superficial dermal vasculitis, ischaemic necrosis of sun-exposed hair-poor skin, and severe liver disease suggests hepatogenous photosensitisation
- Liver lesions most suggestive of pyrrolizidine alkaloid or aflatoxicosis.

- Oxalate poisoning
  - Oxalate crystals of unknown significance are reported in the kidneys and bladder of wombats (Hartley 1991).

References


PHYSICAL INJURY

- Physical injury due to road trauma is probably the most common disease or cause of mortality seen by the public.
- Fight wounds from other wombats are common but sometimes can be due to predators.
- Trapping injuries can occur if animals are caught in cage traps (Skerratt 1998, 2001, Skerratt et al 2004b, Bryant & Reiss 2008).

Hyperthermia

- Wombats are very susceptible to hyperthermia.

References


DEGENERATIVE DISEASES

- Wombat teeth grow continuously so any disruption to normal tooth wear will lead to malocclusion and impair feeding ability (Doube 1982, Bryant & Reiss 2008, Fowler 2011).
- Hypertrophic cardiomyopathy occurred in a 10 year old captive common wombat (Machida et al 1997).

References


NEOPLASTIC DISEASES

- Multicentric lymphosarcoma has been reported in wombats, in one case associated with severe sarcoptic mange and Pneumocystis jiroveci infection (Skerratt 1998). In another animal, the tumour was also leukaemic (Canfield et al. 1990).
- Fibropapilloma of the skin of unknown site (ARWH via Ladds 2009).
- Adenocarcinoma of the mammary gland and bile duct (Munday 1988).

References


NUTRITIONAL DISEASES

These are diseases seen in captive wombats associated with inappropriate diets. These diseases appear to have disappeared with the advent of better diets and husbandry of wombats (Skerratt et al 1997, Bryant and Reiss 2008).

- Copper toxicity (Vanselow & Barboza 1988; Barboza & Vanselow 1990)
  o Acute intravascular haemolysis and death reported in a captive southern hairy-nosed wombat previously maintained on an experimental diet containing a vitamin/mineral supplement high in copper.
  o No clinical illness observed prior to death. Gross findings included haemoglobinuria, severe generalised jaundice, dark brown discolouration of the kidneys, and the liver
had a lobulated pattern.
  o Histological findings in the kidney include haemoglobin within the glomerular space, renal tubules and haemoglobin casts blocking the straight collecting ducts. Other tubules empty and dilated.
  o Histological findings in the liver included congestion, hepatocyte enlargement, anisokaryosis and granular cytoplasm.
  o Copper levels in the affected animal’s liver (1166ppm) were 87 times those of wild wombat livers and the experimental diet had approximately four times as much copper as the natural pasture habitat in the wild.

- Hypervitaminosis D is reported in young common wombats following excessive feeding of milk replacer diets. Lesions included osteodystrophy, especially of the skull and mandible, nephrocalcinosis and other soft tissue mineralisation (Obendorf 1989).

- Lactose excess or intolerance may be associated with cataract formation in wombats (Ladds 2009).

References


SYNDROMES OF UNCERTAIN AAETIOLOGY

There are a number of individual cases where the cause of the pathology was not determined such as meningitis or intussusception especially in orphaned hand-raised joeys where husbandry was not adequate (for list see Doube 1982, Skerratt 1998, Bryant and Reiss 2008 and Ladds 2009).

References


