Diseases of pet rodents

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ABSTRACT

The main pet rodent species are introduced with some brief notes on their suitability as pets and normal behaviour. The general clinical features of disease are discussed with some emphasis on species variation. The important diseases that occur in the United Kingdom are described under the headings of respiratory disease, diseases of the alimentary tract, diseases of the central nervous system, skin lesions, musculo-skeletal disorders, palpable swellings, urinogenital disorders, diseases of pregnancy and injuries.

INTRODUCTION

Although the hamster is probably still the most widely kept pet rodent, the advantages of the Mongolian gerbil are now becoming apparent and it is possible that this species will overtake the hamster in popularity.

Gerbils have periods of activity at dawn and at dusk—just when children are most likely to be around to observe them. They are far less aggressive than hamsters, to both their handlers and other members of their own species, and consequently they can be kept in family groups, from which children can observe the elements of reproduction. One disadvantage is that they do not have such a variety of coat colours and textures as the hamster, although recently white and black mutations have occurred and more varieties are likely to become available in the future.

The guinea-pig will continue to appeal to many as a pet, but the size of this species makes it unsuitable for indoor living and an open run in a garden is usually necessary. There are many interesting and attractive coat colours and textures in the species.

The mouse is an endearing creature and very easily handled, although most people find the smell makes it an unacceptable household pet. It is important, however, as are the hamster and the guinea-pig, in the fancy and show world.

The rat is underrated as a pet. It becomes very tame with handling and, of the rodent species, will be most responsive to kindness and attention. It is quick to learn (being used by behaviourists in maze learning experiments) and is frequently the favourite species of animal technicians who work constantly with a wide range of animals.

CLINICAL EXAMINATION

The clinical examination of rodents presents greater problems than in most species. Careful questioning about the history of both the individual and the group amongst which it is kept should provide most of the available information. A knowledge of the demeanour of the normal animal is essential before conclusions about abnormalities can be drawn. Rats, for example, spend most of the daylight hours curled up with their heads tucked under their abdomens. Hamsters and gerbils build quite elaborate nests and will be extremely difficult to observe when resting. Mice usually nest only when rearing young but, if kept in groups will, like rats, curl up together in a corner of the box. Guinea-pigs, if exposed to sudden unfamiliar sounds, will freeze for up to 20 min (Miller & Murray, 1966) but sudden movements will cause them to flee. They will scatter in different directions if a hand is quickly put into their box.

Mice are rapid movers and some strains or lines will jump remarkable distances if threatened by unusual or sudden movements. Gerbils also, by comparison with the more sluggish hamsters and rats, will show astonishing turns of speed.

There is also great variation in normal coat appearance between the different species. The mouse and guinea-pig (with the exception of Abyssinian, Peruvian and Angora varieties) should have sleek shiny coats while rats, and to some extent gerbils, normally have much rougher looking coats.

The smaller rodents when sick or moribund have a hunched appearance with back arched and head held low; they are reluctant to move even when gently pushed with the hand. Hamsters tend to become even more aggressive when sick.

Rodents are generally meticulous in their grooming habits and the presence of soiling either at the ocular, nasal and oral orifices or in the perineal and ventral abdominal region is a clear indication of disease. These discharges may also be seen on the front feet as a result of grooming. There may be a build up of sebaceous secretions on the tails of older rats and in the circumanal region of old male guinea-pigs. These are fairly common features in normal animals.

Guinea-pigs have at least eleven different calls which are frequently used and play an important part in social organization (Berryman, 1970) and gerbils have a foot stamping behaviour which is used as a warning communication. Other

rodents are generally silent except when fighting. Therefore, listening for sounds may be a valuable aid in clinical examination. Sneezing and snuffling are frequent accompaniments to respiratory disease; chattering in mice and slow rhythmic deep clicking in hamsters are characteristic of such disease in these species.

Handling of rodents for further examination or palpation is fraught with difficulties for the inexperienced. However, a half day's instruction of nursing staff by experienced animal technicians should solve most of the problems. Handling will be necessary to check teeth, to palpate swellings and to make a closer examination with a hand lens or dissecting microscope for external parasites. Palpation for pregnancy is possible in all species by gently using the thumb and forefinger through the abdominal wall. Great care should be taken in handling gerbils which are highly susceptible to epileptic seizures and also heavily pregnant guinea-pigs for reasons that will be given later.

Diagnosis often finally rests on laboratory tests and post-mortem examinations. Sacrificing one animal prior to death, distressing though this may be to the owner, may help to prevent disease in the rest of the colony. Rapid post-mortem autolysis, particularly in mice, makes speedy examination essential.

RESPIRATORY DISEASE

Viral infections of the respiratory tract are inapparent in some situations, but they may give rise to outbreaks of acute disease with high rates or mortality. Sendai virus may be important in all the rodent species and pneumonia virus of mice affects mice, hamsters, and rats causing an interstitial pneumonia (Blackmore, undated). Rat corona virus also causes interstitial pneumonia in rats and a closely related virus, sialodacryoadenitis virus (SDA), causes necrosis of the ducts of the salivary and Harderian glands (Jonas *et al.*, 1969). Damage to the Harderian gland results in periorbital porphyrin deposits and corneal ulceration.

Although infection with viruses does not inevitably lead to acute respiratory disease, it may be an important factor in the aetiology of chronic respiratory disease of mice and rats (Fig. 1); *Mycoplasma pulmonis* is frequently involved in this condition (Cassell & Hill, 1979). Bacteria such as *Pasteurella pneumotropica*, *Bordetella bronchiseptica*, *Corynebacterium murium* (Fig. 2), *Klebsiella* spp., *Pneumococcus* spp. and *Streptococcus* spp. may also play a part.

By far the most important organism in guinea-pig respiratory disease is *Bordetella bronchiseptica*, which can cause explosive outbreaks of mortality affecting particularly young weaners and pregnant females (Woode & McLeod, 1967). This usually occurs in conditions of poor ventilation and high ambient temperatures.

Extreme caution should be taken in the case of antibiotic treatment of guinea-pigs, only broad spectrum antibiotics should be used in this species (never penicillin) as the disturbance of the balanced gut flora caused by eliminating just

FIG. 1. Rat lung—left lobe with multiple abscesses characteristic of chronic respiratory disease.

FIG. 2. Mouse lung with necrotic foci caused by *Corynebacterium murium*.

the gram positive organisms can be rapidly fatal. Chloramphenicol at the rate of 60 mg/day for an adult animal of this species is thought to be safe.

ALIMENTARY TRACT DISEASE

The continuous growth of rodent teeth presents problems of overgrowth when malocclusion occurs or when the opposing tooth is lost or broken. The natural curvature of the upper incisors results in the teeth growing into the palate in extreme cases. Regular clipping can alleviate the problem.

The lower molar teeth of guinea-pigs sometimes grow towards the mid-line trapping the tongue, resulting in severe ptyalism and eventually starvation. Chronic fluorosis has been suggested as the cause of this condition by Hard & Atkinson (1967) in Australia but dietary factors such as folic acid deficiency are more likely to play a part in this country (Reid, Martin & Briggs, 1956).

Diarrhoea in pre-weaning mice may be associated with a number of viruses. A rotavirus, epizootic diarrhoea of infant mice (EDIM) has a high morbidity but deaths usually only occur because of secondary impaction of the rectum. Lethal intestinal virus of infant mice (LIVIM) is now thought to be a strain of mouse hepatitis virus (MHV) (Carthew, 1977). Reo III virus can cause an oily yellow diarrhoea, again in infant mice, but is rarely fatal.

Of the bacterial infections, *Bacillus piliformis* causing Tyzzer's disease, is the most devastating and is invariably associated with some form of stress. A transient diarrhoea followed by rapid death is the common feature in most species (Ganaway, Allen & Moore, 1971). Characteristic focal liver necrosis is found in mice (Fig. 3), gerbils and guinea-pigs (Sparrow & Naylor, 1978). In the rat and hamster, however, necrosis of the heart is a more constant finding. In all species the organisms can be demonstrated in the villi of the small intestine and at the borders of necrotic lesions by silver impregnation staining methods. Treatment with antibiotics has been reported as effective in limiting an outbreak, but the disease tends to be self-limiting, most of the deaths occurring within 3 weeks.

Salmonella infections most commonly occur in guinea-pigs although all species are susceptible. *S. typhimurium* and *S. enteritidis* are the serotypes most frequently recovered. Rapid death may be the only sign (diarrhoea is rare). In peracute cases there may be no lesions at necropsy, but in more chronic cases focal necrosis of spleen, liver and mesenteric lymph nodes occurs and occasionally secondary peritonitis, pleurisy or pericarditis. Isolation of the organism from the heart blood or spleen will confirm a provisional diagnosis.

Yersinia pseudotuberculosis is another important infection of the guinea-pig in particular and is associated, as salmonellosis often is, with feeding green food contaminated with bird droppings. In the acute septicaemic form, death can occur in 24 hours but the classical pseudotubercular lesions are of a more chronic nature (Fig. 4) and death is preceded by diarrhoea and emaciation. The organism may also be responsible for cervical lymphadenitis. Humans can become infected

FIG. 3. Multiple necrotic foci in mouse liver each with haemorrhagic centre—Tyzzer's disease *Bacillus piliformis*.

FIG. 4. *Yersinia pseudotuberculosis*—granulomatous lesions in lung, liver and spleen of a guinea-pig.

with this organism. Therapeutic measure for these two zoonotic diseases are ineffective and the only rational approach is one of prevention.

Mouse hepatitis virus can cause high losses in a colony (Calisher & Rowe, 1966). The typical liver lesions may be confused with those of Tyzzer's disease and serological confirmation is necessary. Only the mouse is affected. A summary of the respiratory and enteric pathogens in the different species is given in Tables 1 and 2.

TABLE 1. Respiratory pathogens

Organism	Mouse	Hamster	Gerbil	Rat	Guinea-pig
Sendai virus	+++	+	?	+++	+
Pneumonia virus of mice (PVM)	++	++	—	+	—
Rat corona virus (RCV)	—	—	—	++	—
Sialodacryoadenitis (SDA)	—	—	—	++	—
<i>Mycoplasma pulmonis</i>	+	—	—	+++	—
<i>Pasteurella pneumotropica</i>	++	+	+	++	+
<i>Bordetella bronchiseptica</i>	+	+	?	+	+++
<i>Corynebacterium murium</i>	++	—	—	+	—
<i>Klebsiella pneumoniae</i>	+	+	?	+	++
<i>Streptococci</i> spp.	++	?	?	+++	+

+ Animals may become infected; ++ clinical disease seen; +++ can cause heavy mortality.

TABLE 2. Enteric pathogens (excluding parasites)

Organism	Mouse	Hamster	Gerbil	Rat	Guinea-pig
Rotavirus (EDIM)	++	—	—	+	—
Coronavirus (MHV)	+++	—	—	—	—
Reo III virus	++	—	—	+	+
<i>Bacillus piliformis</i> (Tyzzer's disease)	+++	+++	+++	+++	+++
<i>Salmonella</i> spp.	+++	+	+	+	+++
<i>Yersinia pseudotuberculosis</i>	+	?	?	+	+++

+ Animals may become infected; ++ clinical disease seen; +++ can cause heavy mortality.

There are numerous intestinal parasites in the different species; Table 3 gives a list of the more common ones. Only a few deserve special mention here. Heavy infestations of *Hexamita* and *Giardia* species (flagellates) may be responsible for diarrhoea, emaciation and death in mice (Sebesteny, 1969) and hamsters. The load of these organisms may be reduced by adding metronidazole to the diet. The disease called 'wet-tail' in hamsters may be caused by these organisms. It is almost

TABLE 3. Enteric parasites

Organism	Mouse	Hamster	Gerbil	Rat	Guinea-pig
Protozoa					
<i>Hexamita</i> spp.	++	++	—	+	—
<i>Giardia</i> spp.	++	++	—	+	+
<i>Trichomonas</i> spp.	+	+	+	+	+
<i>Entamoeba</i> spp.	+	+	+	+	+
<i>Eimeria</i> spp.	++	—	—	++	++
Roundworms					
<i>Aspicularis tetraptera</i>	+	+	—	+	<i>Paraspidodera</i>
<i>Syphacia obvelata</i>	+	+	—	+	<i>uncinata</i>
<i>Capillaria hepatica</i>	++	—	—	—	—
Tapeworms					
<i>Cysticercus fasciolaris</i>	+	—	—	+	—
<i>Hymenolepis nana</i>	++	++	?	+	—
<i>Hymenolepis diminuta</i>	+	+	—	+	—

+ Animals may become infected; ++ clinical disease seen; +++ can cause heavy mortality.

certain, however, that this condition is merely a manifestation of enteric disturbance which may have a number of different causes.

The cestode *Hymenolepis nana* is unusual in having a direct life cycle. Very heavy infections in mice and hamsters may lead to diarrhoea and unthriftiness. Cysts of *Cysticercus fasciolaris* (the intermediate stage of the cat tapeworm, *Taenia taeniaeformis*), may be seen in the liver of mice and rats at necropsy (Fig. 5) but do not cause clinical disease.

Coccidiosis can occur in mice, rats and guinea-pigs and is caused by heavy infections of *Eimeria* spp. *E. pragensis* in mice, *E. mieschulzi* and *E. mayani* in rats and *E. caviae* in guinea-pigs are the most pathogenic and cause loss of weight, dysentery and, in extreme cases, death (Owen, 1972). Strict hygiene to avoid sporulation of oocysts in bedding is the only satisfactory method of control.

DISEASES OF THE CENTRAL NERVOUS SYSTEM

Central nervous system diseases are manifested by head tilting, circling, convulsions and, occasionally, paralysis and generalized weakness. As infections of the middle ear may also produce symptoms of head tilting and circling they will be dealt with under this section.

Lymphocytic choriomeningitis (LCM) has attracted a lot of attention in pet hamsters in West Germany and in laboratory mice in the U.S.A. (Gregg, 1975).

FIG. 5. Mouse liver with cysts of *Cysticercus fasciolaris*.

No evidence has ever been found of this viral infection in hamsters in this country and the only experimental colony of mice known to have been infected has now been destroyed. In view of the important zoonotic hazard of the organism, however, symptoms of photophobia, paralysis and convulsions in mice and hamsters should be treated with suspicion and the advice of a diagnostic laboratory sought. No treatment is advised; affected and in-contact animals should be destroyed.

Theiler's disease in mice with symptoms of flaccid paralysis of the hind limbs is also caused by a virus (Calisher & Rowe, 1966); symptoms occur in only a very small percentage of infected animals.

The protozoan parasite, *Encephalitozoon cuniculi*, is known to cause encephalitis in mice. Kidney and muscle lesions also occur. There is now serological evidence that other rodent species can become infected.

Spontaneous epileptic seizures occur in gerbils. These are easily induced if the animals are handled roughly or spun by the tail. The seizures last only a few minutes and the animals recover without apparent untoward effects. The white strain of gerbils is more resistant to seizures (Robbins, 1976).

Many of the organisms listed under respiratory disease may progress to the middle ear giving rise to a purulent otitis media and symptoms of head tilting and circling.

There is a relatively high incidence of congenital hydrocephalus in mice and rats; the domed shape of the head makes this condition recognisable clinically.

Fungicides and pesticides routinely used in the treatment of imported timber can reach quite high levels in sawdust used as bedding. The possibility of these contaminants must be considered in cases of central nervous system disturbance.

SKIN LESIONS

External parasites are probably the most common cause of dermatitis and pruritus in rats, mice and guinea-pigs. *Mycoptes musculinus* affects the neck and back of mice and *Myobia musculi*, the head and face of mice and rats (Fig. 6). A less common mange mite in rats is *Notoedres muris*, which primarily affects the borders of the pinnae. The two *Demodex* spp., *D. aurati* and *D. criceti*, occur in all hamsters but only very heavy infestations lead to clinical signs, again mainly on the head and neck. There has been one reported case of *Demodex* infestation in the gerbil. The guinea-pig mite, *Trixacarus caviae*, is very similar in morphology to *Sarcoptes scabiei* and can cause quite extensive lesions in this species. It is believed that *Sarcoptes scabiei* can infest all rodent species but reports of this mite are rare. Guinea-pigs are much more frequently infested with lice than with mites, three occurring quite regularly (*Gyropus ovalis*, *Gliricola porcelli* and *Chirodiscoides caviae*). Pruritus and alopecia may occur with very heavy infestations.

Polyplax spinulosa is a species of louse that infests the rat. It can cause severe irritation that is exacerbated by scratching. *P. serrata* in the mouse is much rarer.

The presence of fleas in any of the rodent species is usually an indication of very poor management and hygiene.

FIG. 6. *Myobia musculi* in the rat. Most of the damage is self-inflicted.

Treatment of all external parasites is basically the same. It is generally easier to dip rodents than to dust them. We have found Allugan (0.07% solution) (Hoechst) to be effective in most disease outbreaks or Tetmosol (ICI) diluted 1 part in 13 with warm water.

The dermatophytes, *Trichophyton* spp. and *Microsporum* spp., have been reported in all species except the gerbil (Fig. 7). If treatment is contemplated, great emphasis should be placed on hygienic precautions to prevent transmission to the owners, particularly if young children are involved. Treatment with

FIG. 7. Ringworm (*Microsporum* spp.) in a mouse.

griseofulvin (30 mg/kg) daily in the food for 3 weeks may eliminate the infection but this must be accompanied by sterilization of cages and environment.

Mouse pox (Ectromelia virus) is fortunately rare in the UK. It affects only mice but can cause high losses in a colony. In the acute form of the disease death occurs without other clinical signs and focal necrotic lesions may be found on the liver and spleen. The chronic disease gives rise to typical pox lesions on the head, feet and tail (Fig. 8). Necrosis may be so severe that amputation of the tail or limbs occurs. This disease is highly contagious and infected colonies should be destroyed.

Staphylococcal dermatitis can occur in all species and can cause sub-cutaneous abscesses, usually as a result of fighting. In mice and rats, *Corynebacterium murium* is often responsible for these abscesses.

Alopecia of unknown aetiology frequently occurs in guinea-pigs, particularly in sows suckling a litter. This should not be confused with the vice known as

FIG. 8. Crusty pox lesions on the tail and feet of a mouse—Ectromelia virus.

'barbering' where animals chew at their own and cage-mates' hair. This is associated with low fibre diet and overcrowding (Paterson, 1972).

Rough coats, in conjunction with general loss of condition, in guinea-pigs may be due to vitamin C deficiency (Fig. 9). This is most common in the winter months when green food is less readily available. Addition of ascorbic acid (50 mg/l) to the drinking water will give dramatic results.

Some strains of mice also develop the vice of hair chewing. This is usually restricted to the muzzle area. A symmetrical alopecia seen in mice is probably of hormonal origin.

MUSCULO-SKELETAL DISORDERS

Mycoplasma arthritidis can cause arthritis in rats (Fig. 10). Although it may lead to ankylosis of the joint, the infection frequently subsides without apparent permanent damage (Cassell & Hill, 1979).

Arthritis in mice is more commonly associated with *Streptobacillus moniliformis* (Fig. 11). This organism can be difficult to culture but direct smears show characteristic morphology. The zoonotic importance of this disease should not be overlooked as it causes rat-bite fever in man.

Abscesses from which *Corynebacterium murium* and *Pasteurella pneumotropica*

FIG. 9. Guinea-pig on right with hyperaemia of ears and feet, rough coat and conjunctivitis is typical of avitaminosis C.

FIG. 10. Arthritis in the hind foot of a rat infected with *Mycoplasma arthritidis*.

FIG. 11. Arthritis in hock joint of a mouse infected with *Streptobacillus moniliformis*.

can be isolated occur in the deeper muscle tissue and occasionally the joints of mice.

Muscular dystrophy associated with vitamin E deficiency in hamsters can be reversed in the early stages by vitamin E therapy (West & Mason, 1958). Guinea-pigs with vitamin C deficiency can show severe lameness; necropsy examination reveals subcutaneous haemorrhages, particularly over the stifle joint.

Another type of lameness in guinea-pigs may be due to a painful myositis affecting the hind legs particularly (Saunders, 1958). A viral aetiology has been suggested for this condition. Hyperkeratosis of the foot pad in older guinea-pigs may lead to lameness. The aetiology is not fully understood but chronic irritation due to bad flooring or penetration of grass awns is the most likely cause.

PALPABLE SWELLINGS

Some mouse strains have a relatively high incidence of generalized lymphosarcoma with gross enlargement of all regional lymph nodes and enlargement of spleen and/or liver which can lead to gross abdominal distension.

Enlargement of cervical lymph nodes in guinea-pigs can be caused by *Yersinia pseudotuberculosis* but is more commonly caused by infection with *Streptobacillus caviae* (Smith, 1941). This organism is closely related to *S. moniliformis* and it is

not yet known whether it is pathogenic to man. The lymph nodes may ulcerate and eventually discharge copious quantities of pus. Regular palpation of the cervical region and culling affected animals from a colony is the only satisfactory method of control.

Impacted cheek pouches in hamsters often result from unsuitable food. They can be evacuated manually.

Mammary tumours, frequently malignant in mice and benign in rats, can affect any of the glands which, in mice, extend from the cervical to inguinal region. Hamsters can have up to twenty-two glands. Surgery can be successful, particularly in the rat where a large proportion of mammary tumours are fibromas.

URINOGENITAL DISORDERS

Proteinaceous plugs occluding the neck of the bladder or urethra and leading to urinary retention occur in mice, rats and guinea-pigs. Cystic and renal calculi are relatively frequent in rats and mice and are usually struvite.

Nephritis reaches a high incidence in rats and aged guinea-pigs and, in the latter species, may be the cause of the 'wasting syndrome' (Wagner, 1976). Congenital cystic nephrosis is common in mice. Mice can live for a surprising length of time with a congenital non-patent vagina, the first clinical sign being abdominal distension due to urinary retention.

A helminth of rats, *Trichosomoides crassicauda*, which lives as an adult in the bladder, has low pathogenicity but may predispose to cystic calculi and tumours (Chapman, 1964).

DISEASES OF PREGNANCY

The guinea-pig suffers from a number of conditions associated with parturition. Ketosis, also regarded as a 'pregnancy toxæmia' is a disease that is characteristic of old, obese, females in late pregnancy (Ganaway & Allen, 1971). Avitaminosis C, other nutritional factors and stress all play a part in the aetiology of this condition. Strict attention to diet, particularly to prevent obesity, will reduce the incidence of ketosis. Dystocia and stillbirth may be due to ketosis but foetal oversize is another common cause usually when the sow is carrying only one foetus. The guinea-pig neonate is an unusually large and relatively mature animal. This feature can result in preparturient uterine torsion and post parturient caecal torsion, particularly if the sow is subjected to rough handling; death follows rapidly.

INJURIES

Most injuries arise as a result of fighting. Hamsters are the most notorious and females sometimes effectively castrate their intended mates. Even guinea-pigs, however, may indulge in ear chewing.

Broken legs are fairly common in young guinea-pigs kept in grid floors. Gerbils can shed the ends of their tails if they are picked up by the tip of this appendage (rats tend to shed just the skin in similar circumstances).

Guinea-pigs, rats and hamsters are easily hurt by falls from great heights but mice and gerbils are more resistant to such maltreatment.

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