Chapter 8

DISEASE AND WELFARE

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Abstract: Both infectious and non-infectious disease have a major impact on the welfare of cats. The likelihood of an individual developing a particular disease will depend on a variety of factors including age, exposure, genetic make-up, and general nutritional and health status. Disease can impact on an individual, and can also affect a group or a population of cats. With our current understanding, and with the multi-factorial nature of risk factors, preventing most non-infectious diseases is very difficult so we have to rely on early diagnosis and appropriate treatment. Infectious disease, however, may be more easily preventable using a variety of strategies including vaccination, reduction of exposure and improving resistance to infection. Despite the difficulties in recognising signs of pain, especially chronic pain, in cats, the prevention and treatment of pain is of major importance, and the development of effective easy-to administer analgesics, especially those for long-term use, should be a major research priority in veterinary medicine.

1. INTRODUCTION

1.1 Infectious and Non-infectious Disease

Disease has a significant impact on the welfare of cats and, ultimately, disease of one type or another will lead to their death. Infectious disease is particularly associated with young cats, whose immune system is not fully developed, and those kept in large groups. It tends to affect several individuals within a group and is often persistent within it; clinical signs, however, may be sporadic in their occurrence. The likelihood of an individual acquiring an infectious disease, and the severity of the disease, can be significantly altered by the management systems that are in place. Non-infectious disease, apart from a number of inherited conditions, tends to

I. Rochlitz (ed.), The Welfare of Cats, 205–225.

affect individuals and can be classified as degenerative (for example chronic renal failure, dental disease), inflammatory (inflammatory bowel disease), management-associated (due to poor diet or access to toxins), traumatic (for example a road accident), neoplastic (due to tumours or tumour-associated syndromes) and idiopathic (for example hyperthyroidism, an endocrine disease). Management can affect the prevalence and severity of non-infectious disease as well as the cost, success of treatment and outcome. However, many other factors affect the likelihood of an individual developing disease, in particular its genetic background.

Acute disease can cause profound suffering but, if self-limiting or appropriately treated, the duration of suffering will be short and there tends to be no, or minimal, long-term effects on the individual's welfare. However, the possibility that disease and the treatment of disease, such as hospitalisation and forced medication, may have long-term welfare implications cannot be excluded. Chronic disease may cause less obvious symptoms and be more difficult to recognise (particularly in cats as they are able to modify their lifestyle according to their reduced physical capability), but may have far more profound long-term effects on welfare.

1.2 Effects of Body Form and Breeding

In recent years, cat breeding has led to a significant variation from the standard body form of the domestic short hair cats (see Chapter 10). In many cases, the impact on welfare has been related to the degree of inbreeding and a relatively small genetic pool, leading to certain diseases becoming more prevalent in a particular breed. In some cases, the body form associated with a breed can cause long-term welfare problems, for example respiratory obstruction in brachycephalic cats such as Persians. The desire of some breeders to emphasise breed characteristics has led to 'ultra' type cats, where inherent body form-associated problems have been compounded. There has been a significant increase in breeding from cats that have severe mutations in order to create a unique breed, for example Munchkin, kangaroo or twisty cats. Such mutations invariably give rise to severe welfare issues, as they cause both chronic disease and prevent the cat from being able to express natural behaviours such as jumping.

1.3 Impact of Infectious Disease on the Individual, Group and Population

Disease can have an impact on the welfare of cats at a number of different levels. At the individual level there may be both the physical effects of disease and treatment, preventing a cat from following its natural

behavioural patterns, and the psychological aspects of the disease and treatment. At the group level, disease can have an effect in three main ways: through spread to other individuals; altering the group dynamic so as to lead to disruption of social stability; and the whole group needing treatment and/or screening, whether or not all individuals are showing clinical evidence of disease. At the population level, disease has its effect mainly on the genetic make-up of that population. This can be a direct effect, associated with individuals dying from their disease or having passed on disease susceptibility to their offspring. An indirect effect can also occur, as attempts are made to breed away from a genetically associated disease with individuals being culled, or other, as yet unknown, disease problems being bred into the remaining group.

2. PRINCIPLES OF INFECTIOUS DISEASE PREVENTION

Disease prevention relies mainly on reducing risk factors. This can be achieved by a variety of methods such as providing correct nutrition (see Chapter 9), maintaining good general health, and in the case of infectious disease also by vaccination, screening and decreasing likelihood of exposure.

2.1 Vaccination

Vaccination, particularly primary vaccination, plays a central role in the control of infectious disease within populations. Not all individuals within a population, however, need to be vaccinated in order to achieve this benefit. Vaccination considerably reduces morbidity and mortality associated with an individual infectious agent, and therefore has a significant impact on improving welfare. Vaccination alone is not capable of controlling disease within a population, as the risk of an individual becoming infected by a particular agent is dependent upon the infectious dose, the virulence of the pathogen and the host immune response.

Vaccination serves to create an anamnestic response, such that when the vaccinated individual meets a field infection it produces a stronger and more rapid immune response than if unvaccinated (Schulz & Conklin 1998). If a protective immunity is achieved within the incubation period of the infection, the individual will show few, if any, clinical signs of disease. It is important to remember that vaccination does not prevent infection, hence vaccinated individuals can excrete the infectious agent, contaminating the environment, and they can also become carriers of the agent. However, in the majority of cases when a vaccinated individual becomes infected the

duration and level of excretion of the infectious agent is less, and the environmental contamination is therefore reduced. Thus, indirectly, vaccination will reduce the infectious dose within the group. Vaccination may impact on virulence, as it tends to promote evolution of the infectious agent away from the vaccine strain(s) and this could potentially increase virulence. It is clinical disease, however, that directly affects welfare so vaccination is a positive benefit to the population and to the majority of individuals.

Vaccination is not without risks (Greene 1998), although these are generally to the individual and most commonly occur as vaccine reactions (see next section). There is also the potential for modified live vaccines to cause clinical disease, if the vaccine is administered incorrectly or given to an immunocompromised or pregnant individual. There are reports of certain breeds, and cats infected with feline immunodeficiency virus (FIV), being more susceptible to vaccine-induced disease (Buonavoglia *et al.* 1993). Under rare circumstances, vaccination can be a risk to the welfare of the population as a whole if a batch of vaccine becomes contaminated with another agent. For example, it has been suggested that the worldwide, simultaneous occurrence of parvovirus infection in dogs could have been the result of vaccine contamination.

2.1.1 Vaccine Reactions

Whether or not to vaccinate is a balance between risks and benefits; risks to the individual of vaccination are primarily those of a vaccine reaction. Should large number of individuals within a population remain unvaccinated then the potential exists for an epidemic to occur.

Vaccine reactions are the most common adverse drug reaction reported to the Veterinary Medicines Directorate in the United Kingdom. To some extent vaccine reactions are to be expected, as some sort of response by the individual is necessary in order to stimulate the immune system or the vaccine is unlikely to be efficacious. What is classified as a vaccine reaction is also unclear, as low-grade malaise of less than 24 hours duration is not uncommon but many would not regard this as a vaccine reaction. A crude estimate is that around 3% of vaccinations result in ‘significant’ vaccine reactions, i.e. a reaction beyond 24 hours of low-grade malaise. The impact on the welfare of the individual, in the majority of cases, is short-lived. Recently, however, vaccination in cats has been linked to the development of vaccine-associated sarcomas (invasive soft tissue tumours) that develop at the site of vaccination, usually in the neck region of the cat. The risk has been calculated to be 1 in 10,000 (0.01%) vaccinations (Hendrick 1999). The consequences of a vaccine-associated sarcoma are severe and potentially

fatal. This has prompted the American Association of Feline Practitioners to recommend that vaccines should be given in the distal limbs of the cat (Levy *et al.* 2001), as a limb can be amputated should a sarcoma occur. Further, different vaccines are given at different limb sites in order to try and identify those vaccines associated with the development of sarcomas.

2.1.2 Infectious Diseases against which Vaccination is Available

There are an ever-increasing number of vaccines available on the veterinary market for use in cats. These include vaccines against the following infectious agents: feline parvovirus (also known as feline infectious enteritis, feline panleukopenia); feline herpes virus-1 (feline rhinotracheitis); feline calicivirus; rabies virus; *Chlamydophila felis* (Chlamydiosis, *Chlamydia psittaci*); feline leukaemia virus (FeLV); *Bordetella bronchiseptica*; feline coronavirus (feline infectious peritonitis); *Microsporum canis* (Ringworm, this is a post-exposure vaccine); *Borrelia burgdorferi* (Lyme disease); feline immunodeficiency virus (FIV) and *Toxoplasma gondii* (toxoplasmosis). Vaccines against all these agents are available in the United States, but in the United Kingdom the last five are not.

Few individuals are going to be vaccinated using all potential vaccines, hence it is necessary to decide which vaccines are most suitable for each individual. Likelihood of exposure, severity of disease, known risks of the particular vaccine and previous response of the individual to vaccination should be considered. There are also the effects of a particular infectious agent on the cat population as a whole to be taken into account. Whilst it would be ideal to risk assess each individual, this is rarely possible because so many factors are unknown. This has lead to the concept of ‘core’ and ‘non-core’ vaccines. In the United Kingdom, feline parvovirus and the respiratory viruses (feline rhinotracheitis and feline calicivirus) and sometimes feline leukaemia virus are considered core vaccines, while Chlamydophila and Bordetella are non-core and rabies virus vaccine is given according to need, for example if the cat is travelling abroad.

Concomitant with the debate on which vaccines to use, has been the debate on the frequency with which boosters should be given (particularly in view of the risk of vaccine-associated sarcoma). There is little evidence available on the true duration of immunity engendered by different vaccines. All vaccines will protect the majority of individuals for a minimum of one year, although it has been suggested that booster vaccinations against respiratory viruses should be given six-monthly in cats at high risk of infection. It is also clear that the duration of immunity following some vaccines, for example parvovirus, is considerably longer than one year

depending on the vaccine used and the degree of exposure in the field. This has led to the recommendation that boosters should be given every three years to cats (Levy *et al.* 2001). However, clear scientific evidence in support of this approach is lacking. Again, an individual risk assessment, as far as is possible, is the most suitable approach when deciding how often to administer boosters.

2.2 Screening for Infectious Disease

Cats may be screened for infectious disease in a number of situations, particularly when cats are kept in groups. For example, a breeding cattery may be free of a particular disease so incoming cats should not have that disease if allowed to enter the cattery. The veterinary history of a cat adopted from a shelter may not be known, but the adopter may want to ascertain that the new cat will not pose a risk to existing cats in the house.

There are few reasons to screen for bacterial disease in cats, unless a particular group is to be kept disease-free, for example a breeding cattery with a *Bordetella bronchiseptica* negative status. Faecal screening for some pathogenic bacteria or protozoa may be indicated in specific instances. With the recent availability of a polymerase chain reaction (PCR) test for haemobartonellosis (a mycoplasma agent that is the cause of the disease feline infectious anaemia) (Tasker *et al.* 2003), screening for this infection may become more widespread.

In cats, screening for viral infections is most commonly performed.

2.2.1 Retroviruses

Screening for retroviruses (FIV and FeLV)) in healthy individuals is fraught with difficulties, both in terms of the sensitivity and specificity of the tests available and the action to be taken should an individual be positive (Jarrett *et al.* 1991; Robinson *et al.* 1998). Nevertheless, screening for retroviruses is widespread in veterinary medicine. Depending on the prevalence of infection, enzyme-linked immunosorbent assay (ELISA) or immunochromatography testing in healthy individuals will have a false positive rate of between 30 and 50%. Therefore, a cat should not be euthanased on the basis of a single positive test. Sensitivity can be improved by testing ‘high-risk’ groups where the prevalence of infection should be higher. Traditionally, these groups were thought to be rescue and feral cats; however, a higher prevalence of infection in feral cat populations has not been documented in a number of studies. In many cases, the prevalence of infection appears to be a local phenomenon. Higher false positive rates have also been documented in cats that have been recently vaccinated. Some tests

will also give a positive result if the cat has anti-mouse antibodies in its blood or is infected with spumavirus (a related retrovirus). A variety of other methods such as PCR, virus isolation, western blotting or immunofluoresence testing can be used to detect FeLV (Herring *et al.* 2001) and can be used to confirm a positive ELISA result; alternatively, the screening test can be repeated 6 to 8 weeks later. Discordant results will occur and should be investigated further. In the majority of cases, results will eventually become concordant but a number of individuals will remain persistently discordant and their true virus status unknown.

Cats positive for FIV on screening will often have a long asymptomatic period (usually 2 to 5 years but longer periods are reported) before they show signs of illness, and the risk of virus transmission to other individuals in a group is thought to be low. The main value in knowing the FIV status is for the individual's benefit, allowing prompt and aggressive treatment of other infectious disease that may arise in a cat that is immunocompromised due to FIV infection. Responsible management would also include keeping the FIV positive cat indoors as far as is practicable, to reduce spread of infection through fighting and biting. Entire adults should be neutered, as this reduces fighting in male cats and the risk of transplacental spread in females. Approximately 25 to 30% of kittens born to an infected female are likely to be FIV positive (O'Neill *et al.* 1995), but infection rates will depend on the stage of infection of the queen and the FIV strain involved.

Cats positive for FeLV on screening pose a greater risk to FeLV negative individuals, as the virus is spread by social contact more easily. Whilst vaccination against FeLV may help protect FeLV negative cats from infection, the preventable fraction is significantly less than 100% (Sparkes 2003) (the preventable fraction is the percentage of cats that would be expected to become infected that do not, following vaccination). The prognosis for FeLV positive cats is also more guarded, with more than 80% likely to die within three years of their positive FeLV status being detected. Options for FeLV positive cats include creating a FeLV positive group of cats within a home, keeping infected cats as single cats in a household and euthanasia.

2.2.2 Other Viruses

In one survey, where samples to screen for respiratory viruses were taken from apparently healthy cats at a cat show, approximately 30% of cats less than one year of age were positive for feline calicivirus (FCV). By comparison, 1% of the cats were positive for feline herpes virus (FHV-1) (Coutts *et al.* 1994). Even though the prevalence of FCV and FHV-1 are thought to be similar, screening for FHV-1 is insensitive because the virus is

sequestered in the trigeminal ganglion in carrier cats and is excreted only intermittently, while FCV tends to be excreted continuously (see section 3.3). With FCV infection, however, there are some cats that shed low numbers of virus and need to be sampled on more than one occasion to accurately demonstrate their status. Under most circumstances there is little justification for screening for FCV, given that a large number of cats will be positive. Further, many strains are of low pathogenicity and therefore constitute a minor risk to the cat. Healthy cats should not be euthanased if they are positive for FCV or FHV-1.

The existence of carriers of feline parvovirus (FPV) has recently been suggested. Such individuals could potentially represent a risk to unvaccinated cats within the group that are immunologically naive. The sensitivity of faecal examination for identifying carriers of the virus is unknown. The risk of parvovirus infection is probably better reduced by quarantine (for those individuals incubating primary disease) and vaccination, than by screening for carriers.

2.3 Reduction of Exposure

Disease can be caused by exposure to pathogens and to potentially harmful toxins. Ways to reduce the likelihood of exposure of cats to pathogens are listed in Table 1, and ways to reduce the likelihood of exposure to toxins are listed in Table 2.

For the pet cat, practical solutions to reduce exposure depend on decisions made regarding whether the cat is allowed access beyond the house and garden. Cats may be kept wholly indoors, provided with outside pens, the garden may have a perimeter fence that is cat-proof both from ingress and egress, or the cat may be allowed to roam freely. For cats kept in large groups, such as in catteries and shelters, the control of infectious disease is a major challenge; this is discussed further in section 4.4.

Table 1. Ways of reducing the exposure of cats to pathogens

Decreased contact with other cats, in particular those that are likely to be carriers, incubating disease, or are overtly affected
Spacial or appropriate chronological separation from areas where potentially infectious individuals have been
Avoiding areas likely to be contaminated, for example catteries, rescue centres, veterinary surgeons' waiting rooms
Disinfection of the environment
Vaccination of likely contacts
Quarantine of individuals likely to be infectious
Management practices that reduce the likelihood of spread on inanimate objects (such as clothes, food bowls, grooming and cleaning equipment)

Table 2. Ways of reducing the exposure of cats to toxins

Careful storage and disposal of potential toxic substances
Reduced access to areas (for example neighbours' gardens) where control of potential toxins is unknown
Rapid removal of any potential toxins from the cat's coat to prevent ingestion by grooming
Careful selection and storage of food substances to prevent contamination
Reduced access to food substances that can not be controlled, for example food left out by others, dead prey, live prey species potentially containing toxins

3. METHODS OF INFECTIOUS DISEASE SPREAD

Understanding how infectious disease is spread is key to understanding how to control it, particularly when cats are kept in groups. There are two major ways that infection is spread: horizontal transmission between cats and vertical transmission between a queen and her kittens *in utero*. A carrier of an infectious disease is an animal that does not show clinical signs of the disease but whose body harbours the disease-producing organism and may continue to excrete it. Carrier animals are of great epidemiological importance in the spread of infectious disease in cats.

3.1 Horizontal Transmission

Infection can be transmitted both in the acute phase, when the cat is obviously unwell, and during the incubation period before it has become ill. Recovered cats can become carriers, remaining healthy but continuing to spread infection to susceptible individuals. Horizontal transmission can be by direct cat-to-cat contact or via inanimate objects (indirect transmission).

When disease is spread by direct contact, a part of the body of one animal meets a body part of another animal, for example when skin surfaces come into contact, when one animal licks or grooms another, or during fighting. (Venereal transmission of disease, involving direct contact between the reproductive organs, occurs in dogs and cats but is not a significant route of infection in the United Kingdom). Infectious agents that are spread by direct contact are frequently fragile organisms; they are easily killed by heat, light, desiccation and disinfectants. Disinfection is not, however, a major method of control in such infections. Another method of spread by direct contact is airborne transmission, where the infection is spread in droplets produced during coughing or sneezing. Airborne transmission is particularly important in the spread of respiratory diseases.

When disease is spread by indirect contact, two or more animals come into contact with the same inanimate object, or fomite, such as bedding material or feeding bowls. Pathogenic organisms are spread via this

inanimate object. Some organisms can remain viable in the environment for long periods of time, particularly in dark, damp conditions and where the object has been contaminated with faecal or other organic material. Usually contact with the inanimate object occurs within a short time after contamination; however some infectious agents, such as feline parvovirus, can survive for very long periods in the environment. Infectious agents that rely on indirect spread are generally hardy and more difficult to kill with disinfectants.

Some infectious agents do not pass directly from one individual to another but spend part of their lifecycle on or in another host requiring a vector for transmission, for example the tapeworm *Dipylidium caninum*, which affects cats, uses small rodents as an intermediate host and fleas as the vector.

3.2 Vertical Transmission

Feline parvovirus can be spread vertically if the queen becomes infected whilst she is pregnant. The outcome of such an infection will depend on the stage of the pregnancy. In the case of feline parvovirus, infection can cause a variety of problems including abortion, the birth of mummified kittens, and underdevelopment of the cerebellum, where the kittens are born alive but are poorly co-ordinated due to the cerebellar hypoplasia. Feline leukaemia virus and FIV can also be transmitted vertically.

3.3 Carrier Cats

A carrier cat can be placed in one of four categories, depending on whether it has shown clinical evidence of disease (convalescent or healthy) and on its level of excretion of infectious agent (continuous or intermittent), according to the definitions below:

- Convalescent - individuals who have had the disease, with the usual clinical signs, but who do not rid themselves of the organism completely for a long time; in some cases the organism persists in the animal for the rest of its life.
- Healthy - individuals who have never shown typical clinical signs of the disease. They possess an innate immunity to the organism which is sufficient to prevent clinical signs but not sufficient to prevent infection. Vaccinated animals can become carriers in this way. Healthy carriers can excrete the organism continuously or intermittently without becoming clinically affected themselves.

- Continuous excretors - individuals who continuously excrete the infectious agent and can infect other animals at any time. They are easier to identify than intermittent excretors.
- Intermittent excretors - individuals who only excrete organisms under certain circumstances, usually following periods of stress such as parturition, lactation, rehoming, or the use of immunosuppressive drugs.

Following infection with respiratory viruses, approximately 80% of cats with FHV-1 are thought to become intermittent carriers and are carriers for the rest of their life. Following FCV infection, 50% of cats become continuous excretors and are still excreting virus 90 days post-infection; however, they usually stop excreting after a period of time.

4. METHODS OF INFECTIOUS DISEASE CONTROL

Approaches to disease control include attention to hygiene, reduction of stress factors that may exacerbate disease, isolation and quarantine of potentially infected cats or cats with an unknown vaccination or health history, and measures specific to a particular group of cats or situation.

4.1 Hygiene

Hygiene plays a crucial role in the control of diseases, in particular those spread by indirect contact. In order for hygiene measures to be effective it is essential that all personnel adhere to the disinfection protocols, that the disinfectants used are appropriate ones for the infectious agent and are used at the correct concentration and in the correct manner, and that the disinfectant is safe to use in the environment where cats live.

Hygiene should encompass the cleaning of the living space of the cat, fomites (bowls, litter trays, grooming equipment) and personnel as they move from cat group to cat group. A number of disinfectants, in particular those containing phenolic compounds, are toxic to cats (Liao & Oehme 1980).

4.2 Reduction of Stressors

Stress can increase the likelihood of an individual developing clinical signs of infectious disease due to effects on the host immune response. It can also affect the severity and duration of the clinical signs. Short-term stress results in increases in the hormone cortisol that do not have a significant

effect on the host immune response, and may even cause some enhancement. Long-term stress, however, tends to reduce resistance to disease by compromising the immune system due to the chronic release of hormones (such as cortisol) and cytokines (see Chapter 2). Stress can also be an important factor in the development of non-infectious diseases such as idiopathic feline lower urinary tract disease (Cameron *et al.* 2004), and of behavioural problems such as inappropriate elimination (urination or defecation) (see Chapter 4). Stress can also exacerbate infectious disease indirectly, through the development of stress-induced non-infectious disease or through poor nutritional intake.

4.3 Quarantine and Isolation

Quarantine and isolation are effective methods of reducing exposure to infectious disease. Quarantine is used before introducing a new individual to a group, as it allows time for infectious diseases that the individual is incubating to become clinically apparent. Whilst a quarantine period of 10 to 14 days is suitable for the control of many infectious diseases, it is not sufficient for diseases with a prolonged incubation, particularly rabies, FeLV or FIV. Further, it will not identify asymptomatic carriers. Quarantine is important especially when new, young cats are continuously being added to the group and where the background of the cat is unknown. In many instances, however, it is the new individual that is at higher risk of becoming infected from the group than vice versa. Quarantine also allows time for vaccination to become effective. Following quarantine, an individual can be exposed to potential infections in a controlled manner, in the hope that immunity occurs with the minimum of clinical signs. Welfare aspects should always be borne in mind when an individual is placed in isolation or quarantine.

Isolation of subsets of cats within a group can be of value if:

- Disease has occurred in one part of the premises but as yet not all cats have been exposed.
- Individuals have different disease status e.g. isolating FeLV positive from FeLV negative cats.
- Queens need to be separated from other cats from the time that they are due to kitten until after the kittens have been vaccinated.
- Kittens need to be separated from a queen likely to be a carrier, in the period between waning of their passive immunity and vaccination.

4.4 Disease Prevention and Control in High Risk Groups

While basic methods of disease prevention and control are applicable to all situations, additional approaches will vary depending on the way groups of cats are kept. They mainly rely on identifying potentially infectious cats and then either preventing them from entering the group or placing them in isolation and quarantine. Existing members of the group can be protected by vaccination and ensuring their immune system is effective, through good nutrition and the reduction of intercurrent disease and stress.

4.4.1 Multi-cat Households

For cats kept as pets in multi-cat households, the disease risk is relatively low if the group is stable and there is sufficient room for the number of cats. The risks can be further reduced by knowing the infectious diseases that exist within the group, as this allows risk benefit decisions to be made for an individual cat and for the group as a whole. It also allows the risk of introducing a new individual to the group to be assessed in terms of the likelihood and consequences of new infection being introduced and the risks to the new individual. Screening and immunization, together with quarantine and/or isolation of the new arrival, are most appropriate.

4.4.2 Breeding and Boarding Catteries

In breeding and boarding catteries, there is a major potential risk for infectious disease as cats are continually entering the premises, having arrived from environments over which the owner of the cattery has little control.

4.4.2.1 Breeding catteries

The major risk of infection in a breeding cattery is from visiting queens, new acquisitions and the continual or intermittent presence of immunologically naive individuals (kittens) within the group. Isolation of the various groups (particularly kittens) together with immunization, screening and quarantine of new members is required. This should be combined with knowledge of the disease state of the group as a whole. In most breeding establishments cats are kept indoors or in outdoor pens, so the risk of infection being introduced from cats outside the group is low. Nevertheless, periodic screening is advisable and vaccination to increase levels of immunity within the group is important. Not uncommonly there is a pet cat within a breeding cattery, and in the author’s experience this cat can often be the source of infection as it is the only cat allowed outside and it may well not have been screened prior to introduction to the group.

4.4.2.2 Boarding catteries

The disease status of individuals entering a boarding cattery is generally unknown (even though the cat is usually vaccinated) and there is a continual movement of new individuals in and out of the cattery. Disease control has to rely on hygienic management practices and the construction of the premises to minimise disease spread, for example the placing of sneeze barriers between pens. Vaccination will increase resistance but does not prevent the cat being a carrier of infectious disease. The stress of boarding may well cause healthy carriers to become active excretors (see section 3.3). It is vital that cats are not moved from cage to cage to facilitate cleaning. Ideally each pen should have dedicated cleaning equipment, litter trays, food bowls and other items that are sterilised or discarded after the individual(s) have left.

4.4.3 Cat Shelters

Infectious disease is a major problem within many cat shelters (Cave *et al.* 2002) (Figure 1). Surveys of infection rates in individuals have shown a 2 to 3 fold increase in infection rates in cats that have entered rescue shelters compared to their status on admission (Pedersen *et al.* 2004). In some instances, it can be argued that the welfare of cats brought into a shelter with a significant infectious disease problem may be worse than that of cats left to fend for themselves, for example in feral cat populations.

It is virtually impossible to prevent the entry of infectious disease in rescue facilities and shelters; hence it is essential that buildings and management practices are designed so as to limit the spread of infectious disease. Practically this means:

- Quarantine for new arrivals.
- Maintaining cats in small, stable groups that are allowed to dwindle as cats are rehomed. Small groups should not be combined for easier management.
- Housing kittens together and away from adult cats.
- Vaccination, where financially practical, should be given 7 to 10 days after arriving when general health and disease status have been evaluated.
- Long stay cats should be housed separately from short stay cats
- Particular care should be taken to restrict access of any ‘shelter cats’ as they are sometimes allowed to roam free and may carry infection into or spread infection around the rescue facility.
- Accommodation should be designed to allow easy cleaning and prevent spread of disease to other cages (sneeze barriers, wide corridors, anteroom for cleaning and grooming equipment).

- Equipment should be specific to each individual or group and hygiene measures such as boot dips adopted.
- Cats should be cleaned in the order from the least likely to be infectious to the most likely group.
- Staff should be fully conversant with hygiene practices.

Environmental enrichment and other husbandry techniques to reduce stress should be practised (see Chapter 7).

Figure 1. Infectious disease due to respiratory viruses is a major problem in many shelters, and young animals are most susceptible.

4.4.4 Feral Populations

Surprisingly, stable feral populations are often remarkably free of many infectious diseases. Disease control can be achieved by a trapping, neutering and returning policy together with testing for FeLV and FIV at the time of neutering (see Chapter 6).

5. NON-INFECTIOUS DISEASE

The majority of sick pet cats presenting to veterinary surgeons are suffering from non-infectious disease. This is different from the situation in rescue facilities and some feral cat populations where the incidence of infectious diseases is likely to be greater. Of non-infectious disease, the most commonly reported in surveys of cats attending veterinary surgeries are dental disease, trauma, chronic renal failure (CRF) and gastrointestinal disease. Other common conditions requiring veterinary attention include feline lower urinary tract disease, hyperthyroidism and neoplasia (tumours or tumour-associated diseases). Dental disease, CRF, hyperthyroidism and neoplasia are primarily diseases of older cats. Trauma and gastrointestinal disease may affect cats of any age, although road traffic accidents affect mainly young cats (Rochlitz 2003). Feline lower urinary tract disease is more commonly reported in young to middle-aged cats. Screening will allow earlier detection of degenerative diseases. However, apart from dental disease, there is little information on the benefit of interventional therapies in delaying the onset of clinical disease. Notwithstanding this, preventative health care is important and screening for disease should be encouraged.

5.1 Screening for Non-infectious Disease

The biggest challenge with screening in any population is encouraging presentation of the cat to the clinician to allow screening to be conducted. Many practices offer annual health checks that are usually combined with vaccination, so that no specific charge for the health check is made. Unfortunately, relatively few cats are presented for annual booster vaccination, particularly as they get older. The other opportunity for health screening is when the cat is brought to the clinic for a specific reason, thereby allowing discussion of more general health issues.

Screening can be performed at a number of levels, and most commonly involves history taking, physical examination and blood tests. Physical examination, as a method of health screening, is a standard assessment of an individual but is relatively insensitive in its ability to diagnose occult disease. This has led to the use of other methods to minimise risk and detect disease as early as possible, in particular blood tests (for example prior to anaesthesia). At what age and how frequently an individual should be screened in order to deliver maximum health benefits is unknown. Many screening tests are relatively insensitive; for example, over 75% of renal mass is lost before blood concentrations of urea and creatinine (metabolites excreted by the kidneys) begin to rise. Further, little work has been performed to demonstrate which intervention, and at what stage, would

benefit the individual. Before undertaking screening tests, a clear plan for the interpretation of the results and the action to be taken, if results are abnormal, should be established.

5.2 History Taking and Physical Examination

The skill of history taking and physical examination is one that all veterinary health professionals need to develop. Depending on the experience and training of the professional, history taking and physical examination may lead to a diagnosis. If not, it will significantly narrow the field of likely conditions to be considered and help direct further investigation. Many owners are highly observant and pick up very subtle changes that would not be apparent to the veterinary professional that does not have intimate knowledge of the individual cat; these observations should not be disregarded. The health professional's role is to prompt information from the owner by asking questions in a structured way, and to interpret the observations that have been made. It is often surprising that many owners have noticed overt clinical signs in their cats but have not pursued them further.

During history taking, key questions include those about:

- Appetite – change, duration and attitude towards food, for example if the appetite is decreased, is the cat asking for food and then not eating normally or is it less interested in food.
- Weight – visual changes of weight can often be missed, particularly in longhaired cats, but owners will often notice the change when they pick the cat up.
- Activity – if asked as a direct question, changes in activity are often not mentioned by owners. However, owners will often have noticed whether the cat is in the house more or sleeping more, and whether the distance over which it appears to roam is reduced. How well the cat is jumping can also be revealing.
- Behaviour – is the cat doing the same things it used to do? Has there been a change in the amount of attention seeking?

It is vitally important to ask about appetite, activity and behaviour as some of the changes that the owner may see as desirable or positive, such as an increased appetite, becoming more homely or more affectionate, may indicate problems such as hyperthyroidism or cardiovascular disease. In older cats, it can sometimes be very hard to distinguish changes that are associated with the normal aging process from changes indicative of developing disease. In general, aging changes are slowly progressive with no

clear start point and should be at a level that is within the expected boundaries for a cat of that age.

Following the history, a thorough physical examination should be performed and recorded. A minimum recorded database should include temperature, pulse and heart rate, respiratory rate, colour of mucous membranes, capillary refill time, oral health and body weight. Repeat examinations identifying trends are a much more sensitive way of detecting low grade disease than an examination at a single time point, when the reference is whether an individual falls within the normal population range. Thorough examination of older cats may well reveal abnormalities that then need to be interpreted according to previous findings and the clinician's experience. Subclinical conditions may be associated with non-specific or normal historical and physical findings. In these circumstances, screening blood and urine tests may be of value.

6. THE RECOGNITION AND TREATMENT OF PAIN

Pain is an important welfare issue in all species, not least cats. However, effective pain relief can only be achieved and maintained when the signs of pain are recognised. Recognising signs of pain is complicated by the sedative action of many analgesics in veterinary use.

It is usually relatively easy to assess a cat's response to acute pain. Cats undergoing minor trauma respond by flinching, vocalization, attempts to escape or, occasionally, aggression. More severe injury usually results in the cat hissing, spitting, becoming aggressive or making vigorous attempts to escape. Following the acute response to major trauma, signs that the cat continues to be in pain become less obvious. Typically, the cat will become withdrawn and immobile; vocalization is rare but the cat will appear tense and distant and may emit occasional low growls. There is significant variation between cats and some will continue to spit and hiss whenever they are approached. A rapid respiratory rate is not uncommon and appears to be a pain response, as respiratory rate will frequently fall following analgesia. Later in the time course following acute injury, most cats will attempt to hide and show a marked reduction in appetite.

Following acute trauma the existence of pain is rarely in doubt, unless the cat is not found until some time after the event and external evidence is no longer apparent. The major clinical decision is not whether to give pain relief but what type of pain relief is most appropriate, and judging how long pain relief is necessary. In the majority of cases, continuing pain relief until near normal behaviour returns is appropriate. Administration of analgesics can be

a challenge in cats, and novel routes have been investigated such as giving opioids (buprenorphine) intra-orally (Robertson *et al.* 2003).

Chronic pain is much more difficult to recognise in cats. As a species they are generally secretive about any form of incapacity, and will attempt to hide the fact that they are not 100% fit by altering their behaviour. Typical signs of chronic pain in cats include reduced activity, hiding, decreased interest and response to surroundings and weight loss due to inappetence (these signs are similar to those of chronic stress; see Chapters 2 and 4). Unfortunately, such signs are non-specific and can be associated with other disease processes where pain is not thought to be a significant feature. Pain can be difficult to localise, either because the cat fails to react when the focus is palpated or because the cat reacts wherever it is touched or handled. Localised pain may be seen as abnormalities of posture or prehension, lameness or stiffness or reluctance to perform a specific activity such as jumping. Chronic long-term pain, such as that caused by degenerative joint disease, is likely to have a more significant impact on the welfare of cats than is currently recognised.

Historically, analgesia has been underused in cats except following major orthopaedic procedures. This attitude is changing, and has been associated with a better understanding of pain management in cats and with an increase in the number of women in the profession (Dohoo & Dohoo 1996). Because of their unique metabolism and poor ability to glucuronidate drugs, non-steroidal anti-inflammatory drugs (NSAIDs) have been avoided in cats due to their perceived toxicity. The use of opioids was considered inappropriate, as hyperexcitability is common in cats given high doses, and individual cats can become excited at relatively low doses too. These views have now changed and compounds are in widespread use (albeit with precise dosing protocols) providing effective, short-term pain relief (Taylor *et al.* 2001).

In the United Kingdom, a number of analgesics are licensed for short-term use in cats and are either opiate-based or NSAIDs. These drugs have mainly been evaluated in studies involving post-operative pain relief (Balmer *et al.* 1998; Slingsby & Waterman-Pearson 2000; Lamont 2002). The use of other drugs which have analgesic activity, such as ketamine and medetomidine, is appropriate in some cases, and the value of local anaesthesia should not be overlooked. In extreme cases, euthanasia should be considered as a method of relieving intractable pain.

Analgesia for chronic pain is usually provided by NSAIDs, although they are not licensed for long-term use in cats in the United Kingdom. If NSAIDs are insufficient or inappropriate, opioids such as fentanyl patches can be used (Egger *et al.* 2003).

7. CONCLUSIONS

Infectious and non-infectious diseases can have major impacts on the welfare of cats at the level of the individual, group and population. Recent developments in vaccinology and vaccine protocols should serve to reduce the incidence of clinical disease, though infectious disease will remain a difficult problem in situations where cats are kept in large groups and the composition of these groups is unstable. Improvements in health care, screening and treatment will also reduce the effects of non-infectious disease on welfare by decreasing morbidity and mortality. However, there remain a large percentage of cats that do not have ready access to veterinary care; in these cats the effects of disease, especially infectious disease, can be severe. Studies on behaviours associated with pain in cats are needed, in order to develop better methods of identifying acute (Dixon *et al.* 2002) and chronic cases, and of assessing the effects of analgesics. With the increasing popularity of cats as companion animals in many countries, and their increased longevity associated with improved health care, the development of effective, easy-to-administer analgesics that are safe for long-term administration is urgently required.

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