State of the art
Feline infectious peritonitis

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In this special edition of *Feline Focus* we have chosen infectious disease as our subject. Cats are commonly affected by viral, bacterial and protozoal infections, and veterinary nurses and technicians are involved in infection control in the clinic and asked for advice on vaccination. In the state of the art article, Kerry Simpson discusses a difficult topic; feline infectious peritonitis, a serious and usually fatal viral infection that is challenging to diagnose. Alexandra Taylor then covers cat flu, not only a serious infection in cats, but also a threat to other clinic patients. Laura Rosewell continues this subject with important tips on infection control within the clinic, asking if you perform infection audits in your clinic and explaining the importance of infection control policies. Finally, Nikki Gaut focuses on current vaccine guidelines and this advice may encourage you to review vaccination practices in your clinic.

We hope you enjoy reading this month’s articles and remind you about our previous issues available to you as a nurse member on our website, as well as our webinars which cover a variety of different topics every month.

Best wishes,

Sam Taylor, Veterinary Editor

Contents

279 State of the art
Feline infectious peritonitis: why is it so difficult to diagnose?

287 A closer look at...
Cat flu: causes, treatment and management

295 How to...
Top tips for infection control in the clinic

303 Clinical nursing
Vaccination in cats: latest recommendations
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Feline infectious peritonitis: why is it so difficult to diagnose?

Coronavirus is the cause of feline infectious peritonitis (FIP), but in the majority of cats it causes no, or mild, clinical signs. Development of FIP is due not just to the virus, but also to the cat’s immune response. Clinical signs of FIP include pyrexia and weight loss, body cavity effusions, and ocular and neurological signs. Diagnosis can be challenging, with similar haematology and biochemistry abnormalities as found in other infectious and inflammatory diseases. Serology indicates exposure to coronavirus only, and PCR testing requires more research. Effusion analysis may confirm a high protein effusion, and a definitive diagnosis may be reached with immunohistochemistry on tissue samples.

Coronaviruses cause disease in many species, including cats, dogs, pigs and humans. In the cat there are two serotypes, type I feline coronavirus (FCoV) and type II FCoV. Infection with either serotype can result in either a mild enteric disease (due to feline enteric coronavirus [FECV] infection), or a virulent form of disease, feline infectious peritonitis (FIP). Type I FCoV is far more common within the general cat population, with up to 98% of cats being seropositive, although type II FCoVs make up approximately 30% of isolates in certain countries such as Japan. Despite this high prevalence of FCoV within the feline population, the incidence of FIP is relatively low (approximately 0.3–1% of cats); the highest incidence occurring in cats between the ages of 3 and 16 months.

Figure 1: Post-mortem image of a cat with effusive FIP. Note the pyogranulomatous foci seen as punctate fibrinous plaques on the serosal surface of the intestine and the considerable volume of ascitic fluid within the abdominal cavity. (Photograph courtesy of Dr A E Philbey)
State of the art

Clinical signs
FIP can present as either an effusive (wet) form, or as a granulomatous/non-effusive (dry) form, with some cases transitioning between the two. Cats with FIP usually come from multi-cat households, and classically clinical signs are preceded by a ‘stressful’ experience, such as rehoming or neutering.

Wet FIP
Wet FIP is characterised by a fibrinous and granulomatous serositis, with exudation of a (typically) protein-rich fluid (Figure 1). In the early stages, clinical signs are often vague, and can include lethargy, failure to thrive, inappetence, weight loss, and fluctuating pyrexia. Additional clinical signs will depend on whether the cat has wet or dry FIP. Cats with wet FIP will develop effusion; most commonly this is within the peritoneal cavity (58% of cases) (Figure 2), but it may affect the pleural cavity (11%) or both (22%).²,⁴ Ocular and/or neurological signs may be evident in some cats, but involvement is more common in dry FIP.²,⁴

Dry FIP
Dry FIP is typically more insidious in onset, and harder to diagnose. As

Why do some cats develop FIP?
It is unclear why some cats will develop FIP while others are exposed to FCoV but remain asymptomatic, or develop enteric (intestinal) disease. It has been suggested that in FECV infection the virus is localised to the intestine, whereas in FIP viral mutations allow the virus to enter the macrophages and cause a systemic (body-wide) infection. However, this theory may be somewhat simplistic, as, although FECV exhibits a tropism for the bowel epithelium, during primary infection FECV demonstrates a systemic phase where it can be present in white blood cells in locations other than the intestine. This suggests that host response and environmental factors may also be involved in the development of FIP.¹

Key point
It is still not fully understood why some cats develop FIP and some don’t, but it is likely related not just to the virus but also to the cat’s immune response and environmental factors.

Figure 2: Cat with effusive FIP demonstrating severe abdominal distension due to a large volume of peritoneal fluid. (Photograph courtesy of Professor D Gunn-Moore)
the name implies, there is little or no effusion, but ocular or central nervous system (CNS) lesions are noted in 60% of cases, and granulomatous lesions may be evident within the kidneys (Figure 3), mesenteric lymph nodes, liver (Figure 4a,b) and hepatic lymph nodes. Only about 10% of cases of dry FIP demonstrate thoracic involvement, with small granulomas involving the pleura and lung parenchyma.2

Diagnosis

Making a diagnosis of FIP is fraught with difficulties; although the history and physical examination findings may be suggestive, other conditions may present similarly, and be more treatable than FIP. Therefore, a definitive diagnosis is desirable and tests that optimise specificity (ie, are less likely to suggest that an unaffected cat has the disease) should be utilised, as mis-diagnosis has a potentially fatal outcome.

Laboratory Investigations

Biochemistry and haematology

Haematology and biochemistry may demonstrate various abnormalities. These can include anaemia (typically low grade, non-regenerative), along with lymphopenia and neutrophilia. Lymphopenia has been documented in experimental infection, and occurred around 2 weeks post-infection in cats with effusive FIP but was slower in non-effusive disease.3 Unfortunately, haematological changes are typical of cats with inflammatory/infectious disease and are very non-specific. In addition, serum biochemistry may demonstrate an elevated total protein, with a hypoalbuminaemia and hyperglobulinaemia (predominantly γ-globulins).4,6 The diagnostic utility of serum total protein, γ-globulinaemia and albumin:globulin ratio have been
assessed and albumin:globulin ratio demonstrated a better diagnostic utility than the other two parameters. In that study a ratio of 0.8 was established as being the ideal cut-off for predicting FIP. This value optimises sensitivity and specificity (80% and 82%, respectively); therefore it minimises the risk of making a false positive or false negative diagnosis. However, the utility of a test in predicting disease depends upon the prevalence of the disease within the tested population. For example, if 1 in every 100 cats is infected (ie, a prevalence of 1%), and testing is performed using this ratio alone, 19 of the 100 cats will test positive. Therefore, while the albumin:globulin ratio can be useful in predicting the likelihood of disease, it is best used in a population of cats with a high disease prevalence (ie, cats under 2 years old, from multi-cat households, with signs consistent of FIP).

Other biochemical abnormalities that can be present include hyperbilirubinaemia (typically without elevations in the liver enzymes). In some cases urea, creatinine and occasionally liver enzymes can be increased. However, these changes are non-specific and depend on the degree and localisation of organ damage.

**Key point**

When assessing the performance of a diagnostic test:
- Sensitivity is the probability of a positive test result in a patient with the disease.
- Specificity is the probability of a negative result in a patient without the disease.

A perfect test has 100% sensitivity and specificity but this rarely exists and false positives and negatives occur.

**Coronavirus serology**

Unfortunately, there is no such thing as a blood test for FIP (despite some claims). Serum antibody tests are available, but these do not differentiate between cats with FECV and FIP. Low and medium values are not of any diagnostic value; studies have demonstrated seropositive results in both FIP (73%) and healthy cats (70%). While a very high titre (≥1:1600) may be more likely in cats with FIP, it is not diagnostic, and many young pedigree cats will have high titres. In addition, a negative titre does not rule out disease. Large amounts of virus within the sample can affect the antibody tests, resulting in false-negative results or a reduced titre, and titres can fall dramatically in fulminating disease as the cat’s immune system becomes overwhelmed.

**PCR testing**

Considering the problematic interpretation of serology, polymerase chain reaction (PCR) testing was developed to assess the presence of FCoV genetic material (RNA) within samples. Theoretically, real-time PCR (RT-PCR) should be superior to serology as it detects virus rather than an immune response. Unfortunately, it is not possible to differentiate mutated from non-mutated FCoV RNA by PCR. To date these tests have
underperformed, with lower sensitivity and specificity than those reported for antibody testing.8,11,12

**Acute phase proteins**
Some panels will assess alpha-1-acid glycoprotein (AGP). This is an acute phase protein, which becomes increased in infectious or inflammatory conditions. While this test is non-specific, with levels fluctuating in healthy cats, it has been demonstrated that in a cattery AGP level rose just prior an outbreak of FIP, and it is suggested that high levels (>1.5–3 mg/ml) are uncommon in diseases other than FIP.13,14

**Effusion analysis**
If effusive disease is present, the fluid can be sampled. The fluid in effusive FIP is typically clear, to slightly cloudy, straw coloured mucinous in character and may contain visible fibrin tags (Figure 5). Fluid analysis typically reveals a high protein content (>35 g/l) and a moderate cell count (500–5000/μl), comprised predominantly of macrophages and neutrophils, although occasional lymphocytes may be present. Antibody levels within the effusion can be measured. These are typically higher than in the serum. It has been reported that the presence of antibodies within the effusion has a sensitivity of 86% and a specificity of 85%.7

The Rivalta test can be performed on the effusion. This involves carefully layering a drop of effusion onto a pre-mixed solution containing 5 ml distilled water and one drop of acetic acid (98%).15 If the drop maintains its shape and either stays on the surface or slowly floats down to the bottom of the tube the test is defined as positive. In reality, this test is merely demonstrating that there is a high protein content to the fluid, and therefore, it is best used in situations where full testing is not possible. Several studies have been performed assessing the usefulness of this test.7,15,16 In one study the Rivalta test had a sensitivity of 91.3% and a specificity of 65.5% (which would lead to 34.5 false positive results in each 100 healthy cats),16 whereas an earlier study reported a sensitivity of 98% and specificity of 80%.7 Therefore, once again the significance of a positive test result is markedly altered by the disease prevalence, and once again, this test should be interpreted in the light of the cat’s background. RT-PCR testing on effusions shows some promise as a diagnostic test but further study is needed.
**State of the art**

**Ophthalmic/neurological examination**
In cats with non-effusive disease, ocular and or neurological manifestations may be present. Typical ocular lesions include uveitis, keratic precipitates, aqueous flare and in some cases hyphaema (Figure 6). Retinal examination may demonstrate ‘cuffing’ of the retinal vasculature (fuzzy grey/white areas on either side of the vessel), retinal haemorrhage or detachment or occasionally granulomatous changes. It has been suggested that measuring antibody levels or RT-PCR testing be carried out on the

![Figure 6: A cat with hyphaema (blood in the anterior chamber) and uveitis due to FIP. (Photograph courtesy of Dr Sarah Ellis)](image)

**Limits of diagnostic imaging**
Radiography is of limited use in the diagnosis of FIP. Thoracic imaging may reveal pleural fluid, and abdominal radiographs may reveal effusion, renomegaly or hepatomegaly. Ultrasonography can be useful in the identification of pericardial, pleural or peritoneal effusion and in aiding centesis. In non-effusive/granulomatous disease, ultrasonography can help to identify mass lesions, although lesions are not diagnostic of FIP. In one study of 16 cats with FIP, ultrasonic lesions were highly variable, with five cats demonstrating abnormalities within the liver (three demonstrated diffuse hypoechoic hepatic parenchyma, one had focal hypoechoic lesions, and one focal hyperechoic changes). Five cats demonstrated a hypoechoic subcapsular rim in either one or both kidneys and abdominal lymphadenopathy was noted in nine of the cases. Of these 16 cats, seven had free fluid within the abdominal cavity and one within the retroperitoneal space.

![Figure 7: An MRI scan of a cat with neurological FIP. Blue arrows show dilated ventricles with ependymal enhancement (the white line around the black fluid-filled ventricle)](image)

If neurological signs are present, advanced imaging may be performed. CT or MRI have been used, predominantly to rule out other causes. If FIP is present inflammatory changes can be seen. In one study, 50% of FIP cases demonstrated MRI abnormalities, which included ventricular dilation and ependymal enhancement after contrast injection (Figure 7). A second study demonstrated ventricular dilation in three out of four FIP cases and periventricular contrast enhancement in all cases that were tested (three out of three cases).
aqueous humor; however, there are no studies to date that demonstrate that sampling either fluid compartment is of greater diagnostic value than assessing the serum.\(^{17}\)

Neurological signs can be highly variable and may affect either the brain and/or spinal cord. They are frequently multifocal and can manifest as abnormal mental status, abnormal behavior, cranial nerve deficits, ataxia, nystagmus, central vestibular disease, tetraparesis, hyperaesthesia, abnormal postural reactions, or seizure.\(^{18}\) Advanced imaging in such cases may reveal changes suggestive of inflammatory disease. Cerebrospinal fluid (CSF) analysis can be useful in excluding FIP, but to date, no studies have demonstrated CSF antibody testing to be of a greater diagnostic utility than high serum titres (sensitivity 60%, specificity 90%).\(^{19}\)

**Immunohistochemistry**

For a definitive diagnosis of FIP, virus-infected macrophages should be demonstrated within tissue sections.\(^{5,8,12}\) This technique requires tissue biopsy and immunohistochemistry. Due to the invasive nature of obtaining tissue biopsies, assessment of both Tru-cut biopsies and cytology samples has been undertaken. One study assessed Tru-cut biopsies of the kidney and liver in 25 cats with FIP. In this study Tru-cut samples demonstrated a diagnostic sensitivity (positive result in patients with the disease) of 64% (liver) and 39% (kidney), compared with a diagnostic sensitivity of 82% for fine needle aspirate biopsy (FNAB) of the liver, and 42% for FNAB of the kidney.\(^{22}\)

Direct immunofluorescence testing (a technique to label the virus that then can be seen as a fluorescent colour) to detect virus within macrophages in effusion specimens has been reported to be 100% specific (no false positives) (although this technique is has a sensitivity of 57%, as there were not sufficient macrophage numbers in all effusions).\(^{7}\) However, in a recent study the technique was reported to demonstrate a sensitivity of 100%, but the specificity was only 71.4%.\(^{23}\) In general, a positive result, obtained in the context of appropriate clinical signs, is thought to be highly predictive of FIP, whereas a negative result does not rule out infection, particularly if there are few/no macrophages within the sample.

In some cases, the owner may desire a definitive diagnosis and any delay in providing this may prolong suffering; while in others signalment or clinical signs may be atypical. Therefore more aggressive diagnostics may be warranted (this is particularly common in older cats with non-effusive disease). Where feasible, exploratory laparotomy with biopsy of lesions and immunohistochemistry can provide a definitive diagnosis.\(^{1}\)

Key point

A definitive diagnosis of FIP can be made by performing tests such as immunohistochemistry on tissue samples.

**Conclusions**

FIP is a challenging disease to diagnose and why some cats develop the condition and some don’t is poorly understood. Further research into both diagnostic tests and treatment is under way in the hope that affected cats can be diagnosed, and then treated effectively.
References


icatcare.org/felinefocus

The ISFM has a library of online webinars at: www.icatcare.org/nurses

ISFM is the International Society of Feline Medicine, the veterinary division of International Cat Care. RACE approved
Cat flu: causes, treatment and management

Cat flu is caused by one or more upper respiratory tract pathogens including feline herpesvirus, feline calicivirus and other bacterial infections. Clinical signs include sneezing, ocular and nasal discharge, blepharospasm, inappetence and pyrexia. Treatment includes antiviral and antibiotic treatment but also nursing care including attention to nutrition, analgesia and nebulisation. Barrier nursing of infected patients in the clinic is important to prevent spread of infection, along with promotion of vaccination. Long-term consequences such as rhinosinovitis are possible.

Cat flu is a collective term used to describe upper respiratory signs in cats caused by various pathogens. It is relatively common in cats, and serological studies show that feline herpesvirus-1 (FHV-1) is widespread in the feline population worldwide, with reported exposure rates of up to 97%.

Cats can be affected by one or many of the following pathogens:
- feline herpesvirus-1 (FHV-1);
- feline calicivirus (FCV);
- Chlamydia felis;
- Bordetella bronchiseptica,
- Mycoplasma felis (although the role of this bacteria is not fully understood).

All of these pathogens can cause similar clinical signs and cats may be presented co-infected with more than one, ie, both FHV-1 and FCV. Other secondary bacterial infections are also relatively common in these patients, leading to more severe clinical signs.

Main pathogens causing cat flu
Feline herpesvirus-1
Clinical signs of FHV-1 can range from mild to severe (Figure 1). Kittens, elderly and immunocompromised cats (such as those with feline immunodeficiency virus) are most at risk. Vaccinated cats are less likely to develop acute and severe disease, but with overwhelming exposure may show...
A closer look at...

Clinical signs of FHV-1 infection

Signs include:
- sneezing;
- conjunctivitis;
- ocular conjunctival discharge;
- corneal ulceration (dendritic ulcers) causing blepharospasm and photophobia;
- pharyngitis (may lose or change voice);
- pyrexia;
- lethargy;
- depression;
- anorexia;
- rhinitis;
- ptyalism (hypersalivation); and
- coughing.

The majority (80%) of cats infected with FHV-1 will become lifetime carriers, and around 40% may shed the virus intermittently, especially at times of stress (eg, a house move, new cat, new baby) or if treated with immunosuppressants.1 Shedding often occurs in queens during pregnancy and lactation, therefore FHV-1 can be easily passed onto the kittens causing severe disease. Cats will often show mild flu-like signs at the time of shedding, which can last for several weeks. This is a particular problem in rescue centres and shelters where many cats under stress are housed in close proximity.

Cats infected with FHV-1 may go on to develop post-viral chronic rhinitis (see later). FHV-1 infected cats may also develop FHV-1 associated dermatitis, with inflammation of the skin around the nose, mouth and sometimes legs. Reproductive abnormalities such as abortion or foetal absorption may occur in pregnant cats.3

Feline calicivirus

Infection with FCV usually presents with milder, but similar, upper respiratory signs than FHV-1, but many cats will have severe oral ulceration and are unable to eat properly. Other syndromes have been associated with FCV infection including limping syndrome (often in kittens, lasts for a few days) and gingivitis/stomatitis (although the relationship is unclear). A severe systemic illness is also reported in rare outbreaks, with a fatality rate of up to 50% (virulent systemic calicivirus).4

The incubation period for FCV is 1–7 days and cats usually recover after 7–14 days.2 Cats infected with FCV will usually only shed the virus for a few weeks or months, but a small percentage will shed the virus for years.

Bordetella bronchiseptica

Infection with the Bordetella bronchiseptica bacteria causes fairly mild upper respiratory infections in adult cats, but more severe infection, and sometimes pneumonia, in kittens. Infection is seen more often in catteries and shelters, where it is important to control the spread of disease using quarantine measures. Transmission between cats and dogs can occur. Coughing is not as obvious in infected cats as it is in dogs. There is an intra-nasal vaccine available, although it is not routinely given to cats, unless they are considered high risk (large breeding colony or shelter). B bronchiseptica infection is easily treated with antibiotics (eg, doxycycline). B bronchiseptica infection has an incubation period of 3–10 days and can be shed for 3 months post-recovery.5
**Chlamydia felis**

*Chlamydia felis* (previously *Chlamydophila felis*) is a bacterial pathogen. The incubation period is around 4–10 days, and clinical signs include marked conjunctivitis, tissue swelling and ocular discharge (Figure 3). Mild upper respiratory tract signs may occur. Infection occurs through direct contact and it is species specific. Kittens are most severely affected. There is a vaccine available against *C felis* (show cats and breeding stock are more at risk). There is also a potential for *C felis* to cause infertility in queens, although this has not yet been proven.

**Vaccination for cat flu**

It is important to note that vaccination does not actually stop infection, but can dramatically reduce the clinical signs and the spread of disease in most cases. Primary ‘core’ vaccinations (which include FHV-1/FCV) should be given at 8–9 weeks of age with a second vaccine given 3–4 weeks later. The recent World Small Animal Veterinary Association guidelines recommend a final vaccination at 16 weeks or older to overcome the effects of maternally derived immunity. For more information see Day et al (2015). A full booster is then given at year one, after which a risk/benefit decision should be made as to whether the cat needs a full yearly vaccine.

Owners of cats considered low risk (single cat household/indoor cat) can choose to have the FCV/FHV-1 vaccine once every 3 years if necessary; however, many vets/owners still prefer yearly boosters as circumstances can change and the cat may otherwise be at risk. For owners of cats that venture outside or multi-cat households a yearly vaccine for
A closer look at...

Key point
Vaccination doesn’t completely prevent disease in the face of overwhelming infection, but it should reduce the clinical signs and is strongly recommended.

decrease the likelihood of the spread of the infection.

Owners and breeders bringing in new cats into their household should be encouraged to isolate the newcomer for 2 weeks to minimise the chances of spreading disease to other cats. Control of FHV-1 and FCV in a breeding cattery can be challenging.

Nursing the cat with cat flu
Nurses play an important role in the care of cats with cat flu, as well as ensuring the safety of other patients in the hospital.

Preventing transmission
Nasal secretions can travel for several metres so any cat showing upper respiratory signs or conjunctivitis should be isolated immediately. Protective equipment should be worn at all times when handling the cat. Hair should be tied back and jewellery removed.

Isolated patients should be given their own specific food/water bowls and litter trays, as well as monitoring equipment (thermometer, stethoscope, etc) to prevent infection between patients. Barrier nursing should be applied so that minimal staff are involved with caring for the cat (Figure 4).

Special attention should be paid to thoroughly cleaning each hospital cage as both ocular and nasal secretions are difficult to remove with just regular cleaning and disinfectant. Cat flu viruses are susceptible to most disinfectants. Infected cats should not be housed opposite each other, but instead side-by-side as this will help decrease the likelihood of the spread of the infection.

Owners and breeders bringing in new cats into their household should be encouraged to isolate the newcomer for 2 weeks to minimise the chances of spreading disease to other cats. Control of FHV-1 and FCV in a breeding cattery can be challenging.

Figure 4: Cats with upper respiratory tract viruses should be barrier nursed

Tip
Ensure your isolation facilities have separate equipment so nothing needs to be brought in or out of the isolation area.
**Initial management**

Cats will often present dehydrated, anorexic, depressed and pyrexic. They may also be in pain due to severe oral or ocular ulcers, rhinitis/sinusitis. See Table 1 for medications used in the treatment of cat flu.

Nursing care includes:

- **correcting dehydration and electrolyte imbalance:** affected cats often need intravenous fluids.
- **removing oral and nasal discharges:** clean gently with warm damp cotton wool, then apply Vaseline to the nose if it is sore.
- **steam inhalation/nebulisation:** this can loosen secretions. Nebulisers for small animals are now available, or human paediatric machines can be used. (Figure 5).
- **provision of nutrition:** tempt the cat to eat by warming food, spending time with the cat where possible and providing palatable, calorific food. Syringe feeding should be avoided as it can create food aversions as well as rarely providing adequate nutrition. Oesophagostomy feeding (Figure 6) may be required and allows provision of fluid, food and medication. It is worth asking the owner what the cat usually eats at home, as many cats prefer their own, usual food when they are poorly.

**Tip**

Early nutrition is important. Naso-oesophageal tubes may be painful to insert, so a brief anaesthetic for an oesophagostomy tube is preferred.

- **use cat friendly principles:** these should always be used for hospitalised cats with provision of a soft bed to hide in and a quiet ward away from dogs (a collapsible cage could be placed in a quiet area, if the ward is not cat-only).
- **providing home care advice:** although some cats will need to be hospitalised, the aim is to get the cat back home as soon as possible (in a stress free environment) as this will aid...
A closer look at...

**Table 1: Drugs used to treat cat flu**

<table>
<thead>
<tr>
<th>Drug type</th>
<th>Example</th>
<th>Indication</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antibiotics</strong></td>
<td>Clindamycin, amoxicillin/</td>
<td>Although usually caused by viral pathogens,</td>
<td>Amoxicillin/clavulanate or doxycycline are used to treat <em>Chlamydia felis</em>.</td>
</tr>
<tr>
<td></td>
<td>clavulanate</td>
<td>secondary bacterial infection is possible</td>
<td>Always follow doxycycline with food or water</td>
</tr>
<tr>
<td><strong>Analgesic</strong></td>
<td>Buprenorphine, non-steroidal</td>
<td>Pain from pharyngitis, corneal ulcers</td>
<td>NSAIDs should not be used in dehydrated cats</td>
</tr>
<tr>
<td></td>
<td>anti-inflammatory drugs (NSAIDs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Antiviral drugs</strong></td>
<td>Famciclovir (oral),</td>
<td>Cats with acute FHV-1 infection, as well as</td>
<td>Famciclovir has been shown to reduce the clinical signs of FHV-1, but can be</td>
</tr>
<tr>
<td></td>
<td>cidovirof (topical),</td>
<td>cats with FHV-1 dermatitis and cats</td>
<td>expensive (depending on country).</td>
</tr>
<tr>
<td></td>
<td>ganciclovir (topical)</td>
<td>with rhinosinovitis</td>
<td><strong>NB:</strong> Other antivirals given orally have significant side effects (eg,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>acyclovir)</td>
</tr>
<tr>
<td><strong>Appetite stimulants</strong></td>
<td>Mirtazapine,</td>
<td>Inappetent cats</td>
<td>Only use once hydrated and with adequate analgesia or it will be ineffective.</td>
</tr>
<tr>
<td></td>
<td>cyproheptadine</td>
<td></td>
<td>Feeding tubes should be placed early in the disease process, if required</td>
</tr>
</tbody>
</table>

recovery. Owners or carers/fosterers of cats in multi-cat households should be advised on how to barrier nurse and isolate cats at home to prevent the spread of disease. Owners should be advised how to tempt their cat to eat, to use a nebuliser and give medications.

**Other manifestations of FCV and FHV infection**

**Feline chronic gingivostomatitis**

FCV has been associated with feline chronic gingivostomatitis (FCGS) but the relationship is unclear. Nearly 100% of cats with FCGS are positive for FCV when tested, but the virus is not the sole cause of the problem.8 Cats that are immunosuppressed with diseases such as feline immunodeficiency virus or feline leukaemia virus are also more at risk of developing FCGS. Clinical signs include marked inflammation of the mouth and gums. It is very painful for the cat and cats with this condition will frequently become anorexic and have a poor condition coat as they are unable to groom.

Treatment includes:
- **dental treatment**: descale and extractions if indicated;
- **long-term antibiotics**;
- **analgesia**: both non-steroidal anti-inflammatory drugs and opioids;
- **feline recombinant interferon**;
- **chlorhexidine mouthwash/gel**: use only if the cat will allow it;
- **regular tooth brushing/cleaning**: once the inflammation is under control and after a descale at the clinic.
**Chronic snuffers**

Chronic rhinosinovitis is a cause of chronic sneezing and nasal discharge in cats. A subset of affected cats have a history of acute FHV-1 and/or FCV infection, and may be latently infected with FHV-1. Also sometimes called ‘post-viral chronic rhinitis’, the condition is thought to be caused by severe, long-term damage to the nasal mucosa and turbinate bones during the initial phase of FHV-1 infection. Remodelling of the nasal bones causes inflammation and makes the cat prone to secondary bacterial infections, ie, *Escherichia coli* and *Staphylococcus* species.

Clinical signs of serous or mucopurulent nasal discharge occur (Figure 7). It can be very difficult and frustrating to manage, and often requires long-term antibiotics, antivirals, non-steroidal anti-inflammatory drugs and mucolytics. Nasal flushing (Figure 8) and rhinoscopy (Figure 9) can be very useful in confirming the diagnosis by taking biopsies (other causes of chronic nasal discharge include neoplasia, for example) and in providing both long-term and temporary relief for some cats. Daily nebulisation may also be helpful for some cats, to loosen secretions.

**Conclusions**

Cat flu is a relatively common problem in cats and with the right nursing care most will make a full recovery. Owners should, however, be warned that some cats will become chronic shedders of the viruses that contribute towards cat flu and that treatment can be ongoing and time consuming. Potential recurring problems for some cats that are very young, old or immunocompromised are a real possibility and owners will need to
be given as much information, support and guidance from the veterinary practice staff during what can be a very stressful and worrying time. Prevention is better than cure, so veterinary nurses and technicians should educate owners on the benefits of hygiene in the home and vaccination of cats, especially if they belong to a multi-cat household.

References
**Top tips for infection control in the clinic**

Infection control principles have been commonplace in human medicine for many years, and awareness of these principles is now increasing in the veterinary profession. The veterinary nurse plays a key role in infection control due to his or her involvement in cleaning and preparing surgical and hospitalisation areas and carrying out general medical and surgical nursing. This article will focus on the key areas of personnel, personal protective equipment, surgical considerations, hospitalisation ward considerations, preventing the spread of infectious disease and infection surveillance, providing useful tips which can be implemented in practice.

**Personnel**

**Hand hygiene**

Hand hygiene is the most important activity in controlling nosocomial infections. Hands should be washed thoroughly with a suitable disinfectant hand-wash:

- at the start of a shift;
- before and after eating or smoking;
- after using the toilet;
- after handling any animal excretions or samples;
- whenever visibly soiled;
- before and after a surgical procedure.

**Key point**

Hand hygiene protocols should be strictly followed, with both hand-washing and hand-disinfection techniques used when indicated.
Hand disinfection

Hand disinfection should be carried out in addition to hand-washing, before and after any patient contact, handling equipment and use of high-touch objects such as light switches, telephones, door handles and computer keyboards. This can be achieved with alcohol disinfectant gels (minimum concentration 70–90% alcohol) (Figure 1), provided they are used on dry, clean hands, applied liberally and using a suitable hand-rubbing pattern, and allowed to air-dry.

Choosing a hand gel

When choosing an alcohol gel for your practice, be sure to examine the data-sheet to check for efficacy against a suitable range of pathogens. Products listed as effective against human norovirus are also effective against calicivirus, as this is used as a norovirus substitute in laboratory testing.

Figure 1: Alcohol disinfectant gels should be located near areas of patient contact. Motion-sensor activated gel dispensers are ideal as they avoid the need to touch disinfectant dispensers, reducing transient bacterial contamination

Personal protective equipment

Disposable gloves

Use of personal protective equipment (PPE) should be considered an adjunct to hand-washing rather than a substitute. Disposable gloves should be worn when:

- handling patients with a suspected or confirmed infectious disease;
- handling patients with parasitic infestations;
- handling any wound;
- handling a patient with a suspected resistant infection;
- when in contact with any bodily fluid, tissue or mucous membranes; and

Uniforms

Uniforms should only be worn at work (ie, changing into and out of uniform when entering/leaving the building) and a freshly laundered set worn each day. Uniforms should be washed separately to other clothing, at a minimum temperature of 60°C.

Jewellery

Jewellery should be kept to a minimum and a ‘bare below the elbow’ policy adhered to by all clinical staff, with nail polish and/or false nails avoided. Nails should be kept clean and short.

procedure (in combination with gloves); and

- at the end of a shift.

World Health Organization ‘How to handrub?’ instructions can be found at: http://www.who.int/gpsc/5may/How_To_HandRub_Poster.pdf
• during non-aseptic procedures such as dentistry.¹

Disposable gloves should be changed:
• when handling a different site on the same patient (eg, moving from a clean to dirty site);
• between patients (in addition to hand disinfection); or
• when gloves become soiled.¹

Sterile gloves
Sterile gloves should be worn whenever a surgical or invasive procedure is performed, alongside hand-washing and disinfection, and in combination with other surgical attire such as sterile long-sleeved gowns, surgical caps and masks, dedicated surgical scrub suits and anti-static shoes.

Other PPE
Other PPE such as disposable aprons/gowns, shoe covers, masks and eye protection should be considered when handling a patient with a suspected or confirmed infection or contagious disease.¹

Disposable PPE should be changed in between each episode of patient contact and not re-used, in between patients, and when moving to different areas of the hospital.¹

Surgical considerations

Surgical area
• The surgical area should be well-maintained, easy to clean, free of non-essential equipment and items, and cleaned regularly, utilising a checklist of tasks required on a daily, weekly and monthly basis.⁴
• Surgical staff should wear separate theatre attire, including scrubs, hats, masks and shoes. This should not be worn elsewhere in the building.⁴
• Excessive foot-fall and conversation should be avoided in the surgical area.⁵
• Surgical procedures should be organised in the following order:
  — clean;
  — clean-contaminated;
  — contaminated;
  — dirty.⁶

Pre-operative procedures
• Pre-operative bathing with an antimicrobial solution may be considered in cases of elective orthopaedic surgery, to remove excess skin scales, dirt and external parasites.⁴

Tip
Personal protective equipment should not replace hand-hygiene. Both are important in infection control.
How to...

- Fur should be clipped, using a clean, sharp and well-lubricated size 40 blade, in line with the hair growth to prevent damage to the skin. A disposable apron and gloves should be worn while clipping, to avoid contamination of uniform with hair.\(^7\)
- If removing excess clipped fur with a vacuum cleaner, this should be done with a removable nozzle which is disinfected between patients, or without the vacuum cleaner tip in contact with the patient. The vacuum cleaner nozzle should not be shared between the environment and the patients.

**Environmental considerations**

- The hospitalisation environment should be easy to clean and maintain, and free of non-essential equipment. Items should be stored in closed cupboards where possible to avoid contamination and facilitate cleaning.\(^8\)
- The hospitalisation area should segregate cats and dogs to avoid additional stress to the hospitalised cat; cleaning chemicals used should be free of overpowering odours which may mask a cat’s own scent, causing additional stress; fragrance-free disinfectants should be considered if possible.
- The isolation area, if available, should be located away from the main hospitalisation area and contain a separate stock of bedding, food, bowls and other commonly used equipment. The isolation area should be well stocked with consumables such as needles, syringes and bandages, to avoid contaminated staff travelling into other areas of the hospital to collect supplies (Figure 4).\(^8\)
- Kennels should not be placed directly facing each other, to avoid transmission of airborne pathogens, and to reduce patient anxiety. If this is not possible, wipe-clean screens may be installed to provide a ‘sneeze barrier’ and block the sight of other cats (Figure 5).\(^9\)
- Separate supplies of cleaning equipment should be utilised for the main hospitalisation area, and for isolation. These items should not be used elsewhere in the hospital (Figure 6).\(^9\)
The hospitalisation area should be cleaned thoroughly, utilising a checklist of tasks required on a daily, weekly and monthly basis.

A supply of PPE should be readily available in each hospitalisation area, and hand-washing or hand-rubbing stations should be available near each ward.

Preventing the spread of infectious disease/infection

- Patients should be classified according to the nature of their condition, and the threat of infection they pose. The author’s practice uses a traffic-light system, where ‘green’ patients can be nursed in the normal ward, ‘orange’ patients should be nursed in isolation where possible, and ‘red’ patients must undergo strict isolation and barrier nursing. These classifications take into account the patient’s disease process, presence of discharging wounds and multi-drug resistant infections.

- Reducing entry into isolation areas will help to prevent the spread of pathogens around the hospital — dedicating one nurse and vet to be the ‘isolation team’ can help with this.

- Barrier nursing protocols must be implemented in every practice and strictly adhered to by all members of the practice team.

Key point

Classifying patients according to the threat of infection they pose, and their own risk of developing an infection, is helpful when deciding where to house the patient, and whether isolation and barrier nursing is required.
How to...

- Thorough cleaning and disinfection of barrier nursing areas should take place regularly throughout hospitalisation, and a 'deep clean' performed on discharge of the patient. The use of airborne disinfectants can be considered to provide additional antimicrobial activity.
- Patients at risk of developing an infection or infectious disease include those with indwelling devices, those receiving chemotherapeutic medications and unvaccinated animals. These patients should be identified and reverse barrier nursed (isolating the patient to prevent them contracting a disease/infection, rather than them spreading one), as required.

Conclusions
Infection control is an important area of veterinary practice, and one which the veterinary nurse is ideally suited to manage. The implementation of a biosecurity policy may help to educate the practice team, improve hygiene standards and rapidly identify trends in postoperative infections.

Thoroughly cleaning and maintaining the surgical and hospitalisation environments may help to reduce the incidence of surgical site infection, and the spread of disease.

While maintaining infection control standards, it is important to ‘think cat’ and ensure that their specific needs are met; this can be achieved...

Infection control policies and surveillance

- **appoint an infection control officer:** appoint one individual or a small group of people as ‘infection control officers’ (depending on the size of your hospital). These people should be responsible for monitoring of wound infections, environmental concerns and general hygiene;
- **implement a surgical wound audit:** a simple way to is add a zero-fee ‘wound audit’ fee structure to the practice management system. Several ‘fees’ could be added, eg, Wound Audit 1, Wound Audit 2, Wound Audit 3 depending on the level of contamination. At every postoperative check, an appropriate ‘fee’ is added to the patient record. When auditing wounds, a list of patients with clean, clean-contaminated or contaminated wounds can then easily be generated;
- **create a biosecurity policy:** this should contain all the practice protocols on preventing the spread of infection, and how to manage an infectious case;
- **carry out regular hygiene auditing:**
  - The Bella Moss Foundation ‘Practice Hygiene Self-Audit’ tool: http://www.thebellamossfoundation.com/practice-hygiene-self-audit/ can be used to assess general hygiene throughout the practice, and identify any problem areas which need to be addressed;
- **carry out environmental cultures:** limited evidence currently exists on the benefit of routine environmental cultures, but they may be of benefit if a higher than normal wound infection rate is experienced.

Key point
Does your practice perform any surveillance on infection control? Audits of wound infections and practice hygiene can identify problem areas.
by using fragrance-free cleaning chemicals, performing routine ‘deep cleans’ while no cats are hospitalised, and implementing physical barriers between kennels which will reduce stress as well as the transmission of airborne pathogens.

References
International Cat Care’s much-loved charity calendar is back for another year, with a new theme – Street Cats. This A4-sized landscape calendar (opens to A3 portrait style) features images of street cats (also known as feral cats, stray cats or community cats) from all over the world which capture the character of cats surviving without owners and reflect the reality of a life on the streets.

All proceeds go to support International Cat Care’s work in improving the health and welfare of cats worldwide.

Order online at: icatcare.org/shop or call +44 (0)1747 871872
Vaccination in cats: latest recommendations

Vaccines form an important part of feline preventive healthcare, but should not be given without thought of the cat’s risk of infection, and the appropriate vaccine interval. Core vaccines against common and serious infections should be given to all cats, but the decision to give non-core vaccines should be based on geography and lifestyle. Feline injection site sarcomas lead us to question the site of vaccination and use of the distal limb or tail is recommended by some to avoid inoperable tumours in the intrascapular region. Practice policies should be based on evidence and regularly reviewed.

It wasn’t so long ago that when an owner brought their cat in for vaccination, they would receive a ‘one size fits all’ approach, usually routine yearly vaccination. However, the veterinary profession has known for some time that an individual cat’s vaccination requirements depend on lifestyle, geographical location, individual disease risks and immunity. Vaccines are not innocuous, and owners are rightly questioning how frequently their cats are vaccinated (Figure 1). This article looks at the recent changes to vaccination recommendations in cats, and the vaccine options available.

Drawing on information from the International Society of Feline Medicine (ISFM)/American Association of Feline Practitioners (AAFP),1 the World Small Animal Veterinary Association (WSAVA),2 and European Advisory Board on Cat Diseases (ABCD) vaccination guidelines;3 types, core and non-core vaccines, duration of immunity and recommended protocols are discussed. The article also discusses advice regarding site of vaccination and provides a short reference guide on current guidelines for vaccination in cats. Note that available vaccines may vary from country to country.

Key point
It is now accepted that not every cat should be vaccinated for every disease on a yearly basis. Vaccine type and frequency should be judged individually, based on lifestyle and risk of disease.

What is a vaccine?
Vaccinations are an important part of preventive healthcare in feline medicine. A vaccine is a virus, or part of a virus that has been modified in some way and (usually) injected under the skin to cause the immune system to mount an
immune response. If, and when, the cat is exposed to the virus again, it is recognised and as the immune system has a memory and is therefore primed to respond, the clinical disease is prevented.

What are core vaccinations?
A core vaccination is a vaccination that every cat should have, regardless of where it lives and what its lifestyle may be. This may be due to the virus being common within the feline population, or the disease it causes being serious in nature. Vaccines providing protection against feline panleukopenia virus (FPV), feline calicivirus (FCV) and feline herpesvirus-1 (FHV-1) are considered core vaccinations. Additionally, in countries where it is endemic, rabies vaccine is also a core vaccine, and administration may be a legal requirement.

FPV is a commonly found virus and can be fatal. It can last from weeks to months in the environment, and spreads via the faeco-oral route, or from queen to kitten during pregnancy. Infected kittens from 3–4 weeks may develop gastroenteritis (often haemorrhagic) leading to death. Kittens younger than this, or born to an infected mother, may suffer cerebellar hypoplasia for which no specific treatment is available. Prevention is far better than cure, and thankfully the vaccinations against FPV are highly effective.

FCV and FHV-1 are responsible for what is more commonly known as ‘cat flu’. These viruses are also ubiquitous in the environment, can cause severe clinical disease and can be fatal in certain circumstances. Both are spread through direct contact, aerosol or fomites (objects capable of carrying infectious organisms), leading to acute

Three forms of vaccines
Vaccines come in three main forms:
• modified live virus (MLV): the live virus has been modified to prevent it causing clinical disease, but as it still replicates it prompts the immune system to mount a strong and rapid immune response. MLVs are useful in disease outbreaks and high-risk situations. However, these vaccines should not be used in pregnancy, kittens under 4 weeks old or immunosuppressed animals (eg, cats with feline immunodeficiency virus).
• killed or inactivated: the organism has been killed, but added to another substance (an adjuvant) to increase the immune response. These vaccines can be used in pregnant, immunosuppressed or young animals. However, adjuvants have been implicated in the occurrence of feline injection site sarcoma (see later).
• recombinant: part of an organism that provokes an effective immune response is incorporated into another harmless organism, which is then used to vaccinate the cat.
respiratory infections, ocular conditions and dermatitis (FHV-1). FCV has been implicated in cases of gingivostomatitis (although the link is unclear), limping syndrome and certain strains of FCV can result in virulent systemic disease.\(^4\) See Table 1 for types of core vaccine, and Table 2 for specific vaccine recommendations.

There are also multi-strain FCV vaccines, which allow broader protection such as Purevax (Merial) and Fel-O-Vax Ultra (Boehringer Ingelheim). Use of multi-strain vaccines may improve efficacy.\(^5\) MLV injectable vaccines against FCV can lead to viral replication and shedding and if aerosolised or licked off the coat can cause disease if ingested/inhaled.

**Intranasal vaccinations**
The MLV intranasal vaccinations against FCV and FHV can lead to a rapid protection (<48–92 h) and seem not to be as affected by maternally derived antibody (MDA), so can be useful in shelter outbreaks and in young kittens. However, mild upper respiratory signs are common after vaccination, and the FPV intranasal has a lower efficacy.

**How often should cats be vaccinated with core vaccines?**
We know that immunity from FPV vaccination is strong and long lasting, with a duration of immunity of 7 years or longer.\(^6\) Therefore, WSAVA and ABCD do not recommend vaccinating against FPV more regularly than every 3 years in any cat (as long as they have had the primary course). Vaccination against FCV and FHV-1 is not as protective and, in the face of overwhelming challenge with a virulent virus, vaccinated cats can still develop disease. (See Table 2 for recommendations.) A third, or even fourth, vaccination is recommended for kittens at 16 weeks or older, to ensure that maternally derived antibodies have waned. The earlier the kitten course starts, the more vaccinations are therefore required.

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**Table 1: Types of core vaccine**

<table>
<thead>
<tr>
<th>MLV</th>
<th>Killed</th>
<th>Recombinant</th>
<th>Intranasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPV</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>FHV</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>FCV</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

MLV = modified live virus; FHV = feline herpesvirus; FPV = feline panleukopenia virus; FCV = feline calicivirus

**Table 2: Core vaccine recommendations for use in all cats**

<table>
<thead>
<tr>
<th>WSAVA(^2)</th>
<th>ABCD(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begin 8–9 weeks of age</td>
<td></td>
</tr>
<tr>
<td>Repeat 3–4 weeks later</td>
<td></td>
</tr>
<tr>
<td>Final at 16 weeks or older</td>
<td>Consider 16 weeks or older</td>
</tr>
<tr>
<td>Consider earlier start (eg, 4–6 weeks)</td>
<td></td>
</tr>
<tr>
<td>First ‘booster’ after 12 months old</td>
<td></td>
</tr>
<tr>
<td>FPV: no more frequently than every 3 years</td>
<td>FCV/FHV: Every 1–3 years. Every year for high risk cats (see Table 3)</td>
</tr>
</tbody>
</table>

---

**Key point**
Maternally derived antibodies (MDAs) affect how well vaccination works. A final vaccination at 16 weeks or older is therefore recommended, when maternally derived immunity has waned. Stopping the vaccine course too early, when MDAs are still present, is considered the single most common reason for vaccination failure in kittens.\(^1\)\(^3\)
Once all kittens have received this initial vaccination protocol to a year, further vaccination recommendations are based on the lifestyle of the cat. Some vaccine companies have now created separate core vaccines to allow veterinarians to vaccinate according to individual risk.

What are non-core vaccines?
Non-core vaccines are used only where there is a genuine risk of exposure to the infectious organism, or where the benefit of vaccination outweighs the risk of not vaccinating against that virus. Vaccination against rabies may be required by law in some areas, and for cats travelling into countries without the virus. Vaccines against the following pathogens are considered non-core:
- rabies;
- feline leukaemia virus;
- feline immunodeficiency virus;
- *Chlamydia felis*;
- *Bordetella bronchiseptica*;
- feline infectious peritonitis (FIP);
- dermatophytes.

Feline leukaemia virus (FeLV)
FeLV is spread through prolonged social contact or biting, and from an infected mother in pregnancy. It can cause immunosuppression, anaemia and neoplasia and it is estimated that 80–90% of infected cats die within 3–4 years after diagnosis. This vaccine is therefore recommended for kittens, as in their life they are likely to have access outdoors (kittens are also more susceptible to the disease), adult cats with outdoor access, or indoor cats where new cats of unknown FeLV status are introduced.

The WSAVA vaccine guidelines recommend vaccination of kittens, with revaccination at 1 year of age, then not more frequently than every 2–3 years thereafter. The AAFP guidelines differ slightly, recommending revaccination every 2 years for cats at low risk, and every year for those at higher risk.

Bacterial infections
Chlamydia infection is via a bacterium called *Chlamydia felis* (previously called *Chlamydophila*

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**Missed a vaccination?**
Traditionally if a cat misses a yearly vaccination, a new course of two injections is started again. However, this does not make immunological sense if the cat has had a primary course of vaccinations (including vaccination at 1 year after the kitten course), when it only requires a single dose of MLV vaccine to stimulate adequate immunity. What does your clinic do?

Once the risk of disease is established then frequency and type of vaccination can be selected.
Clinical nursing

Table 3: Recommendations for vaccination of household pet cats

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Kittens</th>
<th>Adults</th>
<th>Boosters</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core vaccination against FPV, FHV-1, FCV</strong></td>
<td>From 6 weeks of age then every 3-4 weeks until 16 weeks or older (third vaccination at 16 weeks may be required)</td>
<td>If not previously vaccinated administer two doses, 3-4 weeks apart</td>
<td>Kittens and adults 6 months to 1 year after primary course. Then booster every 1-3 years depending on lifestyle and risk. FPV should be given not more frequently than every 3 years</td>
<td>Lapsed adult cats that have been previously vaccinated can receive a single booster. Vaccinate 7-10 days before going into a boarding cattery</td>
</tr>
<tr>
<td>Feline leukaemia virus</td>
<td>From 8 weeks 2 injections 3-4 weeks apart</td>
<td>Two doses 3-4 weeks apart</td>
<td>Kittens and adults 1 year after primary course. Then booster every 2-3 years</td>
<td>Annual boosters recommended by AAFP for high risk cats¹</td>
</tr>
<tr>
<td>Rabies</td>
<td>From 12 weeks as a single dose</td>
<td>Single dose</td>
<td>Kittens and adults 1 year after primary course. Revaccination thereafter dependent on local rules</td>
<td>Some vaccines licensed for every 3 years</td>
</tr>
</tbody>
</table>

Adapted from Scherk et al 2013¹ and Day et al 2015²
FHV-1 = feline herpesvirus-1; FPV = feline panleukopenia virus; FCV = feline calicivirus

*felis*). It causes persistent conjunctivitis, potential for infertility and is spread by direct contact between cats. The bacteria *Bordetella bronchiseptica* produces a respiratory tract infection. It is also spread by direct contact, aerosol inhalation or fomites and is a rare zoonosis (can transmit from animals to humans).

As both of these infections are bacterial, they are easily diagnosed and treatable with antibiotics, but vaccination can be recommended in high-risk situations such as colony infections, multi-cat households where the organisms have been identified and clinical signs are present, or shelter/breeding cattery situations where cats are housed closely together. Vaccination can be used along with good hygiene and barrier nursing protocols can help to control outbreaks.

**Feline immunodeficiency virus (FIV)**
FIV vaccine is available in some parts of the world, but may not provide protection against strains in Europe. Testing can now distinguish infected from vaccinated cats, a previous concern regarding the use of this vaccine.⁷

**What are the vaccine site recommendations?**
All the advisory groups have different recommendations on the best anatomical site to vaccinate cats. Although rare, feline injection-
site sarcomas (FISSs) do occur (it is thought to be seen in less than 1 in 10,000 vaccine doses). Treatment is by wide surgical excision due to the invasive nature of the tumour, and sometimes followed by chemo- or radiotherapy.

Although rare, FISSs are another reason to avoid unnecessary vaccination of cats. Importantly, studies have shown that injections other than vaccinations have the ability to induce FISS, as it is assumed a localised inflammatory reaction occurs and malignant transformation of mesenchymal cells results in neoplasia. Previously, and ongoing in some countries, most vaccines are injected into the skin between the shoulder blades, and removal of a FISS at this site is difficult and often impossible.

The AAFP guidelines recommend that rabies vaccination is given in the right hind leg, FeLV in the left hind leg and FHV-1/FCV/FPV in the right front leg to allow potentially life-saving amputation should a FISS arise. Injecting into these sites has not been a protocol used frequently outside North America. Vaccination at other sites such as the tail and lateral abdomen are reported, and a recent pilot study demonstrated that tail vaccination, although not widely carried out in practice as yet, was tolerated well by the cats. The use of a low-volume vaccine was recommended. The WSAVA, AAFP and ABCD guidelines all recommend avoiding the interscapular region for vaccination (and other injections).

Each practice should discuss the best policy for their clients, ideally changing the site of injection each year, and record where injections have been given. Injection into the distal limb is generally well tolerated (Figure 2).

Suspected vaccine reactions, including FISS, should be reported to the country’s advisory body.

**Vaccination in specific situations**

**Breeding catteries**

In breeding catteries, respiratory viruses are often endemic and outbreaks in kittens are common. The age they are affected is down to maternally derived immunity and the dose or strain of the virus. Prevention can be provided by reducing the exposure of the kittens to the virus with good hygiene and...
Clinical nursing

isolating affected queens and kittens from other cats, plus vaccinating the queen prior to mating and kittens from 4–6 weeks with inactivated vaccines. (For more information see http://icatcare.org/advice/cat-health/upper-respiratory-infections-uriis-cat-flu-%E2%80%93-information-breeders.)

Rehoming centres/shelters
In shelters, MLV should be used to get a faster onset of immunity and better protection in the face of MDA. Cats are vaccinated at intake or more than 7 days before entering the shelter and then again 2–3 weeks later. Early vaccination of kittens, and intranasal vaccination may be discussed if infectious disease is an issue at the facility.

Annual health checks
In a veterinary practice setting, annual check-ups should provide a forum during which the requirements of each individual cat should be discussed. If a cat is vaccinated less frequently than yearly following assessment of risk, clients should still be encouraged to have a minimum of an annual examination (more frequently as cats age) to assess the cat’s general health.

Conclusions
Vaccination is important not only for the health of the individual, but also for the health of the community. The WSAVA recommends that: ‘we should aim to vaccinate every animal...and each animal less frequently.’ Our aim therefore, should be to have an up-to-date knowledge of preventable diseases, and the different vaccines on offer to us so that we can provide owners, breeders and shelters with as much useful information as possible.

Vaccination helps to protect not only the individual, but the feline population as a whole. As new data and disease emerges, so protocols will change. By using the evidence-based medicine approach that is available to us as it arises, vaccination should stay as relevant and important to us and our cats as it ever has done.

References