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Feline alimentary lymphoma

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Welcome to February’s issue of Feline Focus.

In this issue we discuss the latest developments in feline alimentary lymphoma, the most common lymphoma in cats and one with very different outcomes depending on the subtype. Next we start a series of five articles that will appear over this coming year on urinalysis, with this first article on urine collection methods and initial assessment. Further articles will cover many other aspects of urinalysis including use of dipsticks and microscopic analysis.

Alison Mann provides an article on surgical site preparation, and suggests regular reassessment of practice protocols in this area. The final article is another in our ‘keeping cats safe’ series looking at the dangers of home decorating products.

Remember, we have a bank of recorded webinars to provide you with hours of CPD without leaving your home! Go to www.icatcare.org/nurses and log in — click on the ‘webinars’ button to see what interests you.

Best wishes,

Sam Taylor, Veterinary Editor

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*Source: Mills 2001. Evaluation of a novel method for delivering a synthetic analogue of feline facial pheromone (Feliway*) to control urine spraying by cats.
Feline alimentary lymphoma: the importance of subtype

Alimentary lymphoma is now the most common form of the disease and is seen most frequently in older cats. Alimentary lymphoma occurs with different subtypes: small cell or low grade alimentary lymphoma, and large cell or high grade alimentary lymphoma. Other subtypes are seen but are less common. Cats with small cell lymphoma often present with diffuse small intestinal thickening and can respond well to treatment with prednisolone and chlorambucil, with long survival times. Cats with large cell lymphoma may present with intestinal masses and do not respond as well to treatment with injectable chemotherapeutics. Defining subtype is vital to provide owners with a prognosis and to treat cases appropriately.

Lymphoma is the most common form of neoplasia in cats, and is seen in a variety of anatomical sites on a regular basis. Although certain types are seen at different ages, essentially any age, sex or breed of cat can be affected. Siamese cats (along with Manx and Burmese in some studies) are over-represented. Studies performed over the past 20 years illustrate a huge increase in the number of cases of alimentary (gastrointestinal) lymphoma. The fall in feline leukaemia virus (FeLV) related lymphoma contributes to this ‘rise’ (FeLV is often associated with mediastinal lymphoma in young cats), but also increased diagnostic testing, for example ultrasound and endoscopy.

Key point
Alimentary lymphoma in cats is categorised into different subtypes, each of which have very different treatment, responses and survival.

Samantha Taylor BVetMed(Hons) CertSAM DipECVIM-CA MRCVS

Samantha Taylor graduated as a veterinary surgeon in 2002 from the Royal Veterinary College, UK, and spent time in first and second opinion practice before becoming the International Cat Care (previously known as Feline Advisory Bureau) Resident in Internal Medicine in 2006. She became a European Specialist in Internal Medicine in 2009 and a Royal College of Veterinary Surgeons Veterinary Recognised Specialist in Feline Medicine in 2010. She is currently the Distance Education Coordinator at International Cat Care and editor of Feline Focus.

The cause of alimentary lymphoma (AL) is unknown, but it is generally accepted that chronic antigenic stimulation may result in inflammatory bowel disease (IBD), and IBD may transform into lymphoma. In cats, AL can have quite different outcomes dependent on subtype.

Subtypes of alimentary lymphoma
We now know that, as in humans, AL in cats is biologically diverse and different subtypes respond very differently to treatment. A diagnosis
of lymphoma in the alimentary tract should not be the end of the investigation and the pathologist reviewing the sample should provide further information on suspected subtype. The clinical signs and diagnostic test results may also suggest a subtype (see later). In general, AL is divided into ‘small cell’ or ‘large cell’. These subtypes have also been called ‘low grade alimentary lymphoma’ (LGAL) and ‘high grade alimentary lymphoma’ (HGAL), respectively. ‘Intermediate grade alimentary lymphoma’ (IGAL) tends to be included with HGAL, with similar treatment and outcomes. Another subtype exists termed ‘large granular lymphocyte lymphoma’ (LGLL), which responds poorly to treatment (see Table 1). The majority of cats with AL will have large cell/HGAL, with 28% of cases having small cell/LGAL in a recent study.¹

Clinical signs of alimentary lymphoma
AL tends to be a disease of older cats, median ages 12–13 years. Common clinical signs include:
• lethargy;
• weight loss;
• reduced appetite; and
• vomiting and diarrhoea.

For cats with small cell lymphoma/LGAL the history may be more chronic, in some cases years, contributing to the suspicion that

Table 1: Alimentary lymphoma (AL) subtypes and response to treatment

<table>
<thead>
<tr>
<th>Lymphoma subtype/cell size</th>
<th>Immunophenotype</th>
<th>Clinical findings</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low grade AL/small cell</td>
<td>T cell predominant ly</td>
<td>Often chronic history, diffuse intestinal wall thickening, lymph node involvement and intestinal mass formation less common than in high grade AL</td>
<td>Prednisolone and chlorambucil (oral)</td>
<td>Often prolonged survival (19–29 months)</td>
</tr>
<tr>
<td>Intermediate/high grade/large cell</td>
<td>B cell predominant ly</td>
<td>Usually shorter history of clinical signs, focal intestinal masses, lymph node involvement ≠ other organs</td>
<td>Intravenous multi-agent chemotherapy protocols</td>
<td>Shorter survival and lower response rates (50 days–7 months*)</td>
</tr>
<tr>
<td>Large granular lymphocyte lymphoma</td>
<td>T cell predominant ly</td>
<td></td>
<td>Intravenous multi-agent chemotherapy</td>
<td>Poor response and short survival (17 days)</td>
</tr>
</tbody>
</table>

Adapted from Barrs and Beatty 2012²

*The higher survival duration is for cats treated with injectable chemotherapy protocols including doxorubicin. Note: Survival times are hard to confirm as earlier studies grouped all AL as one group.
some of these cases represent transformation of IBD into a neoplastic process. Cats with large cell lymphoma/HGAL tend to have a shorter history and in the author’s experience more severe clinical signs; although it is always worth remembering that cats hide illness well and some affected cats are surprisingly well despite having HGAL.

On examination, abdominal palpation may reveal focal intestinal masses and lymph node enlargement (large cell/HGAL) or diffuse intestinal thickening (small cell/LGAL). Cats with small cell AL tend to have less lymph node involvement than those with large cell AL, although lymphadenopathy is still possible.

Making a diagnosis of alimentary lymphoma
Diagnosing AL can be a challenge. Suspicion should be raised based on clinical signs and examination findings, and further testing performed. Abdominal ultrasound can be helpful; small cell/LGAL has been associated with a thickened muscularis layer of the intestine, whereas large cell/HGAL tends to have more significant findings on ultrasound such as focal thickening, lymph node and other organ involvement. Imaging cannot distinguish between IBD and small cell/LGAL, which can look very similar, both causing diffuse intestinal wall thickening (Figure 1).²,³

A diagnosis may be made with fine needle aspirate cytology from lymph nodes or thickened areas in some cases of AL (mainly large cell/HGAL), but most cases, particularly of small cell/LGAL, require histopathology to make a diagnosis. This can be carried out via endoscopy or full thickness intestinal biopsy — each has advantages and disadvantages (Box 1).

Differentiating between IBD and small cell/LGAL can be challenging,
Key point
Making a diagnosis of AL requires biopsy samples for histopathology in most cases. Some cases of large cell/HGAL can be diagnosed from fine needle aspirate samples of intestinal masses or lymph nodes.

and further testing of biopsy samples may be indicated; for example, immunophenotyping to identify the predominant cell type (B or T cell), or clonality testing, to determine if all cells are ‘clones’ of each other — a finding in groups of neoplastic cells.

Treatment of alimentary lymphoma
The treatment of GI lymphoma varies according to the subtype (see Table 1), but importantly cats with small cell/LGAL can respond very well to treatment, with prolonged survival periods. Treatment with prednisolone and chlorambucil orally has been associated with median survival times for cats responding to treatment up to 29 months.

Case study: Charlie
Presenting signs: Charlie (Figure 2), an 8-year-old male neutered domestic shorthair (DSH) cat, presented with an 8-month history of small bowel diarrhoea. He has a good appetite but has lost a little weight. On examination he was bright and alert and in good body condition (2.5/5) but abdominal palpation revealed thickened intestinal loops.

Investigation: Blood samples revealed hypocobalaminemia and abdominal ultrasound showed diffusely thickened small intestines (Figure 3). Endoscopy was performed and a diagnosis of small cell lymphoma was made.

Treatment: Charlie was treated with prednisolone (5 mg once daily) and chlorambucil (2 mg PO every 48 h) and supplemented with cobalamin.

Outcome: Charlie responded very well to treatment. He gained weight and the diarrhoea completely resolved. The prednisolone dose was reduced to 5 mg every other day and chlorambucil to every third day after 2 months. At the time of writing, he had remained in remission for 1 year.
Chlorambucil is a well-tolerated chemotherapeutic. Side effects include neutropenia (tends to be the limiting factor), thrombocytopenia and vomiting/diarrhoea. Liver enzyme elevations are also reported in some cats. Importantly, 78% of cats with small cell/LGAL have low levels of vitamin B12 (cobalamin) and require supplementation.\(^5\)

Treating large cell/HGAL requires chemotherapy such as a ‘COP’ protocol using injectable drugs (vincristine, cyclophosphamide and, in some cases, doxorubicin) along with oral prednisolone. Survival times are much shorter and response rates much lower, with a median survival of just 50 days reported in one study.\(^6\)

**Case study: Beth**

**Presenting signs:** Beth (Figure 4) was a 12-year-old female neutered DSH cat with a 2-month history of weight loss, inappetence and severe diarrhoea. Treatment with diet and antibiotics failed to improve her clinical signs. On examination she was quiet, depressed and thin (body condition score 1.5/5) and her intestines felt thickened.

**Investigation:** Blood samples showed a low albumin and mild anaemia. Abdominal ultrasound revealed a small amount of free fluid and thickened small intestines with a loss of normal layering (Figure 5). Endoscopy was performed and biopsies obtained confirmed large cell lymphoma/HGAL.

**Treatment:** Beth was treated with a COP protocol of chemotherapy (cyclophosphamide, prednisolone and vincristine) and a feeding tube was placed to provide nutrition.

**Outcome:** Unfortunately, Beth responded poorly and continued to have diarrhoea and refuse food. She was euthanased on the basis of the poor response and poor prognosis.

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**Tip**

Cats with AL should have their serum B12 measured as many will be hypocobalamaemic.
State of the art

Key point
Cats with small cell/LGAL can respond well to treatment with prednisolone and chlorambucil with prolonged survival and excellent quality of life.

Prognosis
Outcomes of cats with AL vary enormously — dependent on subtype. Owners can be informed that if their cat has small cell/LGAL they should do well and can live for up to 2-3 years on treatment. For cats with large cell/HGAL the prognosis is much more guarded and if treatment is attempted they should be prepared to stop if the initial response is poor.

References

Online how-to videos
what all cats would want their owners to watch

International Cat Care has produced 16 short videos to demonstrate correct cat care and help owners with various cat care issues.

General
• Apply a spot-on product
• Apply ear drops and clean your cat’s ears
• Apply eye drops or ointment
• Brush your cat’s teeth
• Clip your cat’s claws
• Fit a collar for your cat
• Give subcutaneous fluids to your cat

Giving a cat a tablet
• Two people giving a tablet
• Using a pill popper
• Hiding a tablet in a treat
• Crushing a tablet and mixing with water
• Crushing a tablet and mixing with wet food

Diabetes
• Home blood glucose testing for your cat
• Collect your cat’s urine
• Give your cat an insulin injection
• Test your cat’s urine for substances like glucose and ketones

Available from
www.youtube.com/icatcare
Urinalysis in cats 1:
urine collection, storage and initial assessment

Urinalysis is an essential procedure for the investigation of ill health in feline medicine but often little attention is paid to optimising the data yielded or minimising factors that can affect the results. Careful attention can minimise artefacts and allow maximum useful information to be obtained from this seemingly simple process. For the best results, appropriately collected urine should be prepared promptly for the relevant tests and stored correctly to prevent deterioration or contamination. Urinalysis can be performed in-house or urine samples can be sent to a veterinary laboratory for examination.

Examination of urine (urinalysis) is often carried out to investigate ill health in cats. It is one of the oldest and most commonly performed laboratory tests in veterinary practice. A complete urinalysis, conducted competently and in a timely fashion, can provide important information about both urinary tract and non-urinary tract disorders at relatively low cost. It is therefore imperative that meticulous attention is paid to this seemingly simple test so that accurate information is obtained and artefacts minimised.

Urinalysis has two components:
• **macroscopic examination:** assessing the urine’s gross appearance, as well as performing a dipstick analysis and urine specific gravity (USG) measurement. It is relatively inexpensive and can be performed quickly and easily.
• **microscopic examination:** urine sediment examination and urine cytological assessment. This is more demanding and time-consuming and involves greater skill and more equipment to perform competently.

George Reppas is a specialist veterinary pathologist at Vetnostics (the Veterinary division of Laverty Pathology NSW, Australia). He graduated from the University of Sydney in 1986 and has been involved in all aspects of veterinary laboratory medicine since beginning a residency in Veterinary Pathology at the University of Sydney in 1988.

Sue Foster is Fellow of the Australian College of Veterinary Scientists and a registered specialist in feline medicine. Sue lives in Western Australia and is currently Adjunct Associate Professor in Small Animal Medicine at Murdoch University (Western Australia) and a medical consultant for Vetnostics (Sydney), QML Vetnostics (Brisbane) and ASAP Laboratory (Melbourne).

This is the first in a five-part series on urinalysis. Parts 2 and 3 will look at how to measure USG accurately and how to use and interpret urine dipsticks. Parts 4 and 5 will discuss the microscopic analysis of urine.
A closer look at...

**Indications for urinalysis**
There are many clinical indications for performing macroscopic examination of urine including routine health checks and assessment prior to anaesthesia, fluid therapy or nephrotoxic drug administration. Any cat with polyuria and/or polydipsia, azotaemia or dehydration should have urinalysis performed as a routine; so too should cats with pyrexia of unknown origin, known exposure to nephrotoxins such as lilies or ethylene glycol, urine discoloration or lower urinary tract signs. Monitoring for resolution or recurrence of urinary tract diseases would also require urinalysis.

Most of the above would also be indications for microscopic examination of urine.

**Specimen collection considerations**

**Timing of collection**
Though rarely considered, appropriate timing of collection can be important — and is not necessarily difficult.

Early morning collection of urine (preferably the first urine catch of the day) is best for evaluating tubular function, as urine that has been stored in the bladder overnight is more likely to be concentrated and have an acidic pH, which will retard the dissolution of renal tubular casts.

Freshly formed urine (collected late morning to early evening) is best for microbial culture and assessment of cellular morphology. Fastidious bacteria may only be recoverable from recently formed urine samples and the morphology of cellular constituents may be distorted by prolonged overnight exposure to urine. Immediate centrifugation of recently formed urine and the preparation of an air-dried smear for future reference is prudent if urinary tract infection (UTI) or neoplasia is suspected.1,2

**Methods of collection**
The three methods of urine collection are:
- cystocentesis;
- catheterisation; and
- voided sample collection.

Patient compliance, risk of trauma to the bladder and level of technical expertise are factors that can influence the choice of collection method. Inducing urine formation in cats by administration of diuretics or parenteral fluids is acceptable if urine is required for microbial culture but is not suitable for routine urinalysis.

**Key point**
The integrity of the urine sample presented for urinalysis, and the accuracy and reliability of the results generated from such testing, will be influenced by the timing and method of urine collection, sample handling and sample storage.

**Cystocentesis**
Cystocentesis allows collection of an uncontaminated urine sample ideal for bacterial or fungal culture. It also allows appropriate timing of collection when timing is important. Cystocentesis is usually performed relatively easily in cats unless they have idiopathic feline lower urinary tract disease (iFLUTD). Cats with iFLUTD typically have a small bladder and any handling results in voiding; ultrasound-guided sampling may be more rewarding in these situations.

Microscopic haematuria is frequently present in cystocentesis samples, especially if there is pre-existing...
bladder inflammation. Cystocentesis is thus not ideal when performing routine monitoring for haematuria in cats with recurrent iFLUTD.

**Catheterisation**
Catheterisation in cats requires chemical restraint, thus is not routinely used for urine collection unless it has been performed for another reason (eg, treating urethral obstructions).

**Voided sample**
Collection of a voided sample is simple, and useful when assessing and serially monitoring various chemicals in the urine (eg, glucose, ketones). If the sample is naturally voided (without use of manual expression), haematuria can also be monitored. Voided urine samples can additionally be used for urine protein:creatinine ratio (UPCR) and urine cortisol:creatinine ratio (UCCR) measurement.

Voided samples are sometimes quite easy to obtain as ‘free catch’ samples from cats urinating in litter trays, especially if cats are habituated to collection (eg, for diabetic management). Kit4Cat (Coastline Global) hydrophobic sand or aquarium gravel can also be used to enable urine collection from litter trays. Manual expression of the bladder using digital pressure in an attempt to solicit a urine sample may result in haematuria. It also carries a risk of iatrogenic bladder rupture, particularly if the bladder is friable due to pre-existing pathology, or pressure is excessive. Collection of urine samples from the surface of a clean smooth table top may be adequate for a screening urinalysis if there are no disinfectant residues on the table.

Voided urine from kittens can be obtained by stimulating the anogenital reflex with a warm moist cloth or cotton wool ball. This technique may be more successful if the neonate has been separated from the queen for at least an hour.

Voided samples are not recommended for urine culture unless they are the only option available or cytological examination of an air-dried smear from voided urine suggests that a fulminant UTI is present (ie, numerous neutrophils, some of which may appear degenerate, accompanying a monomorphous bacterial population). Ideally, any voided sample for urine culture should be collected as a ‘midstream’ urine sample. Excluding the first portion of the urine stream, which is often contaminated during contact with the genital tract, skin and hair, is recommended unless disease of the urethra or genital tract is suspected. Midstream catch is feasible with expressed urine and some voided samples.

**Key point**
Samples should ideally be examined within 60 mins of collection. Fresh urine should be evaluated for crystals immediately after collection and prior to refrigeration.

If timing of collection of voided samples is important (eg, stored urine is required) there are various practical strategies that can be employed. A litter tray can be removed at night and only provided in the morning for either free catch or litter collection. Aquarium gravel with particles less than 4 mm has been validated for UCCR determination, and would be reasonable for routine chemical analysis.
A closer look at...

**Urine sample handling and storage**

Urine is an unpredictably unstable mixture. In vitro changes can occur rapidly after collection and it is, therefore, recommended that urine samples are examined as soon as possible following collection to eliminate unknown and unpredictable variables.\(^2\) Ideally, urinalysis is performed within 60 mins of collection.

**Urine containers**

Irrespective of the method of collection, once collected, urine should be placed in a leakproof, clear (for visualisation of the physical characteristics of the sample without opening the vessel) and sterile container. Commercially available 70 ml plastic containers (Figure 1) are ideal, as they are flat-bottomed (to prevent inadvertent spillage) and allow all the relevant patient's details to be clearly recorded on the label.

Subsequent testing will dictate whether the urine sample will require further aliquoting into different tubes (eg, conical tubes for centrifugation, Figure 2).

**Urine preservation techniques if urinalysis is delayed**

Ideally, a complete urinalysis should be performed at the time of urine collection. In a busy veterinary practice, however, this may not always be possible, as the necessary time and appropriate personnel may be unavailable. In vitro changes, including bacterial proliferation, may occur in unpreserved urine stored at room temperature (Table 1). Consequently, if urinalysis cannot be performed on a freshly collected urine sample within a relatively short period of time, the sample will need to be stored and preserved appropriately for later examination.

**Refrigeration**

If sample processing delays of greater than 15–30 mins are anticipated, the urine sample should be refrigerated immediately at 2–8°C to retard bacterial growth and cellular degeneration. If urine has been collected solely for urine culture, then it should be refrigerated immediately. It is imperative that a refrigerated urine
Table 1: Artefacts associated with delays in processing unpreserved urine

<table>
<thead>
<tr>
<th>Causes of urine artefacts</th>
<th>Effects of urine artefacts</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in processing of urine samples stored at room temperature</td>
<td>• Bacterial proliferation (see below)</td>
<td>Refrigerate or transport on cold pack</td>
</tr>
<tr>
<td></td>
<td>• Cell degeneration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cast dissolution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Decreased yield of RBCs, WBCs and casts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Formation or loss of crystals</td>
<td>Return the sample to room temperature or warm the sample in a 37°C water bath before microscopic examination. Also verify the presence of crystals via analysis of another urine sample immediately after collection</td>
</tr>
<tr>
<td></td>
<td>• Evaporative loss of volatile substances (eg, ketones)</td>
<td>Use an airtight seal</td>
</tr>
<tr>
<td>Bacterial proliferation/overgrowth</td>
<td>• Increased urine turbidity</td>
<td>Refrigerate or transport on cold pack</td>
</tr>
<tr>
<td></td>
<td>• False-negative urine glucose</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Falsely increased urine pH if urease-producing bacteria present</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Falsely decreased urine pH if bacteria use glucose to form acidic metabolites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Alkaline urine can alter cellular components, degrading casts and lysing RBCs in urine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• RBC lysis, resulting in false haemoglobinuria rather than haematuria</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Decreased concentration of chemicals metabolised by bacteria (eg, glucose, ketones)</td>
<td></td>
</tr>
</tbody>
</table>

WBCs = white blood cells; RBCs = red blood cells

sample is returned to room temperature before routine dipstick analysis. This may also help to redissolve any substances that may have precipitated at cold temperatures.\(^2\,^4\)

Refrigeration should be avoided if the sediment is to be evaluated specifically for struvite or calcium oxalate crystalluria.\(^3\,^5\) Refrigeration can cause a pronounced increase in the number of these crystals, which is not always reversed by returning the sample to room temperature or warming the sample in a 37°C water bath prior to microscopic examination.

**Key point**

Refrigeration may artificially increase the number of crystals in a urine sample.
Chemical preservation
Several chemical substances have been purported to help prevent in vitro degenerative changes in the constituents of urine (cells and casts). In the authors’ experience, the use of chemical preservatives (other than EDTA anticoagulant) generally introduces artefacts. If samples are to be sent to a laboratory for further processing, it is worthwhile checking with the referral laboratory for its preferred urine preservatives.

- **formalin:** urine cells, casts and crystals can be preserved by adding four or five drops of neutral buffered formalin per 10 ml of urine, but this is only applicable for urine submitted for unstained wet-prep examination. Urine subjected to formalin treatment should not be used to prepare air-dried direct smears or cytospin smears destined for Romanowsky staining (eg, Diff-Quik), as the formalin will adversely affect Romanowsky staining techniques. For this reason, urine samples treated with formalin should be clearly labelled when being sent to an external veterinary laboratory to avoid confusion and generation of spurious results. Such samples should be accompanied by a duplicate ‘untreated’ urine sample, aliquoted into a separate container, which can be used for microbial culture, dipstick analysis and air-dried cytological smear assessment.

### Artefacts associated with urine preservation

Refrigeration and chemical preservation can result in artefacts in urine samples presented for urinalysis. Some of these artefacts (Table 2) are reversible. Bacterial contamination, however, creates similar artefacts to those associated with unpreserved urine samples (Table 1).

#### Table 2: Artefacts associated with preserved urine samples

<table>
<thead>
<tr>
<th>Urine preservation technique</th>
<th>Types of urine artefacts</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigeration</td>
<td>• Possible inhibition of enzyme reactions (eg, glucose) on urine dipstick analysis</td>
<td>Bring urine sample to room temperature before examination</td>
</tr>
<tr>
<td></td>
<td>• Higher urine specific gravity in cold samples</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tendency for in vitro formation of struvite and calcium oxalate crystals</td>
<td>Verify via analysis of another urine sample immediately after collection</td>
</tr>
<tr>
<td></td>
<td>• In vitro precipitation of amorphous urates or phosphates</td>
<td></td>
</tr>
<tr>
<td>Formalin and other chemical preservatives</td>
<td>• Unreliable dipstick analysis and microbial culture</td>
<td>Provide another aliquot of untreated urine collected at the same time and refrigerated</td>
</tr>
<tr>
<td></td>
<td>• Poor stain uptake when air-dried smears are stained for cytological assessment</td>
<td></td>
</tr>
</tbody>
</table>
• EDTA anticoagulant: aliquoting urine into tubes containing EDTA anticoagulant helps to preserve cellular detail, particularly where air-dried urine cytological smear assessment is required. It should always be ensured that EDTA tubes are used within their expiry date and are filled with urine to the designated level. These samples are unsuitable for urine culture.

Key point
Freezing can preserve urine for dipstick analysis but is unsuitable for wet-prep sediment examination, air-dried stained urine cytology examinations or microbial culture.

• other chemical preservatives: other, less commonly used urine chemical preservatives include thymol, toluene and boric acid. Their use, however, is associated with artefacts, which vary depending on the preservative. For example, urine samples sent away for laboratory culture using boric acid as the preservative were found to be significantly less likely to give a positive culture result when compared with urine submitted in a plain sterile tube.

Performing and interpreting the macroscopic urinalysis
A complete urinalysis includes a macroscopic and microscopic examination of the urine specimen.

Macroscopic examination is relatively quick, cheap and easy. It entails a subjective assessment of the physical properties of urine (colour, turbidity, odour and volume) and a USG reading, which is objectively measured with a refractometer. It also includes semiquantitative assessment of the chemical properties of urine by dipstick analysis.

Physical properties
Colour
Urine samples should be examined for colour through a clear container held against a white background under good lighting conditions. Normal cat urine may be light yellow or yellow to amber in colour (Figure 2). This normal coloration is mainly attributable to the presence of urochrome and urobin pigment, which are both by-products of normal metabolic processes. Urochrome is a yellow, lipid-soluble, sulfur-containing pigment that results from oxidation of the colourless metabolite urochromogen. Increased urochrome excretion can occur in fever and starvation, and should be assessed in the light of the clinical history and USG.

Discoloration of urine is one of the reasons that cat owners seek veterinary attention. The most
**A closer look at common causes for discoloured urine in cats** are haematuria, haemoglobinuria, myoglobinuria and bilirubinuria (Figure 3, Table 3). Various drugs and foods have also been documented to cause urine discoloration in humans. In cats, urine discoloration can occur after treatment with the antibiotics clofazimine (pink to brown) and rifampicin (orange-red).

**Turbidity**

Turbidity can be assessed semiquantitatively by how clearly one can visualise background newsprint through a well-mixed urine sample in a clear container under good lighting (Figure 3). Freshly collected urine from normal cats is usually clear (Figure 1). However, clear urine must still be analysed to ensure no abnormalities are present.

Turbidity due to lipiduria in healthy cats is often localised to the surface layers, as lipids rise to the top of urine samples. Artefactual turbidity may arise as a result of changes in temperature and pH. Following refrigeration, for example, urine can become cloudy due to precipitation of crystals; this can sometimes be reversed by returning the sample to room temperature or warming the sample in a 37°C water bath. Other causes of artefactual turbidity in urine samples include contaminants in the collection container, semen and faeces.

Abnormal turbidity or cloudy urine may be associated with increased numbers of micro-organisms, cellular elements (red blood cells, white blood cells, epithelial cells) or crystalluria. Milky turbid fresh urine specimens are most commonly associated with pyuria. Abnormally turbid urine should always be subjected to microscopic examination to further investigate the underlying cause.

Macroscopic haematuria typically results in brownish to red turbid urine. Haemoglobinuria and myoglobinuria result in brownish to red (occasionally black) transparent urine.

**Odour**

Although odour may vary in intensity depending on the gender of the cat (eg, the urine of mature...
intact male cats has a strong characteristic odour), in the authors' experience urine odour is not pathognomonic for any particular disease process.

**Volume**

Normal adult cats produce a urine volume of 18-28 ml/kg/day (5-60 ml/kg/day in kittens). Polyuria is defined as a urine volume exceeding 40 ml/kg/day.¹²

**USG**

USG is the only test of renal function (i.e., the kidneys’ ability to modify the solute content of the urine via dilution and concentration) performed during routine urinalysis. Measuring and interpretation of USG will be covered in part 2 of this series appearing in next month’s issue.

**Conclusions**

Precautions should be taken when submitting urine samples to a veterinary laboratory, as improper collection, handling and delays in transit can affect the integrity of some urine constituents, leading to spurious results.

**References**


This article has been adapted from: George Reppas and Susan F Foster. *Practical urinalysis in the cat 1: urine macroscopic examination ‘tips and traps’*. *J Feline Med Surg* 2016; 18: 190-202.

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One day nursing programme

Brand new for 2017, ISFM is running a programme for nurses/techs. Split into manageable sessions, the talks will be full of practical hints and tips to take back to practice.

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>09.00–10.00</td>
<td>Registration</td>
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<tr>
<td>10.00–10.45</td>
<td>Contentment with confinement – coping with carriers and crates</td>
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<td>Sarah Ellis, International Cat Care</td>
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<td>10.45–11.30</td>
<td>Cats under stress – clinical significance and importance</td>
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<td>Martha Cannon, Oxford Cat Clinic</td>
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<td>11.30–12.00</td>
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<td>12.00–12.45</td>
<td>Implementing Cat Friendly Clinic principles in practice</td>
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<td>Martha Cannon, Oxford Cat Clinic</td>
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<td>12.45–13.30</td>
<td>Pain scoring in cats - new tools and practical implications</td>
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<td>Louise Clark, Davies Veterinary Specialists</td>
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<td>13.30–14.30</td>
<td>Lunch</td>
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<tr>
<td>14.30–15.15</td>
<td>Analgesics and analgesic therapy – what you need to know</td>
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<td></td>
<td>Louise Clark, Davies Veterinary Specialists</td>
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<tr>
<td>15.15–16.00</td>
<td>Causes, management and monitoring of cats with seizures</td>
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<td></td>
<td>Mark Lowrie, Dovecote Veterinary Hospital</td>
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<td>Tea break</td>
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<td>16.30–17.00</td>
<td>Choices and management of long-term urinary and IV catheters</td>
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<td>Sophie Adamantos, University of Bristol</td>
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<td>17.00–17.30</td>
<td>The role of the nurse in managing the feline diabetic</td>
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<td></td>
<td>Stijn Niessen, Royal Veterinary College</td>
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<tr>
<td>17.30</td>
<td>Close</td>
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What’s included?

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Preparing a surgical site correctly

Skin preparation is an important aspect of the perioperative period and normally is a requirement of the veterinary nurse or technician. With this in mind it is important that if you are carrying this out you are aware of the key stages and why they are important. Surgical site infections are acknowledged as a common cause of nosocomial infections in patients, both animal and human, and gold standard skin preparation is one way in which we can minimise this risk.

Skin preparation is carried out in order to reduce infection risk during surgical procedures. It is often the responsibility of the veterinary nurse or technician to carry out patient preparation and so they should be knowledgeable on skin preparation, and up to date with current products and techniques being advised. A standard operating procedure (SOP) would be useful in this instance, which should be evidence based and reviewed regularly.

The hair of a patient is home to microbes and debris, which can both contribute to a surgical site infection (SSI). Skin carries transient as well as residual flora and the aim of skin preparation, once the hair has been removed, is to rid the skin of transient bacteria while reducing levels of residual bacteria, and also preventing any rebound growth.

Transient bacteria are acquired after contact with people or animals, and can be totally eradicated from skin after adequate skin preparation. Despite skin preparation, residual bacteria will remain in the skin, and they are not of concern unless they appear at the surface in large numbers. One of the aims of skin preparation is targeting residual bacteria appearing at the skin surface, by using a product that continues to work after application (residual action). This relies on the correct products being used.

Key point
Careful preparation of the surgical site is vital to prevent surgical site infection; an important cause of postoperative morbidity.
Before the skin can be cleaned the hair needs to be removed. There are a small number of skin removal options but clipping is associated with the lowest incidences of SSIs.\(^1\) Razors are now rarely used, and can cause trauma to the skin and discomfort to the patient. This additional traumatised area may also be colonised by bacteria. Hair removal cream is often not effective due the amount of hair and it can cause some skin reactions. (It can be useful in small animals, such as rodents, where clippers may be too bulky and damaging to their fragile skin.)

Hair removal should take place away from the theatre area, and once the animal has been anaesthetised for the procedure. Clipping the animal prior to anaesthesia is associated with a higher bacterial load on the skin, so is only indicated in cases where time under anaesthesia needs to be minimised in high-risk or emergency procedures.

A study into postoperative wound infections by Cimino-Brown et al.\(^3\) found that animals which had their surgical sites clipped before the induction of general anaesthesia were three times more likely to develop postoperative wound infections. Poor clipping, either due to bad technique or poor maintenance of clippers can increase microbial colonisation at the surface of the skin in abrasions and ‘clipper rash’.\(^4\)

Size 40 clipper blades are recommended to achieve the correct finish (Figure 1); any bigger and there will not be a close enough clip, and any smaller may not cope with the amount of hair to be removed. Clipper blades should be maintained on a regular basis (see Box 1). They need sharpening and replacing when necessary. A good way to do this may be to have one person in charge of clipper maintenance and to colour code the blades so it is clear when they have been sharpened, or when they are on their last use before being replaced.

When clipping the skin, it is useful to first take the bulk of the hair off by clipping in the direction of hair growth. A closer clip can then be achieved by clipping against the growth of the hair (Figure 2). The area clipped should be 10–15 cm wide either side of the proposed incision site. The veterinary nurse or technician should also think about any other access that may be needed, and therefore clipped, at this stage such as for feeding tubes and/or chest drains.

### Risk factors for surgical site infection
- surgical time;
- clipping prior to induction;
- age (>8 years); and
- poor body condition.

### Clipping

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### Hair removal: important points
- Clip outside the operating theatre, but after induction.
- For limb surgery clip entire limb, otherwise give a 10–15 cm margin around the incision site.
- Cover open wounds with damp swabs or fill with sterile, water-soluble gel before removing hair.
- Remove fallen hair with a vacuum cleaner.
- Use a size 40 blade.
- Ensure there are no missing teeth in the clippers.
- Clean tools between patients: brush, use cleaning solution and lubrication (see box on page 53).
Skin preparation

Skin preparation has two actions, mechanical and chemical. The mechanical action is provided by the friction caused by the swab. This allows the products to penetrate down into the skin. The chemical action is provided by the skin preparation product on the microorganisms on and in the skin layers.\(^5\)

The skin preparation product should be applied with gauze swabs. The non-woven swabs are preferred to the coarser, more abrasive swabs such as those used in surgical procedures, or used in wound management to debride wounds. The swabs used at this point of preparation do not need to be sterile. Cotton wool should never be used to apply skin disinfectant as it has a tendency to leave behind debris (or fragments), which could enter a wound and cause a foreign body reaction.

Clipper cleaning

Between patients, clipper blades should be cleaned, ideally with a designated clipper spray, which cleans, disinfects and lubricates.

**Method**
- Remove hair from the blades with a toothbrush.
- Spray the clippers with a designated cleaner while they are running to allow the spray to get into hard to reach areas.
- For a deep clean, clipper blades can be sterilised in an autoclave.

Do not leave clippers soaking in disinfectant, as this will cause rusting.

**Figure 1:** Clipper blades must be maintained clean and sharp

**Figure 2:** Hair should be clipped first (a) in the direction of growth and then (b) against the direction of growth, taking care not to damage the skin
Skin preparation products
Chlorhexidine gluconate (CHG) is an effective skin preparation product as it has a broad spectrum of activity, requires less contact time than povidone-iodine (PI) and also provides ‘residual activity’ as it binds to the stratum corneum of the skin, providing a prolonged activity should residual bacteria surface. It is, however, contraindicated in some instances, such as for preparation around the eyes and ears, as it is ototoxic and meningiotoxic.¹ In these instances an iodophor, such as PI, should be used in solution form (not the PI scrub).

Current literature gives a wide range of concentrations to use but there is very little evidence for the veterinary field. Herring⁶ suggests a dilution of 1:10–1:50 of a 10% PI solution. At the author’s workplace a 1:50 dilution of 1% PI is used. A quick and easy way to do this is to remove 10 ml from a 500 ml bag of sterile saline and add 10 ml of PI solution in its place.

CHG (4%) should be mixed at a ratio of 50:50 (thus making a 2% concentration) with water before applying to the patient. See Table 1 for further comparison between skin preparation products.

Skin solutions will evaporate and this may cause heat loss, so the area clipped and prepared should be kept as small as is practically possible.

One human study into heat loss during anaesthesia found that using warm water only marginally reduces heat loss, so more focus should be on the area that is prepared and alternative measures to minimise heat loss should be considered such as bubble wrap and the use of heat mats.⁷

CHG is effective after 2 minutes of contact time but an increase to 5 minutes increases the likelihood of residual activity. PI will start to kill bacteria after 2 minutes but requires much longer contact time (15 minutes) to inactivate spores.⁸

A survey of veterinary nurses in practice found that only 21% of nurses who regularly prepare animals for surgical procedures were aware of correct concentrations of CHG and contact times.⁹ This could be due to a lack of evidence in the field of veterinary surgery. Much information is extrapolated from human studies.

Preparation of the surgical site
When applying solution to the skin in both the initial skin preparation and the final skin preparation, the traditional method was to use a circular motion working from the

Table 1: Comparison of skin preparation products

<table>
<thead>
<tr>
<th>Chemical group</th>
<th>Spectrum</th>
<th>Persistent action</th>
<th>Residual action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Povidone-iodine</td>
<td>Broad</td>
<td>4–6 h</td>
<td>None</td>
</tr>
<tr>
<td>Chlorhexidine 4%</td>
<td>Broad</td>
<td>&gt;6 h</td>
<td>2 days</td>
</tr>
<tr>
<td>Alcohol 70%</td>
<td>Broad</td>
<td>3 h</td>
<td>None</td>
</tr>
<tr>
<td>Chloroxylenol 3%</td>
<td>Broad</td>
<td>3 h</td>
<td>None</td>
</tr>
<tr>
<td>Triclosan</td>
<td>MRSA</td>
<td>4 h</td>
<td>Long</td>
</tr>
</tbody>
</table>

MRSA = methicillin-resistant Staphylococcus aureus

Minimising heat loss
Skin preparation can increase the risk of hypothermia if not undertaken correctly:

- Avoid wetting unclipped areas.
- Avoid using excessive preparation solutions that will run away from the surgical site and underneath the animal.
- Use alcohol solutions sparingly, focusing on the surgical site only, as they evaporate quickly causing rapid heat loss.
- Place absorvent pads under the animal to catch excess preparation solution. Discard and replace these with clean, dry pads in theatre.
proposed incision site outwards to the periphery when the swab should then be discarded. Evidence now suggests that this particular method of skin preparation is ineffective as it is not mechanical enough to penetrate into the cracks and fissures of the skin. Backwards, forwards and side-to-side motions should be used first over the proposed incision site and then working outwards before discarding the swab when the periphery is reached.

This initial skin preparation should remove any organic matter as well as reduce the bacterial load. It should be carried out until the swabs come away from the skin clean.

At the author’s workplace the CHG lather is removed with dry swabs rather than ‘rinsing’ with an alcohol solution, as this will soak the patient and lead to hypothermia. During transport through to theatre the prepared area is covered with a drape to prevent contamination.

**Final skin preparation**

There should be a final skin preparation once the animal is moved into theatre and positioned correctly. The most effective method for this, based on current research, is using a solution of 2% CHG and 70% isopropyl alcohol (IPA), e.g., ChloraPrep (Invicta). Two percent CHG and 70% IPA has been found to have more effective antimicrobial activity than CHG on its own, even in the presence of biofilms, and also has better residual activity. The mixture is available in a pre-made applicator, which is designed in a way that there should be no need for hand-to-skin contact with the patient (although it is still advised that clean, non-sterile gloves be worn)(Figure 3).

The correct size applicator should be chosen for the surgical site, and solution applied using a grid system. Once the solution has been applied it should be remembered that it contains alcohol and should be allowed to dry before draping, especially if the surgeon plans on using electrocautery.

Previous methods for performing final skin preparation included the use of sterile Cheatle forceps and swabs to apply more solution once the animal had been moved through
Clinical nursing

To and positioned in theatre, and also the use of spray bottles. Spray bottles have only been found to soak the area and the bottles are also at risk of microbial contamination.11

Alternatively, use 70% IPA alone as a final stage before surgery, as alcohol is effective against most Gram-negative bacteria. However, this requires a 2 minute contact time, it has a notable cooling effect on the patient and also can be a fire risk if not allowed to evaporate fully before electrocautery is used.8

Conclusions

The veterinary nurse or technician is often in the position to provide evidenced-based care for their patients during the surgical preparation period in order to reduce the risk of SSIs. The bacterial load of patients’ skin can never be totally eradicated but using the correct equipment and products can ensure that all is done to try and reduce the bacterial count and stop the rebound growth. An SOP could be developed by a veterinary nurse or technician by looking at available evidence so that all members of staff, especially new members, are using the same techniques. This should then be reviewed and updated at regular intervals.

References

Risks from exposure to home decorating products

Home decorating and maintenance involves the use of a variety of different chemicals, which a cat may be exposed to. It is important to determine the type of product involved in order to assess the potential risks and appropriate treatment. The risks and the appropriate management options from common household decorating products such as paint, fillers, expanding foam, adhesives and white spirit are discussed.

Decorating and maintaining the home involves the use of numerous chemicals and products (Figure 1) and cats can be accidentally exposed by drinking from open containers or spills from knocked over bottles, and by licking or brushing against treated surfaces and then grooming. Owners may only become aware of such exposure by the presence of paint footprints, sticky or discoloured fur or the smell of the product on the cat.

Expanding foam and adhesives
Expanding foam is used as a gap filler, insulation or sealant. Expanding foam is usually available in aerosol cans (to be applied by hand) or in tubes (used in a hand-held gun applicator) and expanding glue is available with an applicator top and is typically used as a wood glue. These products contain polyurethane and isocyanates, typically diphenylmethane di-isocyanate. The reaction of the di-isocyanate and the urethane is exothermic, resulting in polymerisation of the urethane. For the first 20 mins the product remains soft and then it gradually hardens (cures).

Cats may be exposed to the product as it is curing, either where it was applied or from tools used to apply it or they may eat lumps of the cured, dried material. There is also a risk from biting and puncturing the container, although most cases of exposure in
this circumstance involve dogs and expanding adhesive containing diphenylmethane di-isocyanate.\textsuperscript{1-3}

Systemic toxicity is not expected from ingestion of these products; the risk is obstruction due to expansion of the foam or adhesive in the stomach. Expanding wood glues can expand to more than eight times the original volume within 2 h.\textsuperscript{2} Products vary and some expanding foam products carry claims that they can expand up to 30 or even 50 times in volume. Once the foam sets (is cured and dried) it expands no further.

**Clinical effects**
There is limited information in cats but in dogs clinical signs from ingestion of these products are usually seen within 12 h.\textsuperscript{4} If the glue has formed a gastric mass signs will persist until the mass is removed. If there is no foreign body mass gastrointestinal signs resolve over 3–9 days.\textsuperscript{4}

Most animals develop only mild gastrointestinal signs\textsuperscript{3} but ingestion of even a small volume can cause vomiting, haematemesis, anorexia, diarrhoea, lethargy, depression and abdominal discomfort and distension. Dehydration may occur due to excessive vomiting.

These products can expand to fill the stomach; obstruction beyond the pylorus has not been reported in veterinary cases;\textsuperscript{1} in a human case the material expanded to fill the stomach and part of the oesophagus.\textsuperscript{5} The material does not stick to the gastric mucosa but gastric irritation and ulceration may be observed during surgical removal.\textsuperscript{4} Gastric perforation is rare.\textsuperscript{4}

On the skin, foam that is still uncured will set rapidly and may cause local irritation with erythema, pruritus and dermatitis. Once cured residual material flakes off within a few days. Ingestion of set foam from the coat or feet is not expected to cause any problems.\textsuperscript{3,4}

**Treatment**
Emetics, gastric lavage and absorbents are not recommended after ingestion of uncured expanding foam or glue (eg, from puncturing the container). This is because the gastric mass forms within minutes of ingestion, material could be aspirated into the lungs and there is a risk of the mass forming in the oesophagus.

Oral fluids should not be given for the first 3–4 h after ingestion since water may be absorbed into the
mass, increasing the size. Food should also be avoided as it will be trapped within the expanding mass.

Cats should be assessed for a gastric foreign body and, if well, should be monitored of the signs of gastric complications (eg, vomiting, abdominal distension) over the following 24 h. Gastroprotectant drugs (eg, sucralfate or a H2 blocker such as ranitidine) may be helpful in animals without a foreign body mass, but in animals with a gastric mass these drugs are unlikely to be useful until the mass is removed.

On x-ray, a foreign body obstruction has been observed as early as 4 h after ingestion but x-rays taken at 24 h may be more reliable. If x-rays are inconclusive, ultrasound may aid diagnosis. The expanded material will not be digested and, therefore, surgical intervention is required in these cases.

On the skin, set foam or glue is very difficult to remove. The coat may be clipped if necessary and washing with detergent (eg, washing up liquid, shampoo) or oil (eg, baby oil, vegetable oil) may help remove some of the foam. Otherwise it is best to leave it and allow it to come off over several days. Any local irritation on the skin should be managed symptomatically.

**White spirit**

White spirit is also known as turpentine substitute, ‘turps’, Stoddard solvent and mineral spirits, and is a colourless volatile liquid commonly found in the home as a paintbrush cleaner (Figure 2). Some paint brush cleaner products contain white spirit or other hydrocarbons such as naphtha. White spirit is a solvent and a petroleum distillate (it is derived from the distillation of crude oil) and should not be confused with turpentine oil, which is an essential oil and is used by artists to mix and dilute paints and clean brushes (and usually comes in smaller bottles and is more expensive than white spirit).

Petroleum distillates have various toxic effects. They are irritant to the skin, eyes and mucous membranes (including the gastrointestinal tract). They also dry and de-fat the skin leading to irritation and erythema. Petroleum distillates are thought to cause effects on mucous membranes and skin by dissolving lipid membranes and damaging cells. Petroleum distillates may also cause central nervous system (CNS) depression; the mechanism of this is unclear but hypoxia may be a contributing factor.

The most severe clinical problems associated with petroleum distillate exposure are pulmonary and are not due to absorption from the
Keeping cats safe

gastrointestinal tract but to aspiration pneumonia, resulting in severe pulmonary dysfunction and rapid onset hypoxaemia.

The risk of aspiration is determined by several properties of a particular petroleum distillate. The more volatile the petroleum distillate the greater the risk of aspiration and development of pulmonary oedema. A low surface tension allows widespread diffusion into the lungs, even when small quantities of fluid are involved. Low viscosity enables deeper penetration in the distal airways. White spirit has all the properties that increase the risk of aspiration and lung damage — low surface tension, low viscosity and high volatility.

Aspiration causes severe intrapulmonary shunting (a physiological condition which results when the alveoli of the lungs are perfused with blood as normal, but ventilation fails to supply the perfused region), leading to hypoxaemia and acidemia. There is a change in respiratory rate which may be due to the effect of severe pulmonary injury on blood gas exchange. Alveolar collapse results in oedema.

Studies have shown that aspiration of petroleum distillates results in changes in the surface tension properties of pulmonary surfactant, haemorrhagic necrosis, intra-alveolar oedema, epithelial destruction and inflammatory exudation.

Clinical signs
Ingestion or oral exposure following grooming after dermal exposure to petroleum distillates may cause a burning sensation which can manifest as hypersalivation, head shaking and pawing at the mouth. There may be vomiting, diarrhoea, local irritation and ulceration of the mouth, and the breath and fur may smell strongly of the solvent.

Aspiration pneumonia is a potential complication of ingestion; it can develop after ingestion (including grooming) or if vomiting has occurred. Clinical effects include choking, coughing, pyrexia, dyspnoea, cyanosis and in severe cases, pulmonary oedema. There may also be leukocytosis. Signs can progress for the first 24–48 h with recovery over 2–5 days. Potential complications of aspiration include pneumomediastinum and pneumothorax.

Tip
White spirit is flammable and care should be taken to avoid any naked flame or sources of ignition. It is also important to ensure the area is well ventilated, particularly when handling animals with heavy contamination, to prevent staff becoming unwell from the fumes of white spirit (eg, sore eyes and throat, headache, nausea).

Ingestion of a large volume or inhalation of a petroleum distillate (eg, following a spill in an enclosed space) could result in CNS depression with ataxia, depression, drowsiness and, in severe cases, (rare) coma. Tachycardia may occur.

On the skin, white spirit may cause erythema, dermatitis, inflammation, oedema and burns. There may also be alopecia. Corneal damage may occur after ocular exposure to white spirit.

Treatment
The use of emetics and gastric lavage is contraindicated after ingestion of a volatile petroleum
distillate such as white spirit because of the risk of aspiration. Activated charcoal is of limited benefit and may increase the risk of vomiting and is therefore not recommended. Depending on the clinical condition of the animal it may be helpful to wash the mouth out with water.

Where dermal exposure has occurred the animal should be thoroughly washed. White spirit is not soluble in water so detergents, vegetable oil followed by soap and water or commercially available hand degreasers (eg, Swarfega) should be used. If required, the cat should be collared to prevent further grooming and ingestion of the distillate. Contaminated eyes should be irrigated with water or saline, and then stained with fluorescein and examined for corneal injury.

Treatment following decontamination is supportive. An antiemetic can be given to prevent vomiting and reduce the risk of aspiration. Atropine may be given if there is excessive salivation. Sedation is best avoided where practical, as it can depress the gag reflex and increase the risk of aspiration. Symptomatic cats should be assessed for respiratory effects. x-ray evidence of pulmonary changes may occur within 1 h of aspiration or take 6–12 h to manifest and be maximal at 48 h.

Bland diets are recommended if there is evidence of severe buccal irritation. Care should be taken to ensure adequate hydration and nutrition. Intravenous fluids are only recommended if the cat is not drinking and cannot maintain hydration. In cats with aspiration pneumonia, fluid therapy should be monitored carefully because of the risk of pulmonary oedema.

Aspiration pneumonia requires conventional therapy with oxygen supplementation and cage rest. Hydrocarbons are eliminated via the lungs so closed or semi-closed loop systems need to be purged frequently. Salbutamol can be used as a bronchodilator, if required. Steroids are not recommended in the management of petroleum distillate aspiration pneumonia, as they can increase the risk of infection and have been showed to be ineffective in both animal studies and clinical cases in humans. Routine use of antibiotics is not necessary as petroleum distillate pneumonitis is non-bacterial in origin.

For dermal exposure, mild irritation will usually respond to an emollient, but topical steroids may be required for moderate to severe dermatitis. Severe irritation should be managed as a thermal burn injury.

### Wallpaper paste

Wallpaper pastes are available as powders or ready-to-use pastes and typically contain starches (eg, potato starch derivatives), polyvinyl acetate (PVA) and some contain fungicides (often captan or a triazine) to inhibit mould growth. The powders are mixed with water to form a paste to be applied to the wallpaper before it is hung.

Clinical signs in cats after ingestion of wallpaper paste are generally mild, with lethargy, inappetence, oral ulceration or inflammation and dehydration. Treatment is supportive.

### Household paint

Paints typically containing pigment (for colour), binders (to help the paint stick) and solvents (to keep it liquid and make it easier to apply). It is important to know what type of
Keeping cats safe

paint a cat has been exposed to in order to determine the potential risks. The important thing to know is whether the paint is water-based or solvent-based. Several pieces of information will tell you this.

- The volatile organic compound (VOC) content of the paint. In Europe paint labels are required to state the VOC content with the appropriate symbol (Figure 3). If the paint is labelled ‘minimal’ or ‘low VOC’ then it is effectively water-based and if the label

states ‘medium’ or ‘high VOC’ it should be managed as a solvent-based paint.

- If the VOC content is unknown, then ask what it recommended to clean the paint brushes. If it is water then the paint is water-based; if white spirit is recommended then the paint is solvent-based.

- The product contains solvents if the product label states any of the following phrases:
  - flammable;
  - keep away from sources of ignition;
  - no smoking.

Modern household paints increasingly contain low concentrations of solvent and are labelled ‘low VOC’. This is not due to toxicity but to the impact of VOCs on air pollution and other environmental aspects.

**Water-based paint (low VOC)**

Low VOC paint is a thick liquid usually used on walls. It typically contains latex or alkyd binders, pigments and extender pigments, biocides, plasticisers, drying agents and surfactants, in a water base. A typical example would be emulsion paint.

These paints are of low toxicity and most cats remain asymptomatic after exposure, although a small number develop mild gastrointestinal upset. No specific treatment is recommended but if there is heavy contamination of fur the cat should be washed with water and a detergent such as washing-up liquid or shampoo.

**Solvent-based paint (medium or high VOC)**

These paints, which may (but not always) include gloss paints or specialist paints, contain organic
solvents. These are typically petroleum distillates and should be managed as above for white spirit.

Conclusions
Home maintenance and decorating products are potentially hazardous, particularly white spirit and paints containing VOCs. Although these products are of low toxicity systemically they are an aspiration hazard and can cause pulmonary injury. This may occur as result of ingestion or subsequent vomiting. Treatment of a cat exposed to a decorating product involves decontamination and symptomatic care, with monitoring and support of respiratory function in those cats that develop respiratory complications.

References